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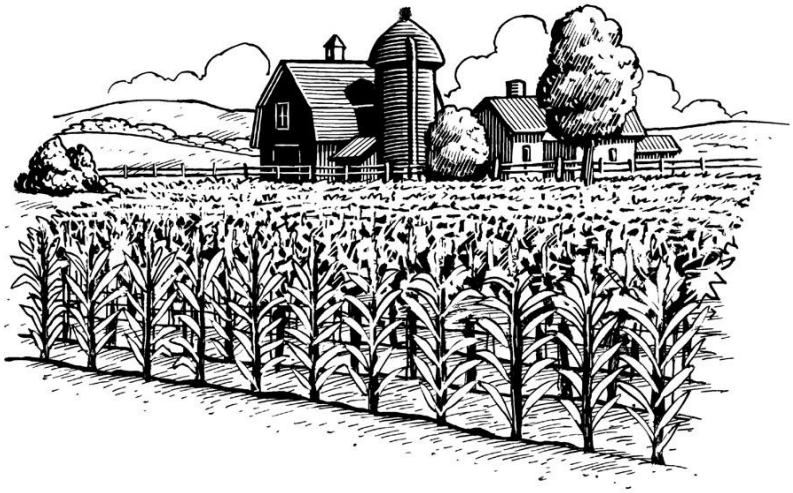

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Session Organizers

Tuesday, February 5

High Tunnels – A.J Both, Specialist in Bioresource Engineering, Rutgers NJAES Cooperative Extension

Sweet Corn – Raymond Samulis, Agricultural Agent, Rutgers NJAES Cooperative Extension of Burlington County

Ag Marketing – Jenny Carleo, Agricultural Agent, Rutgers NJAES Cooperative Extension of Cape May County

Peppers – Andy Wyenandt, Extension Specialist in Vegetable Pathology, Rutgers NJAES Cooperative Extension

Soil Fertility – Dan Kluchinski, Department Chairman, Agriculture and Resource Management Agents, Rutgers NJAES Cooperative Extension

GMO Food Crops-What's the Scoop
Bill Hlubik, Agricultural Agent, Rutgers Cooperative Extension of Middlesex County

Farm Safety - Raymond Samulis, Agricultural Agent, Rutgers NJAES Cooperative Extension of Burlington County

Agricultural Water Issues – Steve Komar, Agricultural Agent, Rutgers NJAES Cooperative Extension of Sussex County

Greens/Herbs – Rick VanVranken, Agricultural Agent, Rutgers NJAES Cooperative Extension of Atlantic County

Wednesday, February 6

Tomatoes – Kris Holmstrom, Program Associate, Vegetable IPM, Rutgers NJAES Cooperative Extension

Agricultural Labor - Michelle Infante-Casella, Agricultural Agent, Rutgers NJAES Cooperative Extension of Gloucester County

Small Fruit – Peter Nitzsche, Agricultural Agent, Rutgers NJAES Cooperative Extension of Morris County

Food Safety – Meredith Melendez, Senior Program Coordinator, Rutgers NJAES Cooperative Extension of Mercer County

Insect Hot Topics and Brown Marmorated Stink Bugs– Joe Mahar, Vegetable IPM Coordinator, Rutgers NJAES Cooperative Extension

Blueberries – Gary Pavlis, Agricultural Agent, Rutgers NJAES Cooperative Extension of Atlantic County

Enterprising New Crops – Bill Sciarappa, Agricultural Agent, Rutgers NJAES Cooperative Extension of Monmouth County

Grape Production – Dan Ward, Extension Specialist in Fruit Crops, Rutgers NJAES Cooperative Extension

Thursday, February 7

Food Safety Audit Training Workshop – Wes Kline, Agricultural Agent, Rutgers NJAES Cooperative Extension of Cumberland County

NJF2S Twitter Workshop – Rick VanVranken, Agricultural Agent, Rutgers NJAES Cooperative Extension of Atlantic County

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High Tunnels

HIGH TUNNEL COVER CROP PRELIMINARY TRIAL

Meredith Melendez, Senior Program Coordinator, Agriculture
Rutgers NJAES Cooperative Extension of Mercer County

NJ growers have quickly embraced high tunnels as a season extension system on the farm. The numbers of high tunnels in the state have steadily increased over the past 10 years, and growers have shown a continued interest via the large response to the recent NRCS funding of seasonal high tunnels.

Cover crops could prove useful in a high tunnel system that is not used year round. A cover crops ability to take up excess nutrients in the fall and release them in the spring as well as reduce off season weed pressures is attractive. Cover crop usage is sometimes overlooked in high tunnels due to the reduced risk of soil erosion in tunnels, a shorter window of time for cover crop usage, and the concern for overwintering of potential crop pests.

The goal of this preliminary study was to evaluate cover crops for practicality of use in NJ high tunnels. Pest harborage was taken into consideration as well as residual plant residue in early spring. *Phacelia tanacetifolia*, hairy vetch, Rodeo oats, and oilseed radish were planted on September 2, 12, 22 and October 3rd of 2011. Each high tunnel evaluation plot was mimicked with a field plot of the same dimensions and layout. The high tunnel plots were watered via overhead irrigation when needed, the outside plots were not irrigated.

The first seeding on September 2nd was just after Hurricane Irene and soil conditions were extremely compacted inside of the high tunnels. Just after the first seeding Tropical Storm Lee hit and much of the first seeding blocks co-mingled. While the tunnels were covered and the sides were lowered during the rain event a river of water flowed through the tunnels. A total of 17 inches of rain fell on the outside plots during the two storms. The warmer than usual winter temperatures prevented the cover crops from winter killing. All but the hairy vetch would have winter killed during a normal winter season. The tunnel sides were not lowered until January 6th, and the crops had minimal frost damage at that point.

Of the four cover crops evaluated two showed the greatest potential for use in New Jersey high tunnel systems, *Phacelia* and oilseed radish. These two cover crops offer late season planting success, fall uptake of leachable excess soil nutrients, weed suppression, quick plant residue decomposition, spring nitrogen release, and other studies have shown bare spring seedbeds when a killing frost occurs. Hairy vetch grew well, too well in fact, and was highly effective at suppressing weeds in both the tunnel and outside plot areas. Vetch, even at the late planting date sprawled beyond its plot borders and used the taller cover crops as a trellis to grow upon. While vetch has qualities that make it a good cover crop its lack of winter kill and weedy nature are deterrents for use in high tunnels where bare ground planting is done. Allowing vetch to produce seen can perpetuate its weediness into future seasons. The rodeo oats plantings had the poorest germination rates out of the group, and did poorly in the later plantings compared to the radish and *Phacelia*. No insect pests were noticed to be overwintering in the high tunnel cover crop plots.

Phacelia tanacetifolia

Phacelia is a fast growing non-leguminous plant native to the southwestern portion of the U.S. It is commonly used as a cover crop and an insectary plant in Europe. There is renewed recent interest in the U.S. for *Phacelia* as a cover crop. *Phacelia* geminates best at cooler temperatures, is a quick grower, winter kills, leaves little residue in early spring and is tolerant of drought conditions.

Research in other regions shows that *Phacelia* is effective at catching excess nitrates in the soil before they are leached from the topsoil. These qualities make it an interesting candidate for high tunnel cover crop use but it should be noted that *Phacelia* is also susceptible to *Sclerotinia minor*, a major disease of lettuce for NJ growers. Growers considering planting a lettuce crop in their high tunnel will not want to use *Phacelia*.

As an insectary crop *Phacelia* produces a high quality nectar and pollen and is an excellent food source for honeybees, bumblebees and syrphid flies.

Phacelia plots in the high tunnels that performed best were those planted on the latest planting date, October 3rd. A planting rate of 15 lbs per acre was used, recommended rates go as high as 18 lbs per acre. Based on seeding observations the higher rate would be recommended for use in high tunnel cover crops. The cooler temperatures allowed for quick foliar growth providing canopy cover. *Phacelia* performed well in terms of weed suppression, and has potential to do better at the higher seeding rate. Dandelion, sorrel and henbit populations were reduced but still evident in the *Phacelia* plots.

Phacelia has an attractive purple flower, which bloomed in the tunnels in mid March. Due to the lack of winterkill *Phacelia* reached an average height of 3.5' in the tunnels. By mid-March plant material was tilled in to prepare for the subsequent high tunnel tomato crop.

Oilseed radish

Oilseed radish was planted due to easy access of its seed through retailers. Oilseed radish is touted as a fall planted cover crop that absorbs nutrients and releases them in early spring. Oilseed radish is similar to forage radish, but its taproot tends to be shorter and fatter. Management recommendations and traits of forage radish are about the same for oilseed radish. Radish has considerable nitrogen needs during its fall growth, offering growers a storage sink for excess nitrogen. Oilseed radish plant residue decomposes quickly in early spring leaving the seedbed ready to plant after a winter with killing temperatures. This early season decomposition of plant residue releases the fall absorbed nitrogen, increasing the topsoil fertility. The 1" in diameter root growth encourages water infiltration into the soil.

The oilseed radish germinated within 10 days and all four planting dates produced sizeable root and foliage growth inside of the tunnels. A seeding rate of 42 pounds per acre was used and this provided ample coverage of the soil surface. Of the four cover crops evaluated oilseed radish provided the most weed suppression early on due to early canopy cover, and most consistently throughout the trial due to the size and shape of the leaf. The only weed that was consistently evident in the outside plots was dandelion. Inside of the tunnels few if any weeds were evident once full canopy cover was achieved. Due to the mild winter the oilseed radish did not winterkill and was in full bloom by mid March. This left considerable plant residue in the tunnels, which was tilled in. Average taproot size by March was about 3" in length and 1" in diameter.

Conclusion

This trial answered some preliminary questions as to how these four cover crops would grow in a high tunnel setting. Due to the mild winter we did not see the expected winterkill of the oats, radish and *Phacelia*, leaving us with many questions about cover crop growth during a winter with killing temperatures. In future studies more data could be collected to assess the actual increase to topsoil fertility, soil water infiltration, compaction reduction, pest harborage and weed suppression particularly dandelion.

HIGH TUNNELS IN THE URBAN ENVIRONMENT OF PHILADELPHIA

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I want to write about some present day activities in the City of Philadelphia and some good "old style" extension and applied research that we have been undertaking in the heart of the city under the gaze of William Penn, perched high atop City Hall. As you may or may not know, myself and other colleagues in the Department of Horticulture have been working with high tunnels since 1998 when we started the High Tunnel Research and Education Facility located on the Penn State Horticulture Farm at Rock Springs, PA. We have over 30 high tunnels of various sizes and more recently moveable high tunnels located at the facility. For those that may not be aware of what high tunnels are all about I will give a brief description of them.

High tunnels are an excellent example of season extension technology when employed by growers can extend the growing season and improve the yield and quality of vegetables, small fruits and cut flowers. High tunnels are certainly not greenhouses, although greenhouse principles serve as the basis for the function of a high tunnel. High tunnels normally have only one layer of plastic over a pipe frame, unlike a greenhouse where there are two layers inflated with air over a pipe frame. There is usually not a furnace or permanent type heating system or the associated fans for heating and ventilating. There is no electricity in a high tunnel. Ventilation is accomplished by manually rolling up the sides each morning. The ventilation of the tunnels is critical to the successful production of crops in a high tunnel. Some growers have installed a small fan and louvers to provide some ventilation and to keep the temperatures from rising rapidly in the morning until they are able to get over to roll the sides up. Some growers do provide supplemental heat through the use of non-vented propane heaters that should only be used in an emergency situation (such as an extreme drop in temperatures) and only for the short term. Drip irrigation is used for watering and fertigation is used to inject soluble fertilizers to feed the crops or organic based fertilizers are used. In many cases biological control of insect pest is practiced.

In partnership with community based organizations, the Department of Plant Science, Penn State University, and Philadelphia County Cooperative Extension personnel) and through funding supplied by two USDA's Specialty Crops Block Grants administered by the Pennsylvania Department of Agriculture we are assisting with the purchase and/or construction of high tunnels and providing hands-on training on construction, production and operation of these high tunnels to produce vegetable crops for an extended season even year around production of greens, root crops and other cool season vegetables to help eliminate the food deserts that exist in the city of

Philadelphia and to provide more fresh and nutritious specialty crops (vegetables/small fruits) to the underserved populations thus fighting obesity especially childhood obesity and the associated health ramifications.

Urban farming is a rapidly growing and expanding movement in the United States and in particular Philadelphia. Half of the population of the United States resides in or around urban areas and urban farming could contribute to increased food security, food safety, workforce development and entrepreneurship. Increased availability of fresh and nutritious vegetables and fruits especially to underserved populations in urban areas lacking retail food outlets is a high priority of decision makers at the federal, state and local level and is viewed as a way to combat the alarming rise of obesity especially in children and thus reduce the potential ballooning health care costs in the United States. We have found that high tunnels have proven to extend the growing season to even year around production of selected crops, increased yields and improved the quality and shelf life of vegetables, small fruits and cut flowers while reducing disease pressure and thus the need for pesticides.

Thus far we have partnered on the construction of fourteen high tunnels in the city of Philadelphia: a 30 foot wide by 60 foot long high tunnel located at Nice Roots Farm, SHARE Food Program, on 2901 West Hunting Park Avenue; a 21 foot wide by 48 foot long high tunnel at Grumblethorpe Museum and Farmstand, located at 5267 Germantown Ave.; a 12 foot wide by 20 foot long high tunnel at Walnut Hill Community Farm, located between 46th and Farragut Streets, and Ludlow and Market Streets; a 21 foot wide by 48 foot long high tunnel located at the Awbury Arboretum, Washington Lane in association with Weaver's Way Produce; a 21 foot wide by 48 foot long high tunnel with Urban Girls Produce located at the Schuylkill Center for Environmental Education located in the northwest corner of Philadelphia, in the neighborhood of Roxborough; a 17 foot wide by 36 foot long high tunnel located at Saul Agricultural High School located off Ridge Ave. and most recently a 30 foot wide by 48 foot long high tunnel with Teens for Good part of the Federation of Neighborhood Centers, at 8th and Poplar Street at a Philadelphia Parks and Recreation site. At the Overbrook Environmental Center, we partnered on the construction of a 17-foot wide by 36-foot long high tunnel built on a raised concrete foundation of an old millwork company.

A second award of an USDA Specialty Crops Block Grant allowed us to construct six additional high tunnels at the following sites and with the following partners. At Heritage Farms we assisted two very energetic young lady farmers on the construction and operation of two 21-foot wide by 96-foot long high tunnels that are being used for production of vegetables for the Methodist Home kitchen and for sale to the local communities. In addition, a non-profit group Tomorrows Promise that trains young men and women in the building trades in doing all the framing of the endwalls, attaching the baseboards and hipboards at that site and additional positive spinoff of the high tunnels. Heritage Farm is located off of City Ave. at the old Methodist Center for children. At the Nice Roots Farm SHARE Food Program located off of Hunting Park Avenue we partnered on the construction and operation of a second smaller high tunnel 21-foot wide by 60-foot long to be placed alongside their current 30-foot wide by 60-foot long high tunnel for the year around production of vegetables for sale at their food

distribution center for the food pantries and soup kitchens of Philadelphia. The SHARE Food Program high tunnels offer a tremendous opportunity for a large number of people from various communities throughout the city to visit the high tunnels when they come to pick up their food and supplies and see how they too could produce fresh produce (specialty crops) back in their own communities. Guild House West, a Friends Rehabilitation Program located at 1221Fairmount Avenue is an independent living facility with 155 units for low-income elders. We are partnering with them on a 21-foot wide by 60-foot long high tunnel to expand the quantity and seasonal availability of produce that can be utilized by the facilities kitchen and also actively involved the senior residents in this project. At Bartram's Garden the oldest surviving botanic garden in North America, located on the west bank of the Schuylkill River in Fairmount Park, we are partnering with them in constructing a 30-foot wide by 60-foot long high tunnel for their urban farming project. Due to overwhelming demand for food grown on Urban Tree Connection (UTC) sites thus far, UTC is converting a 2/3 of an acre parcel in Haddington (the Polselli site at 53rd and Wyalusing) into a farm that will be the central production site of a new venture: a mixed income CSA (Community Supported Agriculture) program named Neighborhood Foods. At the core of the Neighborhood Foods model is the commitment to building a community-based, local, sustainable food system that empowers residents to leverage the resources that exist within their community to build a stronger economy and improve access to fresh, healthy food. They will be partnering with us on constructing a 21-foot wide by 80-foot long high tunnel. With our partner, Teens for Good part of the Federation of Neighborhood Centers we will be constructing another 30 foot wide by 48-foot long high tunnel located at the Schuylkill Center for Environmental Education.

At each of these sites our partners will teach and employ young people and members of the community in the production of fresh vegetables, small fruits and flowers using high tunnel technology. Since 1998, Penn State has developed tremendous expertise in the development and utilization of high tunnel technology across the state and is indeed a natural partner to assist with the further introduction of high tunnels into the city as part of the larger Urban Farming Initiative ongoing in Philadelphia. A wide variety of partners are certainly involved in this project from public and private K-12 schools, non-profit community organizations, community parks and recreation centers, food banks, environmental centers and all are committed to the utilization of high tunnels to teach and employ young people and members of the community in the production of fresh vegetables, small fruits and flowers thus helping to fight obesity in adults and children and also fighting childhood diabetes. This project truly showcases “old style” extension and applied research at its finest, directly and positively impacting the lives of countless people in the City of Philadelphia.

For further information:
2003 High Tunnel Production Manual- a157 page manual is available for $25.00 from Dr. Bill Lamont at the above address. Checks should be made out to The Pennsylvania State University.

THE INFLUENCE OF GRAFTING ON HIGH TUNNEL TOMATO PRODUCTION

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Introduction:

Many studies have shown that grafting susceptible tomato varieties onto disease resistant rootstocks can improve plant growth and yield. This is especially true where crop rotation choices are limited in high tunnels. There is increasing interest in utilizing grafting in high tunnel production because of concerns with soil-borne diseases and the difficulty of practicing good crop rotation. One grower study in Pennsylvania also showed a yield response when a disease resistant variety was grafted and planted into fumigated and non-fumigated soil in a high tunnel. In order to investigate whether grafting can enhance yield without the presence of soil-borne disease in a high tunnel, a study was conducted in the research high tunnels at the Rutgers Agricultural Research & Extension Center, Bridgeton, NJ in 2011and 2012.

Materials and Methods:

Four varieties of tomatoes ('BHN589', 'Primo Red', 'Red Deuce', and 'Scarlet Red') were grafted onto 'Multifort' rootstock in 2011 and 'Maxifort' rootstock in 2012 and compared with ungrafted plants. The grafted and ungrafted plants were transplanted 1 cu ft bags (2 plants/ bag) of clean soilless mix to eliminate the possibility of soil-borne disease on April 18, 2011 and April 19, 2012. The bags were setup on landscape fabric on the floor of research high tunnels, watered with drip tape through the bags and the plants were trellised using 4' stakes. Tomatoes were harvested vine ripe, graded for marketability and into three size categories (>3.5", 2.75-3.5" and 2.35"-2.75) and weighed.

Results and Discussion:

The yields of all four varieties were higher for the grafted plants than the ungrafted plants (Figures 1., 2., 3., & 4.). In 2011, the yields and fruit quality from the plots were somewhat low due to a problem with a lack of surfactant in the bag media mix. In 2012 a surfactant was added through drip irrigation with fertilizer to prevent this problem. It is unclear why the ungrafted 'BHN 589' performed so poorly in 2012.

Conclusions:

Grafting appears to be a potential tool for increasing tomato yields in high tunnels even when soil-borne diseases are not know to be present.

Acknowledgement:

Funded by the Charles E. and Lean Maier Research Fund administered through the New Jersey Vegetable Growers Association and Rutgers NJAES.

Figure 1. Marketable yield from high tunnels RAREC, Bridgeton, NJ 2011

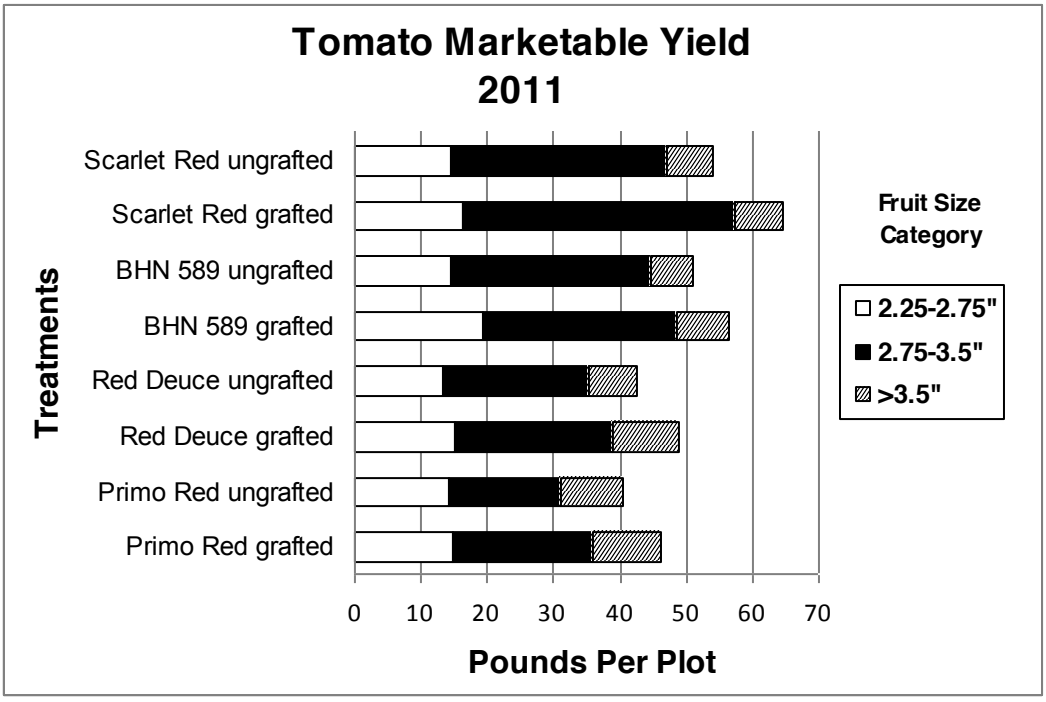


Figure 2. Marketable yield from all varieties combined RAREC, Bridgeton, NJ 2011

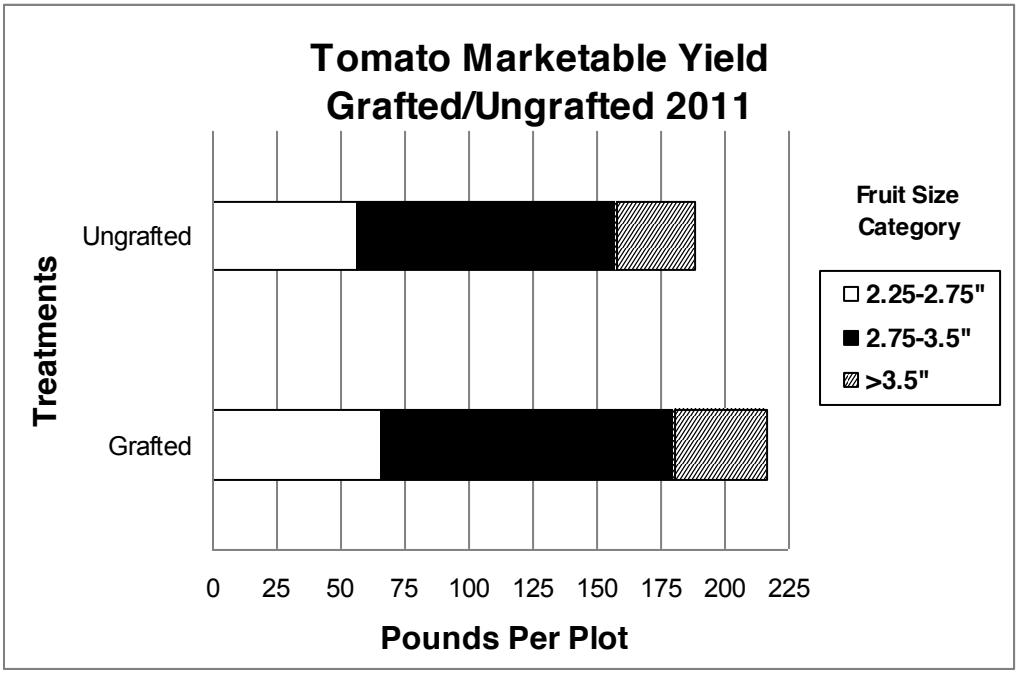


Figure 3. Marketable yield from high tunnels RAREC, Bridgeton, NJ 2012

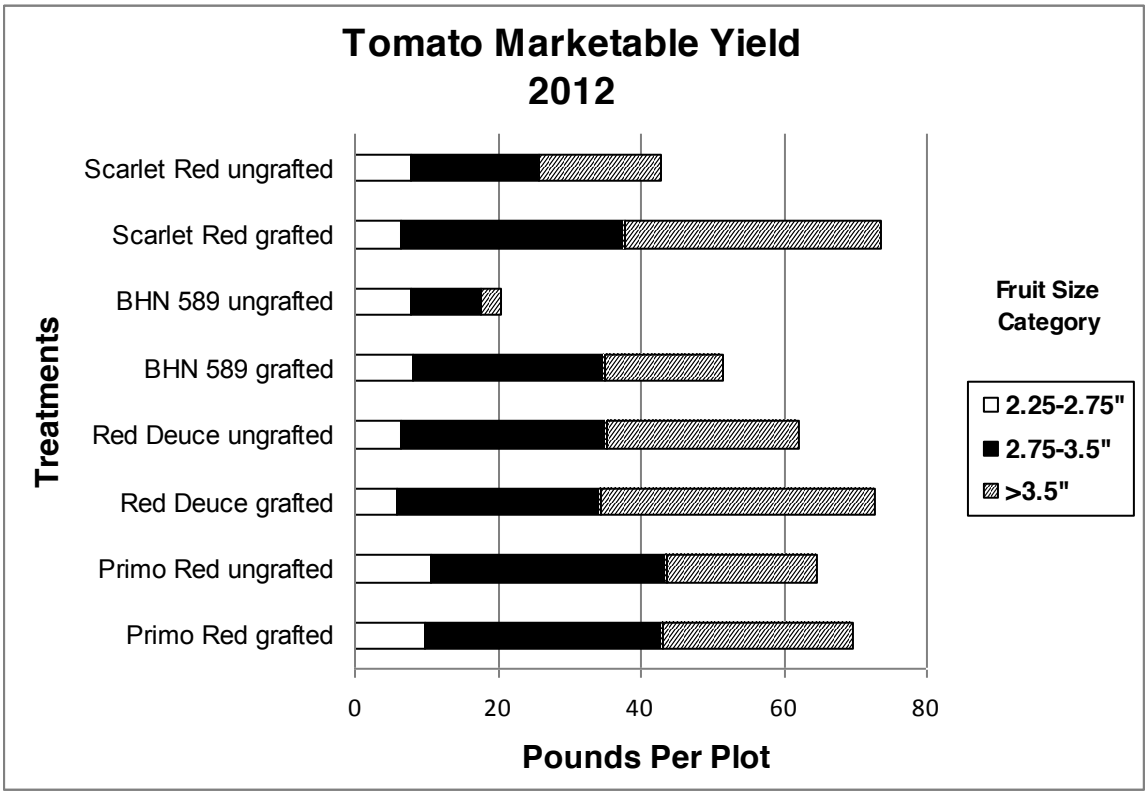
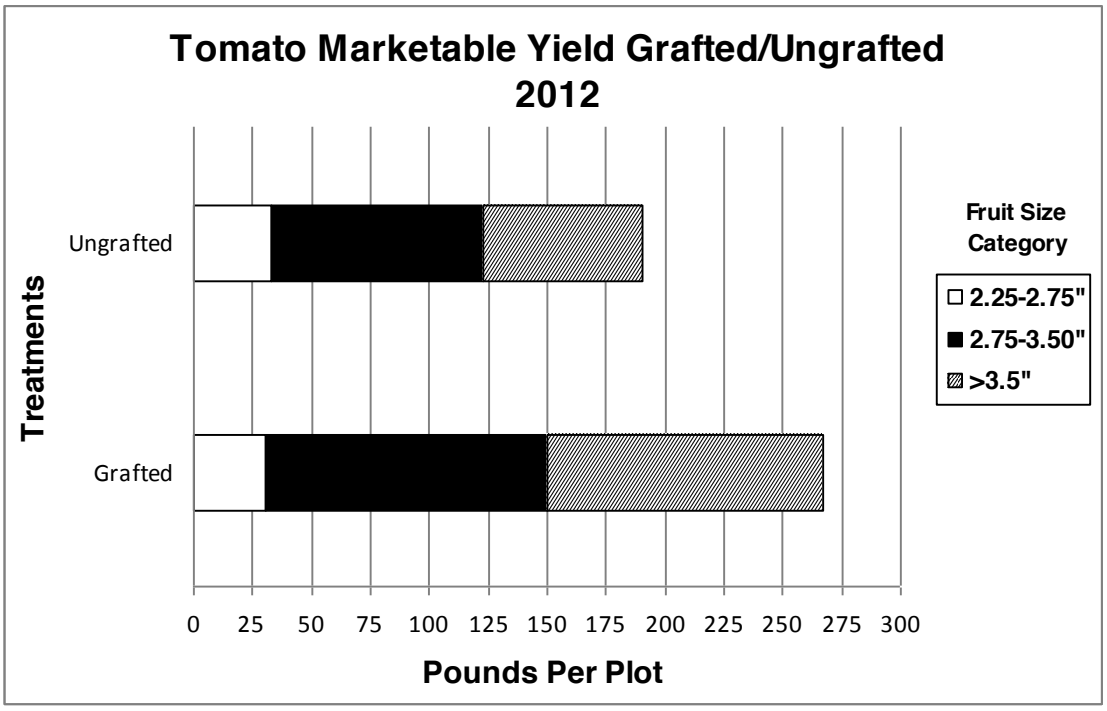


Figure 4. Marketable yield from all varieties combined RAREC, Bridgeton, NJ 2012



TOMATO DISEASE CONTROL IN HIGH TUNNELS

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Tomato diseases such as early blight, late blight and white mold can cause serious problems high tunnel tomato production. In general, most diseases which cause problems in field-grown tomatoes will also cause problems during high tunnel and greenhouse production. It is important to remember that disease development is driven by environmental conditions, and in some cases, conditions inside structures such as high tunnels and greenhouses can be extremely conducive to disease development. Even though high tunnel tomatoes are grown "inside", relative humidity (RH), air temperature, soil temperature and leaf wetness will greatly influence disease development in high tunnels.

Septoria leaf spot will only infect the foliage and stems of the tomato plant. Symptoms to scout for are small, circular lesions with a dark outer edge and brownish-tan center. Black spore-producing bodies will develop in the center of these lesions. When scouting, look on the lower foliage of the tomato plant early in the season. The disease usually works its way up from the base of the plant causing premature defoliation.

Early blight will affect the foliage, stems and fruit. Early blight will produce brown, concentric lesions on the foliage and stems and are much larger than lesions produced by septoria leaf spot. Early blight, like septoria leaf spot, can also cause premature defoliation. Early blight can also infect green and red fruit through the stem attachment. Lesions that develop on the fruit also produce brown, concentric rings.

Although anthracnose fruit rot can infect green fruit and foliage, symptoms only appear on ripe fruit during the growing season. Anthracnose lesions begin as slightly depressed circular lesions. As lesions enlarge they become more flat and develop black, speck-like fruiting bodies in the center of the lesion.

Control of all three diseases should begin with a weekly regular fungicide maintenance program of alternating fungicide chemistries. The rotation of fungicide chemistries helps to reduce the potential for fungicide resistance development.

Late blight (*Phytophthora infestans*) is an important disease of fresh-market and processing tomato and potato in the Northeast. The pathogen, *Phytophthora infestans*, is an oomycete, or water mold, with free-water favoring its development and spread. Cool, wet weather with high relative humidity is ideal for its development. Left uncontrolled, late blight can spread swiftly from plant to plant. Late blight survives between seasons on infected plant material left in the production field, in cull piles, and in homeowner's gardens. The fungus can infect all aboveground parts of the tomato plant causing circular, water-soaked lesions on leaves. Gray to white 'fluzzy' growth develops on the margins of leaf lesions which produce masses of sporangia that are spread during rainfall. Infections in fruit often begin when green fruit are maturing. On green fruit, dark, blackish-brown lesions develop remain firm as lesions expand.

Control of late blight begins with removing sources of potential inoculum, such as plant material left in the field and cull piles. Plant material should be disked under thoroughly or buried. Preventative fungicide programs should be followed during the growing season to help reduce the chances for infection. High tunnels, and especially field-grown tomatoes, should be monitored and scouted on a weekly basis. If Late blight has been diagnosed in surrounding areas fungicide applications need to be adjusted accordingly. Late blight will move into high tunnels and greenhouses if surrounding field-grown tomatoes are infected.

Bacterial diseases of tomato such as canker, spot and speck can cause serious losses in tomato crops if left uncontrolled. All three bacterial diseases of tomato can be seed-borne and great care should be taken in planting certified, disease-free seed and/or treating seed prior to seeding. These bacterial diseases can start in the greenhouse during seedling production. Cultural practices in the greenhouse, such as using hot water heat seed treatment, keeping greenhouse space free of weed species, and proper sanitary practices can be used to help reduce the chances for bacterial disease development. Symptoms of Bacterial canker on infected leaves include marginal leaf necrosis and dieback. On fruit, Bacterial canker causes distinct 'bird's eye spots' on green and red fruit which appear as a small, raised, scabby, circular spot with a white margin. Symptoms of Bacterial speck (*Pseudomonas syringae* pv. *tomato*) on infected leaves include small, blackish-brown lesions with an irregular chlorosis (yellowing). On infected fruit, Bacterial speck causes distinct, pin-point black lesion. Symptoms of Bacterial spot (*Xanthomanos campestris* pv. *vesicatoria)* on infected leaves include small, blackish-brown circular lesions which produce a chlorotic (yellow) 'halo'. On infected fruit, Bacterial spot produces large brown, raised, circular, scabby lesions which are distinctly different from Bacterial speck lesions. In the case of both Spot and Speck, heavily infected foliage will cause premature defoliation leading to potential sunscald and fruit infections if left uncontrolled. Regular applications of copper containing compounds can help suppress bacterial infections. If infected plants are suspected in the high tunnel or greenhouse great care should be taken to help reduce the chances of spreading all three diseases. For example, plants that are suspect to bacterial infections should be removed and destroyed. Maintain proper weed control and remove any plants suspected with disease. Avoid working when foliage is wet because harvesting, pruning and tying can spread bacterial diseases. Disinfest all stakes and equipment prior to and after use.

Powdery mildew (*Oidiopsis* sp.) can also become a serious problem in high tunnels and greenhouses if left uncontrolled. Symptoms of powdery mildew are the white powdery spots that will gradually coalesce on all parts of the plant. Infected leaves will become chlorotic and eventually die. Fruit are not infected. Powdery mildew will lead to premature defoliation, smaller fruit size and predispose fruit to potential sunscald. Powdery mildew needs a living host in order to survive from crop to crop. Therefore, after a crop is finished great care should be taken to remove all plant material from the high tunnel or greenhouse. Keep structure free of weeds, ornamental plants and houseplants. Successfully controlling Powdery mildew begins with regular scouting and preventative fungicide programs. Early detection and weekly fungicide applications will be necessary once powdery mildew is detected.

For more recommendations on controlling tomato and other diseases in high tunnels and greenhouses see Table E-14 in the 2013 Commercial Fungicide Recommendations Guide and the 2013 FRAC Guide.

Sweet Corn

IS IT REALISTIC TO USE UNTREATED SWEET CORN SEED?

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Sweet Corn seed treatments have been around for many years. They are a part of sweet corn culture that is often over looked and taken for granted. It is the intent of this study and talk to explain their value in detail for producing high crop yields and to evaluate some of the newer seed treatments that might have an application in replacing chemical treatments. These newer treatments boast that they are “almost as good” as standard seed treatments in producing even stands and high yield. This is a pretty broad statement and one I tool to task in this study to prove or disprove this claim.

For the most part, seed treatments are applied at the seed production facility to assure even application of the seed coating as well as to ensure that the rates are adequate in order to get the pest control needed and get the job done. Generally, sophisticated equipment is needed to make sure the coating application is even. Seed treatments are used to control many different pests however the two broadest categories would include various insects and diseases. With advent of newer genetics in sweet corn, such as super sweet, the need for new more effective treatments became necessary particularly since the newer varieties of corn generally contain considerably less stored endosperm (food reserves) in the seed which is important for seed initial seed vigor. This need is especially critical in situations where corn is planted in early cold soil conditions. Captan and Thiram are two standard seed treatments that have been used for sweet corn for many years with great success. These two materials are non-systemic and control a broad range of fungal organisms and can be used on all types of sweet corn genotypes. Maxim is another seed treatment that is especially good at controlling both seed and soil borne diseases. Dividend is still another more recent treatment that excels in controlling both Penecillium and Fusarium as seedlings emerge. Apron is used as a seed treatment to control Pythium and other water molds that we frequently encounter in New Jersey Soils. Poncho is an effective insecticide seed treatment that controls larger soil insects such as rootworms, wireworms, flea beetles and grubs depending on the rate used. These are all important insects here in New Jersey particularly the flea beetles that are a persistent threat for spreading Stewarts Wilt Disease. Latitude is a planter box treatment that gives control of wireworms and grubs.

Of particular interest in this study was a new seed treatment called “Natural II” that could be used in organic systems. Natural II makes claims that seem to go above those normally touted by other seed treatments currently available. For example, it is reported to be “an organic, liquid biological seed treatment applied as a film coating and formulated with beneficial microbes, macro and micro nutrients, amino acids, organic acids, enzymes, proteins, vitamins, and minerals”. Natural II also is applied to “promote root growth and protect seedlings against soil-borne pathogens, improving germination stand establishment and uniformity”. Did you get all that? But what does this really mean? It is the intent of this study to evaluate these claims with a side by side comparison with traditional treated seed.

This study was conducted at the Rutgers Agricultural Research and Extension Center located outside of Bridgeton New Jersey. The study was conducted as a randomized, complete block design to reduce field variability as much as possible. All experimental units consisted of two row blocks of the same varieties. All varieties planted

were further subdivided into seed treatments consisting of untreated seed, conventional treatments, and Natural II treatment. Treatments were planted on May 12, 2011 which was not a particularly early planting date as intended. To study the efficacy of seed treatments I would have liked to have trials planted a month earlier which would stress the plants even more and most likely result in more dramatic test results.

The varieties used for this study ranged from 67 to 81 days maturity. The varieties used in part one of the study were Frisky, Trinity, Fleet, Pay Dirt, Polka, XtraTender 270A. XtraTender 277A, all of which are longer season varieties.

Just as early emergence occurred, it was evident there were going to be highly significant stand differences between varieties as well as the type of seed treatments. Results show that with the variety Trinity that the differences in stand counts between the traditional chemical seed treatments and Natural II were negligible while the untreated seed showed more than 80%loss in stand count. With the variety Fleet the variability between treated and untreated seed was negligible in this study. Apparently the variety might have a greater genetic tolerance to root diseases that make it stand up better to colder, wet, and unfavorable soil conditions. Fleet unfortunately, did not have very good flavor, tended to be tough with a starchy taste, By picking a few days earlier you might improve its eating quality but I felt it was still below that of some other varieties in the test. Frisky was another variety that seemed to have some favorable results with the Natural II treatment however it had other undesirable characteristics that would make it not suited to the commercial markets. Both the plants and ears were exceptionally small and not salable. With the variety Pay Dirt, both the untreated seed and Natural II seemed to fall below accepted standards and had stand losses of more than 74% below the standard treatments. While the ears on Pay Dirt were good eating quality, they were also too small to be of commercial acceptability of this trial. The plants were vigorous, healthy and it appeared that there were no real differences between untreated, and conventional. This was the only variety in the test that you might possibly be able to plant without any seed treatments. This variety seemed to have some pollination problems that I attributed to the high Oriental beetle populations and by the fact that it was the closest variety planted to the grassy areas that were the primary source for the beetles.

In conclusion, I *feel that the following can be learned from this study*

1) *Overall, the risk of using untreated sweet corn seed is simply too great at this time. Conventional Seed treatments are essential if you are not willing to accept stand reductions of 75-80% or greater.*
2) *The organic seed treatment, Natural II seemed to produce acceptable results but only on some varieties and only in situations where the disease pressures were low.*
3) *Some varieties in this study namely Pay Dirt, Frisky and others had ears too small for commercial production.*
4) *The variety XtraTender 270A had strong vigorous plants, good ears, and had superior growth habits but lacked some of the better eating quality of the other varieties.*
5) *If interested in eliminating sweet corn seed treatments for whatever scientific or philosophical reason, be sure to start small and only plant blocks small enough that you are willing to lose the stand and replant if needed.*

CURRENT TRENDS WITH BT SWEET CORN CONTROL

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Sweet corn producers must rely on timely pest monitoring and effective insecticide sprays to minimize ear damage by corn earworm, European corn borer, and fall armyworm. The fresh market and processing industry can tolerate only minimal damage to the ears. Pyrethroids are the popular choice for worm control but efficacy has declined in recent years due to resistance in corn earworm populations. Spray mixtures of Lannate or Larvin plus a pyrethroid have become a common practice to circumvent a potential resistance problem. Also, rotations and mixtures with newer but more expensive insecticides such as Coragen, Belt and Radiant, as well as some premix products (i.e. Voliam Xpress, Hero EC) are recommended options and provide excellent control. However, despite what insecticide is used, timing the first spray at the first signs of silking, followed by a prescribed schedule based on moth pressure, and adequate spray coverage of the ear zone are critical steps to achieve effective control. For example, most corn earworm eggs are oviposited directly on sweet corn silks; once larvae hatch, they quickly move down the silk channel, and begin feeding on the ear tip, where they are protected from insecticidal sprays. It is thus important to maintain a residual level of insecticide on silk tissue at all times.

These problems with conventionally applied insecticides have been solved by transgenic delivery of insecticide within the sweet corn plant. As an alternative, the most potent bioinsecticide for sweet corn insect control is provided by transgenic hybrids expressing one or more insect-active toxins from the bacterium, *Bacillus thuringiensis* (Bt sweet corn). Attribute® Insect Protected hybrids from Syngenta Seeds have been commercially available since 1996. Acreage of Bt sweet corn has increased significantly in recent years with the introduction of improved ROGERS® Brand fresh market hybrids. The availability of seed in 25K units has also made it easier for the small producer to use the Bt technology. Attribute Bt hybrids express a single Cry1Ab toxin (event Bt11) that is highly effective against European corn borer but this toxin alone does not provide 100% control of corn earworm or fall armyworm. Based on multiple-year field trials in Maryland, Attribute® hybrids eliminates all whorl treatments and reduces silk sprays by at least four applications. Although these hybrids provide excellent protection against the caterpillar complex, two and sometimes three supplemental insecticide sprays are needed to ensure fresh market quality ears, especially during high moth activity. Moreover, corn earworm populations may be developing tolerance to the Cry1Ab toxin in mid-Atlantic region, where this insect successfully overwinters.

Biotech and seed companies are continually working on new Bt gene combinations in corn to broaden the spectrum of activity and to prevent resistance development. The development and commercialization of new Bt field corn events by Syngenta Seeds have isolated a novel vegetative insecticidal protein from *B.t.* – Vip3A (MIR162 event). This toxin is highly effective against a range of agriculturally important lepidopteran larvae including black cutworm, fall armyworm, corn earworm, and western bean cutworm. In field studies conducted in Maryland and Minnesota, hybrids expressing the Vip3A trait and pyramided with the Cry1Ab Bt protein were compared to near isogenic non-Bt hybrids. Over all years and locations, the non-Bt hybrids, without insecticide protection, averaged between 43 and 100% ears infested with a range of 0.24 to 1.74 *H. zea* larvae per ear. By comparison, no

larvae were found in the pyramided Vip3A x Cry1Ab hybrids, indicating virtually 100% of all lepidopteran larvae. Compared to the single gene Bt11 event, this combination of Bt proteins significantly increases control efficacy against a broader spectrum of lepidopteran pests for several reasons. First, the MIR162 event has been shown to express a high dose of Vip3A protein against fall armyworm and a “near high dose” against corn earworm. Second, the average expression per ear in the endosperm of the kernels is higher due to the segregation pattern of the two independent genes encoding the Cry1Ab and Vip3A proteins compared to the segregation pattern of a single gene. For example, Attribute Cry1Ab sweet corn hybrids are hemizygous for the Bt11 trait. Due to open pollination and gene segregation in the ear, approximately 75% of the kernels per ear will express the Bt11 trait (50% hemizygous and 25% homozygous) while 25% of kernels will not inherit the gene. This is true for any single insect resistance trait sold as a hemizygous hybrid. Hybrids containing two unlinked insect resistance traits, such as the pyramided Bt11 x MIR162 hybrids will have only 6% of the kernels that do not inherit at least one trait, with 94% expressing either the Cry1Ab, the Vip3A or both insecticidal proteins. This is an important point because larvae hatching later in the crop cycle can invade the ear without feeding on silk tissue, depending on the ear tip coverage and tightness of the silk channel. Reducing the number of non-protein expressing kernels increases the average expression per ear and thus the likelihood of larval mortality via consumption of protein-expressing kernels. The pyramided Vip3A x Cry1Ab hybrids will be marketed under the Attribute II trade name and Syngenta Seeds plans to commercialize this technology in 2013.

Monsanto’s Seminis Seeds also has developed and is marketing pyramided Bt sweet corn under the Performance Series trade name. Bt hybrids available are Temptation, Obsession, and Passion. These hybrids express three insecticidal proteins: Cry1A.105 and Cry2Ab (events MON89034/ MON88017) to control lepidopteran larvae, and Cry3Bb1 to control rootworms, as well as herbicide tolerant traits. Maryland studies have shown that the Performance Series hybrids provide virtually 100% control of corn borers and fall armyworms and more than 95% control of corn earworms, of which the few surviving larvae are small and cause only minor injury on the ear tip. Depending upon insect pressure, Performance Series hybrids may show a little more ear damage compared with the Attribute II sweet corn. The reason is that protein expression per ear is lower than Attribute II because the Cry1A.105 and Cry2Ab genes were vectored together into the plant and thus the segregation pattern in the same as a single gene (that is 25% of kernels do not express).

Attribute II and Performance Series sweet corn hybrids ideally fit the IPM philosophy by combining host plant resistance traits, different modes of action to prevent resistance, and a reduced risk bioinsecticide; and they provide an environmental safe option to conserves beneficial insects. Clearly, the Bt technology can significantly reduce pesticide use and control costs, but control efficacy may vary under adverse growing conditions or very high insect pressure. And finally, these Bt hybrids will not be insect pest free, so regular monitoring of insect pests not affected by the expressed proteins will be essential for successful IPM.

Ag Marketing

REAL FARM EXAMPLES OF CREATIVE AGRIMARKETING

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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. 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. The overall goal of this presentation is to introduce and discuss various real farm examples of creative agrimarketing strategies.

AGRITOURISM AND MARKETING

For many farmers, their venture into Agritourism also means a transition from selling primarily products to also selling a service. Agritourism means the provider is now in the service industry and in the 'people business' dealing with the public on a daily basis. Marketing services is a little different than marketing products as services has 5 unique characteristics:

1. Intangible – Services cannot be seen, held, touched.

2. Inseparable – Services cannot be inventoried or stored and a loss of revenue is incurred if the service is not used or sold.

3. Perishable – Production and consumption occur at the same time meaning the customer and the service provider must interact.

4. Variable – Quality of service is often harder to standardize as each interaction and customer are different. Proper training and communication are very important.

5. Rental/Access – Services often provide temporary access or ownership.

While marketing services can be a little different from marketing products, there are strategies for dealing with each of these unique service characteristics. The examples discussed in this presentation will not only illustrate creative real farm marketing examples but also strategies for successfully marketing services – more specifically, agritourism.

The following real farm marketing examples will be discussed using photographs:

- Photo Opportunities
- Signage and Maps
- Directions
- Creative Corn Mazes
- Farm Dinner
- Open Farm Days
- Hands on Fun
- Visually Educate
- Let Your Customers Do the Talking
- Identify Opportunities for Collaborations & Joint Marketing

Time will be given at the end of this presentation for a discussion among the audience of successful (and unsuccessful) agritourism marketing strategies.
In addition to the above, a recent study by Dr. Rich and colleagues will be briefly discussed which shows that farmers, residents, and extension faculty have dissimilar preferences regarding labels for agritourism-related concepts and regarding definitions of agritourism. Specifically, the study suggests **farm visit** appears to be the preferred label for both farmers and residents. Current resources related to this study:

- Rich, S.R., Barbieri, C., Arroyo, G., & Xu, S. (2012). Agritourism, farm visits, agro-tourism, oh my! Do consumers, farmers, and extension agents speak the same language? North Carolina Cooperative Extension Service, North Carolina State University, Raleigh, NC.
- Arroyo, G., Barbieri, C., & Rich, S. R. (2012 – In Print). Defining agritourism: A comparative study of stakeholders' perceptions in Missouri and North Carolina. *Tourism Management*.

*A large majority of this presentation uses visual pictures to describe the examples listed above; as such, if you would like a PDF copy of actual presentation, please contact Dr. Rich (Samantha.Rich@enrichedconsultingllc.com).

Biography:
Dr. Samantha Rozier Rich is owner/lead researcher of enRiched Consulting, LLC which provides tourism and recreation stakeholders the tools and information required to effectively evaluate and enhance their communication strategies. Dr. Rich has worked in the travel and tourism industry for 10+ years, on both the practitioner and academic sides, with her research focusing primarily on marketing, promotion, and agritourism.

DIRECT MARKETING YOUR PRODUCE AND FARM: UNDERSTANDING CONSUMER MOTIVATIONS AND INTERESTS

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The increasing interest and demand for local foods as well as farm and ranch experiences represent one of the best opportunities for smaller-scale and more intensively managed enterprises to attain financial viability through developing loyal buyers and visitors. Moreover, the widespread differentiation of food offerings and venues has allowed for consumers to more carefully search out attributes that are important to them, so I summarize research on the underlying factors that motivate consumers to choose local food and how motivations vary among buyers in different market venues, based on several surveys administered by colleagues and myself at Colorado State University.

Identifying your Customer

Understanding your customer base is important, and there is no one way to approach this market planning activity. Traditionally, consumers were more likely to be described by demographics such as age, gender, education and income. More recently, and especially in food markets, consumers are being defined more by their values, interests and concerns. However, most would agree that price and value will always be of interest to the majority of customers.

We expect to see differences in fresh produce expenditures by consumers depending on where they shop and the buying power of "local shoppers" will help you determine the potential revenue your business can expect from this group of shoppers. Table 1 shows that the largest share of people spend $0-20 each week on fresh produce, no matter where they shop.

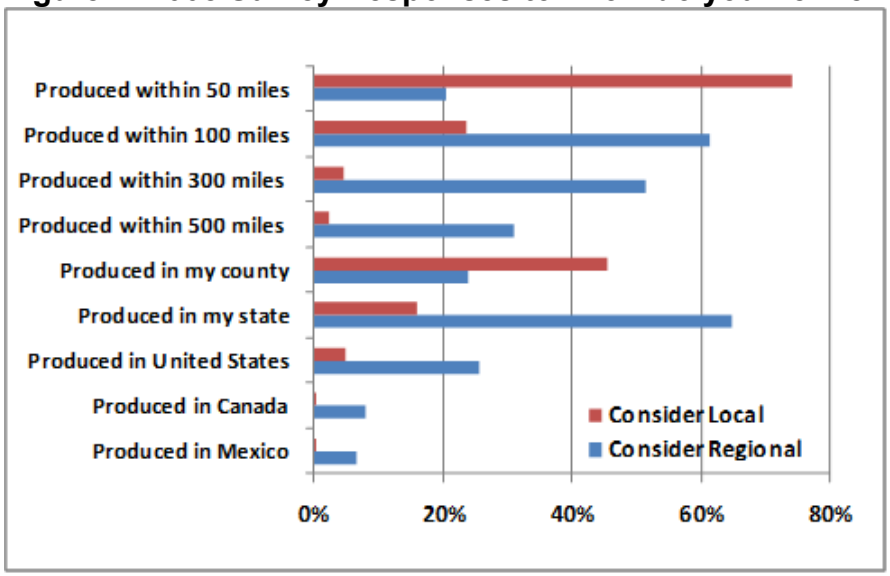
Table 1: Fresh Produce Expenditures by Primary Shopping Venue

	Supermarket	Health/Natural Foods	Farmers Markets	Direct	Overall
$0 - $20	67%	42%	63%	74%	65%
$21 -$40	23%	27%	24%	17%	23%
$41 - $60	7%	15%	5%	9%	7%
$61 - $80	3%	8%	3%	0%	3%
$81 - $100	0%	2%	0%	0%	0%
> $100	1%	6%	4%	0%	1%

As expected, those who spend relatively more are shopping at health/natural or direct outlets. These expenditures are likely a reflection of the share of all food purchases that are fresh produce among these shoppers, and perceived quality demands of these consumers that may raise the overall price points of their purchases. In CSU's 2008 national study, the vast majority of respondents (82%) said they have bought locally grown fresh produce. On the other hand, the number of respondents who reported buying organic fresh produce is lower than that of locally grown fresh produce; slightly above 50%. Close to 40% have purchased fresh produce that is both locally grown *and* organic, suggesting some complementarity between those segments.

Yet, it is important to note that consumers are varied in how they define the term "local" based on both physical distance and political boundaries (Figure 1). Over 70% of respondents considered a 50 mile radius as "local," while the 300 mile radius is more likely considered "regional" than "local" by most consumers. This is an important delineation since 300 miles is often used as a boundary for "local" by retailers. In terms of political boundaries, over 40% considered food produced within one's county as "local."

Figure 1: 2008 Survey Responses to "How do you Define Local?"



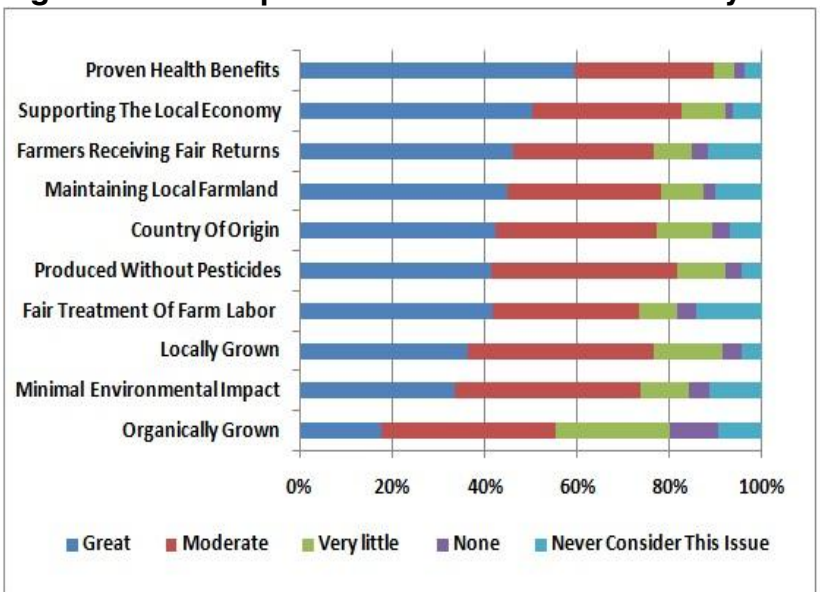
Capturing Local Food and Tourism Dollars by Understanding Motivations

What factors do consumers consider when choosing fresh produce? How do you attract local visitors, "staycation" planners and out-of-staters who want to experience something authentic while visiting other regions? Our studies exploer these very issues.

For food, we traditionally focused on eating quality, food safety, and health benefits, and those factors are still key!! But, there is increasing evidence that some consumers are "voting with their dollars" and make their purchase decisions based on a variety of issues and our findings on these motivations are illustrated in Figure 2 (the

wider the first and second bars, the higher share of respondents who felt that factor was important to their purchase choice).

Figure 2: How Important are Various Factors in your Choice



As one may expect, the factor "proven health benefits," had the highest percentage of consumers who assigned it great importance. In contrast, the next three most important factors, "supporting local economy," "farmers received fair share of economic returns," and "maintaining local farmland" could be framed as more altruistic motivations related to public goods consumers want to support. And, although these factors might be associated with locally grown, the broader "locally grown" attribute was rated lower. Despite its significant market presence, organic was rated quite low, which is consistent with the lower market penetration reported earlier. These results illustrate that consumers are seeking assurances on specific "outcomes" such as supporting the local economy, farmers receiving fair share, maintaining local farmland, and fair treatment of farm labor, rather than more vague claims, such as locally grown, organic, and minimal environmental damages.

Do Motivations Relate to Where Consumers Shop?

In reporting their primary fresh produce sources, the majority of respondents (83%) reported supermarkets as their primary source while farmers market and direct purchases from farmers had small but significant shares (9% and 2%, respectively). However, 33% and 8% of the US households use farmers market and direct purchases from farmers as a secondary source to procure at least one-quarter of their produce. We went on to ask about how shoppers believe their food purchases may affect their lives and communities. We found that those who shop in direct, local markets believe they are helping their local economy and the preservation of farmland, so if you have a story about how your consumers help you and your community, Share it!!

How about Agritourism?

There are similar insights one can gain by looking at travel behavior and agritourism participants and their behavior. We identified consumer clusters focusing on visitors that did some planned agritourism activities on their trips to Colorado (we named them the Out-of-State Activity Seekers, the Loyal Colorado Enthusiasts and the Family Ag Adventurers) but also found that one in five of all visitors to Colorado surveyed indicated that they participated in unplanned agritourism activities during their last trip. Key characteristics of these targeted clusters are:

- The Out-of-State Activity Seekers are made up of mid- to upper-middle, traveling in smaller parties, who were more likely to engage in agritourism as a secondary or unplanned activity. They enjoy participating in numerous outdoor activities, and report some of the highest interest in all agritourism activities from this group.
- The Loyal Colorado are parents of older children and couples who return often—based on past experiences. They are the highest share of participants in outdoor recreation on farms and ranches during the summer, are most likely to camp while traveling, stay within a few hundred miles of home and participate in a diverse set of agritourism activities.
- Family Ag Adventurers are among the most promising agritourism visitors. This segment plans their travels around specific agritourism outings as well as participating in unplanned activities several times per year. This group can be defined as middle income, often with children and travel in bigger parties. They are willing to visit local enterprises as well as traveling long distances to reach a variety of agritourism destinations.

We found that a relatively small, well-targeted investments in agritourism promotion could yield large returns for entrepreneurs and communities across Colorado and create a large field of repeat visitors to businesses associated with the agritourism sector. Partnerships with other travel-related organizations are key to increasing the success of Colorado's agritourism sector. For agritourism operators looking to leverage scarce advertising resources, investment in a functional, informative Web site, and promotion through state Welcome Centers, park brochures and travel associations will target the greatest number of interested consumer segments and engage both the planner and the spontaneous traveler.

For More Information:

Onozaka,Y. G. Nurse, and D. Thilmany McFadden. 2010. "Local Food Consumers: How Motivations and Perceptions Translate to Buying Behavior." *CHOICES*. 1st Quarter 2010 | 25(1). http://www.choicesmagazine.org/magazine/article.php?article=109

Thilmany McFadden, D., C. Thomas, and Y. Onozaka. AMR 09-02. Who are the Locavores and Where Do They Shop? An Analysis of Fresh Produce Market Choices in the United States. June 2009. http://dare.colostate.edu/pubs/AMR/AMR%2009-02.pdf

These studies were funded with support from USDA-CSREES NRI Project #2008-35400-18693 and the Colorado Ag Experiment Station.

COMMUNITY SUPPORTED AGRICULTURE: ADDING SEAFOOD TO THE RECIPE

Gef Flimlin, Rutgers Cooperative Extension of Ocean County of Ocean
Caroline McLaughlin, NJ Sea Grant Consortium
Jennifer Lamonaca, Sea Salt CSA

Rutgers Cooperative Extension of Ocean County and the New Jersey Sea Grant Consortium partnered with Sea Salt Community Supported Agriculture (CSA) organic farm, located at B&B Farms in Galloway Township, New Jersey, to develop and implement a small-scale pilot program offering current CSA shareholders the option to buy biweekly local seafood shares in addition to farm produce. Twenty six opted to participate in the pilot project out of 75 produce shareholders.

The program hopes to expand regional markets for local New Jersey seafood by adapting the success of community supported fishery (CSF) models to the popularity of the local foods movement in New Jersey. Due to legal and regulatory requirements associated with seafood distribution in the New Jersey, the program coordinators chose to source all shares from certified seafood distributors that sell local responsibly harvested or grown seafood. Every two weeks, seafood shares were distributed out of the farm store at B&B Farms, accompanied by an online packet that includes information about the product suppliers, methods of catch or harvest, a brief natural history of the featured species, instructions for handling and preparation, and recipe suggestions.

Two surveys were done with the shareholders before and toward the end of the seafood share process. Initial surveys helped to make decisions about what types of seafood would be offered and the later survey critiqued various aspects of the overall program. Satisfaction was high among the shareholders, although the delivery logistics and pricing of the shares need to be re-evaluated before this would be expanded to other CSAs around the state.

Peppers

ANTHRACNOSE AND PHYTOPHTHORA CONTROL IN PEPPER

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Controlling anthracnose fruit rot in bell pepper.

Anthracnose fruit rot has been an increasing problem in pepper production during the past few years in NJ. The pathogen, *Colletotrichum* spp., also causes a fruit rot in strawberries and tomatoes. The pathogen can infect pepper during all stages of fruit 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 (i.e., disced, plowed under) 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
Priaxor (boscalid + pyraclostrobin, 7 + 11) at 4.0 to 8.0 fl oz 4.17SC/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 reducing control. Growers have had success in reducing the spread of anthracnose by finding 'hot spots' early in the infection cycle and removing infected fruit and/or entire plants within and immediately around the hot spot.

Controlling Phytophthora crown and fruit rot.

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. Always plant phytophthora-resistant/tolerant cultivars such as Paladin, Aristotle, Revolution to help minimize losses to the crown rot phase of the disease.

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

Ridomil Gold (mefenoxam, 4) at 1.0 pt 4E/A or 1 Ultra Flourish (mefenoxam, 4) at 1.0 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. Mefenoxam is still effective against sensitive populations of the pathogen. However, DO NOT USE mefenoxam, if mefenoxam-insensitive strains are present on your farm.

Ranman (cyazofamid, 21) at 2.75 fl. oz 400SC/A may be applied via transplant water (see label for restrictions)

Presidio (fluopicolide, 43) at 3.0 to 4.0 fl oz/4SC/A can be applied via drip irrigation (see supplemental label); PHI: 2 days

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

Ridomil Gold Copper (mefenoxam + copper, 4 + M1) 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.

Tank mixing one of the above materials with a phosphite fungicide (FRAC code 33), such as K-Phite, Rampart, or Prophyt will also help control the fruit rot phase of Phytophthora blight.

Recommended Red Pepper Varieties – Two Years of Research

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Introduction

We have evaluated colored pepper varieties over the last two years to determine which are adapted to Southern New Jersey conditions. The pepper advisory committee requested these evaluations and the work was carried out at the Rutgers Agricultural Research and Extension Center. We will present the results from 2012 and discuss which varieties from the two years growers may want to evaluate in 2013.

Materials and Methods

Culture: Eighteen varieties were transplanted in a summer trial (May 31) and a fall trial (July 5) from 128 cell trays containing peat-vermiculite media. 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. Plants were staked and tied by running a string on each side of the plants on the first string then forming a box around each plot for the second string.

Sixty pounds/acre of nitrogen as calcium nitrate was incorporated prior to bed making. Additional fertilizer was applied through the drip system on a weekly basis at the rate of 30 gal/A 5-0-10 until August 24 when the rate was reduced by 20%. Calcium (EDTA 9.5 % at 2 lbs/A) and boron (solubor at 2 lbs/A) supplemented the complete fertilizer when the tissue analysis indicated the need for additional nutrients.

Preplant herbicide applications of Devrinol, Command, Dual Magnum, Prowl and Sandea followed by hand weeding after planting resulted in weed free plots. Admire was applied as a drench to the seedling flats prior transplanting at a rate of 3 ml per flat in sufficient water to saturate the growing media. Fungicides were applied on a weekly basis (Bravo, Kocide and Quadris) starting at flowering to reduce the chance of Anthracnose development. Coragen and Admire were injected through the drip system followed by spray applications (Voliam and Baythroid XL) late in the season to control insects.

The summer trial was hand harvested on August 8, 15, 22, 29 and September 5, 12, 19 and 26. The fall trial was harvested September 12, 19, 28 and October 3, 10, 17 and 24. At harvest fruit were graded by size and weight- extra-large (0.5 lbs/fruit or larger), large (0.33-0.49 lbs/fruit), medium (0.25-0.32 lbs/fruit), commercial (misshapen fruit) and culls (0.24 lbs/fruit or smaller and diseased or other problems). Yield is reported in 28 lb boxes/A.

At the fifth harvest for the summer trial and the fourth harvest for the fall trial ten 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.

Varieties and breeding lines

Variety/Line	Source	2011[1]		2012	
		summer	fall	summer	fall
Alliance	Harris Moran	X	X	X	X
Aristotle	Seminis	X	X	X	X
Camelot	Seminis	-	X	X	X
Classic	Sakata	X	X	X	X
Crusader	Syngenta	X	X	X	x
Festos	Enza Zaden	X	X	X	X
Hunter	Syngenta	X	X	X	X
King Arthur	Seminis	X	X	X	X
Paladin	Syngenta	X	X	X	X
Patriot	Harris Moran	X	X	X	X
Red Bull	Sakata	X	X	X	X
Red Knight	Seminis	X	X	X	X
Red Start	Stokes	X	-	X	X
Revolution	Harris Moran	X	X	X	X
Sir Galahad	Seminis	X	X	-	-
Socrates	Seminis	X	X	X	X
Vanguard	Harris Moran	X	X	X	X
XPP 6001	Sakata	X	X	X	X
1819	Seminis	-	X	X	X

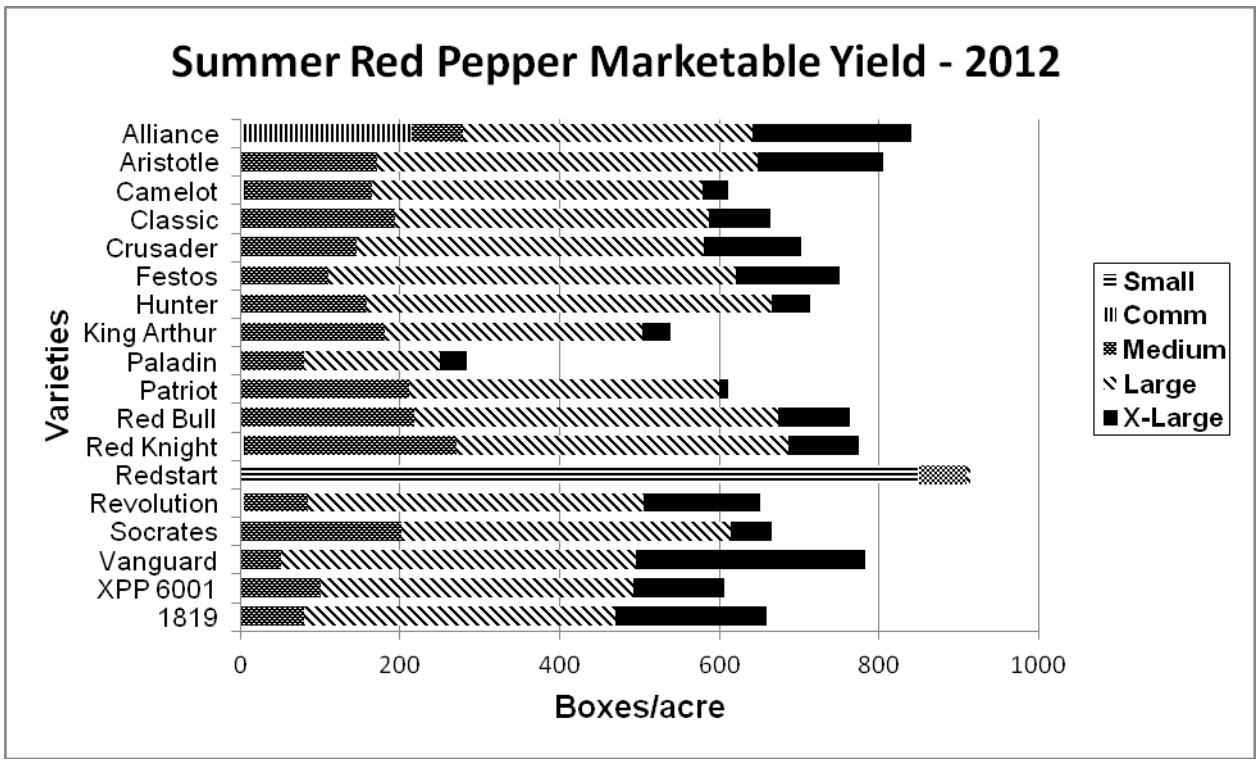
X represents in which study the variety was planted.

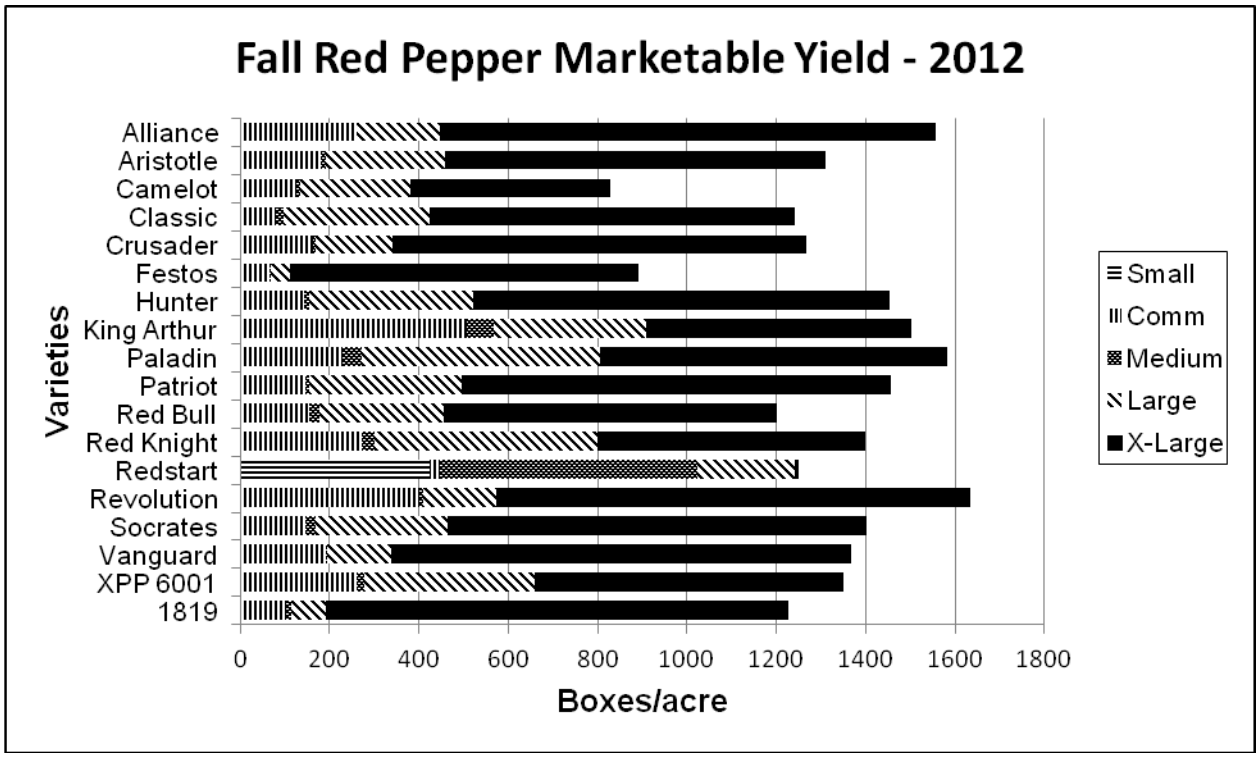
Results and Discussion

Rainfall patterns for 2012 were uniform throughout the growing season with the exception of June when 10.16 inches fell. One night of light frost was recorded before the final fall harvest.

Yields in the summer planting were approximately 50% less than the fall planting. This same pattern was observed in 2011. The fall planting had an increase in extra-large and commercial fruit while the summer planting had more medium and large fruit.

The variety Red Start produced nice early small fruit that would be accept for roadside stands and farmers markets. Alliance, Aristotle, Vanguard, Red Knight, Red Bull, Hunter and Crusader had the higher yields for summer production.


Summer Red Pepper Marketable Yield - 2012
Varieties
Alliance
Aristotle
Camelot
Classic
Crusader
Festos
Hunter
King Arthur
Paladin
Patriot
Red Bull
Red Knight
Redstart
Revolution
Socrates
Vanguard
XPP 6001
1819
0
200
400
600
800
1000
Boxes/acre
Small
Comm
Medium
Large
X-Large


Fall Red Pepper Marketable Yield - 2012
Varieties
Alliance
Aristotle
Camelot
Classic
Crusader
Festos
Hunter
King Arthur
Paladin
Patriot
Red Bull
Red Knight
Redstart
Revolution
Socrates
Vanguard
XPP 6001
1819
0
200
400
600
800
1000
1200
1400
1600
1800
Boxes/acre
Small
Comm
Medium
Large
X-Large

Planting for fall harvest can be much different than summer plantings. Some varieties exhibit a physiological disorder called black spot or color spot. Black spot appears when temperatures just above freezing occur for several nights at harvest time. Color spot (green pitting) has been reported in Australia with normal growing temperatures, but was associated with higher than normal calcium content of the fruit. Both are variety related. This year saw fewer problems with black or colored spot compared to 2011. The varieties that exhibited spotting were Red Bull, Revolution, Camelot (worst), Alliance, Hunter and Vanguard. This disorder may make the fruit unsalable for the wholesale market.

The fall planting produced heavier fruit and better quality peppers which translated into higher yields. This relates to cooler temperatures in the fall production thicker walled fruit. Varieties that are worthy of grower evaluation from the fall trial include Revolution, Alliance, King Arthur, Patriot, Hunter, Socrates, Red Knight, Vanguard, XPP6001 and Aristotle.

Conclusion

Based on the two year study growers can produce red peppers, but it takes increased management. Fruit must be harvested weekly and a weekly spray program is required when plants start to flower. Plant smaller fields over several cycles to maintain fruit quality and consistent yields. Varieties with the best overall quality and yield for both summer and fall harvests include: Socrates, King Arthur, Red Knight, Alliance, Aristotle and XPP6001.

Acknowledgements

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Tom Dauria from Stokes Seeds made suggestions for varieties and arranged to obtain the seed.

Dave St John from Plant Food Company provided the fertilizer recommendations and the liquid fertilizer.

Seed companies that provided seed: Enza Zaden, Harris Moran, Sakata, Seminis, Stokes Seed and Syngenta.

THE PEPPER WEEVIL PROJECT (PART 1): TRACKING PEPPER WEEVIL

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Pepper weevils (*Anthonomus eugenii* Cano) are the most important pest of peppers in sub-tropical regions, including those in the U.S. This pest is common throughout Florida and Texas. We've been finding patches of the pest in Southern New Jersey peppers over the past seven years, which is not their native habitat. In 2011 they invaded an Atlantic County farm causing repetitive applications of insecticide to control them. We found them at a second farm in Atlantic County and a third farm in Gloucester County. We surveyed for them through the winter and spring at the three farms. In 2012, with a grant from the USDA NE SARE (Northeast Sustainable Agriculture Research and Education) program we commenced an effort to detect the source. Figure 1 is a photograph of a pepper weevil.

Photo (~200X) by Joseph Ingerson-Mahar

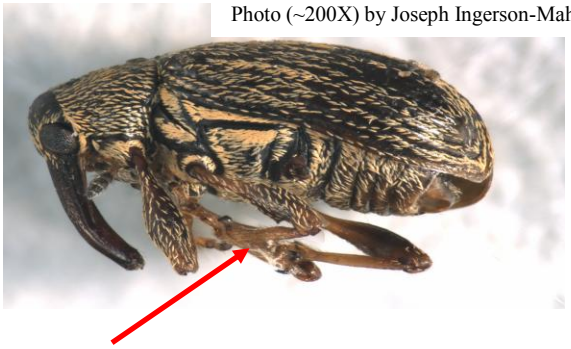

Figure 1 is a photograph of the first pepper weevil trapped in 2012. Be sure to note the spur on the underside of the femur. This is an important characteristic of pepper weevil.

Conversations with farmers led our focus to a few potential areas of introduction in Atlantic County. We attached a 2-component pepper weevil lure (Trécé, Inc.) to 6" x12" yellow cards coated with sticky Tanglefoot™. Figure 2 shows the usual configuration of the trap with lures.

Figure 2: Left shows 6"x12" sticky trap mounted on a ¼" dowel. Right shows the two pepper weevil pheromones (Trécé, Inc.) that are placed into the holes of the trap. In the center, showing relative size, are the last four pepper weevils caught in 2012.

Traps were placed in two non-farm areas known to handle peppers as part of processing and waste chains. Traps were positioned throughout the three farms where the weevils were previously identified. The field trapping lines were arranged in an x-pattern or around the perimeter of fields being prepared for the 2012 planting season. Included were new areas on

the farms such as migrant housing, loading docks, and field entrances. Figure 3 gives an aerial view of one of the farms in Atlantic County showing card placement for 2012.

Figure 3 depicts one of the farms in Atlantic County. Orange markers show positions of traps. The ~50 acre area on the right side outlined in green was planted with peppers in 2012. Other flags outside the 2012 pepper fields and shown in the upper left are trap positions also placed this season in high farm traffic areas and 2011capture areas. Letters indicate approximate weevil arrival sequence. The white flag marks one pepper field in 2011 that currently is planted with tomatoes. No trap is in the center of the tomato field, but traps are near it.

The program plan anticipated a widening scope with more traps placed beyond those three farms affected in 2011 and a control. We added traps to a pepper field in nearby Camden County, at a farm that had discontinued peppers following repeat infestations, but had planted a 2012 crop. The geographic area did further expand as the season progressed through the summer finally incorporating 12 farms in 5 counties.

We caught our first two pepper weevils on April 16th, 2012 at a processing facility near two of the Atlantic County farms. The next capture, at the same facility, was on May 16th, 2012. We found no additional weevils until mid-May when one appeared in the Camden County pepper field. No other activity was detected in June or July. In mid through late August weevils appeared on most of the original traps that we had mounted. Our survey scope expanded when a processor told us of local equipment exchange among various farms with other counties. A private scout alerted us to field damage. We identified more weevils in Camden County and at several farms, community gardens, and late season greenhouses in Cumberland County. A pepper weevil was identified at the control farm in Salem County well after peppers had been harvested and turned under. Four late-comers arrived at a variety trial in a high tunnel on December 7. As scope expanded we did less extensive trapping on the later farms, choosing to provide us more information on scope. Table 1 lists the number of traps placed and weevils caught.

Table I summarizes the 2012 season's number of traps placed and captures.

TABLE 1

Location	# Traps	# Weevils	~ Acres of Peppers	County
CMRCL 1	3	39	0	Atl
CMRCL 2	3	34	0	Atl
EVAL 1	1	1	0	roving
EVAL 2	1	0	0	roving
FARM 0	4	1	4	Sal
FARM 1	12	144	52	Atl
FARM 2	10	231	36	Atl
FARM 3	10	111	9	Glou
FARM 4	7	92	10	Cam
FARM 5	4	160	19	Cum
FARM 6	3	19	28	Cum
FARM 7	3	8	33	Cum
FARM 8	2	31	10	Cum
FARM 9	2	5	<1	Cum
FARM 10	1	5	30	Glou
FARM 11	1	3	<1	Sal
Totals	67	884	231	
CMRCL = non-farm site				
EVAL = truck of evaluator				
TABLE 1 NOTES: Farm 0 is intended as a control. Farms highlighted in blue were added as the spread, or separate arrival, of pepper weevil became apparent. The number of traps and coverage are lower in the later farms than for the sites originally planned. This potential for add-ons was recognized at project initiation, but the geographic extent was surprising. Farms 9 and 11 are greenhouses.				

At farm 1, 79% of weevils trapped were attached to cards near last year's pepper fields now containing tomatoes, and ½ mile away from this year's peppers. At farm 2 we caught 228 weevils versus 11 last year. The comparison for Farm 3 is 107 versus 2. Farm 3, Gloucester County, reports no association with the Atlantic County farms or facilities. Farmer 4 (Camden County) planted peppers after a 4-year lapse. 48% of weevils trapped here were remote from the peppers. We are still trying to determine why weevils select sites without typical food sources. In a Cumberland County greenhouse adult weevils were inside young fruits with no card captures signaling their presence. We attracted pepper weevils to almost every card that we placed, a fact that suggests a much wider dispersal of the pest into Southern New Jersey than expected. We did not monitor in counties other than the five mentioned.

We know that weevils were present in many locations prior to card placement, but still question the possibility of the lures pulling the weevil to a site. One next step is to evaluate the effectiveness of card traps lacking lures. We also need to evaluate the relationship to card captures, field damage, and control activities. An association has not been made between card captures and field populations. In southern states decisions on control relate to a determined level of field damage or to a very low level of adults found on terminal buds. We discovered a

number of potential entry points into pepper fields during this past summer's monitoring that will need further study (and owner participation). In addition, we will need to scan other counties for summer arrival to determine geographic scope of the pest. Part 2 of this work, following, will provide a closer view of the geographic extent of weevil discovery, the complexity of farm or process interactions, the areas targeted for additional evaluation, and the goals that we hope to achieve.

We would like to thank our partners in this cooperative investigation for willingness to provide operational data, for information on process and for patience in tolerating trap placement.
Bob Muth of Muth Family Farms
George Ruggero of Homestead Farms
August Wuillermin of Ed Wuillermin and Sons Farms

THE PEPPER WEEVIL PROJECT (PART 2): RESULTS AND FOLLOWUP

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Pepper weevils are a sub-tropical native to Mexico and are typically found in the hotter parts of the United States. The insect is not regulated in the U.S. Sporadically they've been found in New Jersey especially in Atlantic County. Since 2004 they've arrived every year, skipping 2005, and have caused sporadic crop damage and economic loss. In 2012, we obtained a grant from USDA SARE to initiate a formal task to try to find the source of arrival of the pest into the area. In the summer of 2012 we trapped almost nine hundred pepper weevils on Tanglefoot™ coated 9x12 yellow cards. The cards were placed in pepper fields and farm production areas as well as at non-farm sites. At the start of the project we monitored for the arrival in Atlantic and Gloucester counties, but in late summer the span of interest rapidly spread to Cumberland and Salem counties, as we had reason to suspect the weevil presence in farms remote from our initial area of interest. Nearly every site we placed a card, we caught weevils. Part 1 of this report provides detail on card placement and weevil catches. Part 2 summarizes observations and follow-up needed to assist in managing the pest if it continues arrival to our area.

What we learned

- Pepper weevil is present in fruit processed from Florida (and probably from other southern locations)
- Southern transplants are **not** the source of pepper weevil arrival
- None of the greenhouses monitored from the prior winter through the spring had weevils present
- Pepper weevil was present in April and May at a processing facility dumpster and at a local cull pile
- The weevil arrived mid to late summer at all of the sites monitored in Atlantic and Gloucester counties
- Infestations build rapidly and spread easily within fields and between farms
- Weevils will infest loading areas with pepper fruit
- Once found in fields it will be found in their processed scraps
- Weevils can be trapped in areas with no peppers present such as housing
- Weevils can be more abundant in areas with no peppers present than where there are peppers
- It can be transported via vehicles

- Wooden packing crates interchange among farms routinely from central storage, transport and processing points.
- Many of the facilities and farms use the same open dumpster contractors
- The mobile health professional service (and other legal and social services) at the farm housing areas is common.
- Microcosms of presence formed. (If found at one farm, high likelihood of spread to a neighbor)
- If not detected upon arrival fruit/yield loss can occur
- Insecticidal sprays may inhibit but don't stop the infestation
- The weevil can survive in empty fields into December
- At least two facilities frequented by many of the farms receive or repack southern peppers
- A greenhouse near a central worker pick-up point has weevils in it
- A greenhouse growing late peppers exhibited infested fruit
- Pepper fruit can be infested without the card showing any adults

What we need to confirm

- Agents of introduction, i.e. sites and timing of arrival of infested fruit (at nearby re-packers, distributors, supermarkets, etc., by capture of weevils)
- The originating source of infested fruit
- Agents of spread (e.g. dumpster, cull pile, truck delivery, weather front, workers)
- The link between distant locations
- How many counties are routinely infested
- Cost/benefit of monitoring and insecticidal control

Ultimate goals

- Introduce mechanical or process change to inhibit or eliminate initial entry of the weevil
- Introduce mechanical or process change to limit spread
- Provide detection, action level, and control protocol to assist farmers in managing the pest to their economic advantage

EXOTIC PEPPER PROJECT AT RUTGERS AGRICULTURAL RESEARCH AND EXTENSION CENTER

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Abstract: From a total of 40 pepper types (exotic & mainstream) evaluated in 2010 at Rutgers Agricultural Research and Extension Center (RAREC) , Bridgeton, NJ, 30 were selected for further evaluation in 2011 at the same location. Based on plant size, phenotypic stability, yield, life cycle and tolerance to stink bug attack, 10 of the 30 planted in 2011 were identified as having significant potential for integration into the New Jersey's "culinary" system. Fruits from these 10 selections were evaluated by 99 volunteers randomly selected from within and outside Rutgers University for appearance on a scale of 1-5 (1 = I do not like this pepper at all; 5 = I love this pepper). Exotic pepper variety #19 (EPV19) (red color), a large size Habanero type (*Capsicum chinense*), scored highest (4.6 out of 5.0 points) followed by EPV 28 (red color), a medium size Habanero type (4.4 out of 5 points), EPV17 (red color), a large size Habanero type (4.3 out of 5 points), EPV22 (yellow color), a medium size Habanero type (4.2 out of 5 points) and EPV24 (red color), a large size Aji type (4.1 out of 5 points) in that order. The remaining five pepper types scored less than 4 out of 5 points. Breeding is proposed among the top selections for future development of two to three unique Rutgers cultivars with appropriate heat level and stink bug tolerance to be added to the ***"Jersey Fresh"*** food basket.

Introduction: For centuries, peppers (*Capsicum* spp.) have played significant roles in human societies around the world as spices, medicinal herbs and ornamentals. In particular, hot peppers (chilis or chiles) are highly valued for their therapeutic capacity and nutritional quality. In New Jersey and the Mid-Atlantic region these roles are relatively unknown. The growing ethnic populations in New Jersey and the Mid-Atlantic present a market opportunity, which needs to be explored. The Exotic pepper project at Rutgers New Jersey Agricultural Experiment Station (NJAES) was initiated at Rutgers Agricultural Research and Extension Center (RAREC), Bridgeton, NJ, in 2010 to explore hot peppers for their roles and promote production and utilization in and beyond the state. In 2010 experiment was conducted to confirm the agronomic feasibility of 33 hot pepper types obtained from B&B Farms, Egg Harbor, NJ and from Africa. These were compared with seven mainstream peppers traditionally grown in New Jersey and the Mid-Atlantic, namely Big Bomb (Cherry), Camino Real (Serrano), Cheyenne (Cayenne), Cubanelle (Italian Frying), El Jefe (Jalapeno), Habanero (Scotch Bonnet), and Paladin (Sweet Bell).

In a three randomized complete block experiment, it was demonstrated that the 33 hot peppers (except *Capsicum hirsutum* or C. *pubescence*) compared could be raised in the greenhouse in April, transplanted in June and grown in the field successfully during the summer months from June to October. Exotic pepper yields compared favorably with the yields obtained from the mainstream peppers. At the close of field trial in 2010, a total of 30 pepper types were selected from the 40 that were compared for further evaluation based on yield, growth characteristics, and life cycle. The objective of the 2011 field trial was to reduce further the number to be selected for future evaluation with the ultimate goal being to breed two or three unique hot peppers that fit into the New Jersey and Mid-Atlantic hot pepper culinary preferences.

Materials & Methods: The 30 pepper types selected for 2011 field evaluation were seeded in the greenhouse at RAREC on April 8 and transplanted to the field on May 23. In the field the peppers were numbered as Exotic pepper variety (EPV) 1- 30, each one planted into a 5-feet wide black plastic mulched bed at 24 inches apart. Each bed was long enough to accommodate 25 pepper stands. There was a spacing of approximately 6 feet between pepper rows. Drip/trickle irrigation was used to supply water as necessary. Fertilizers (N-P-K) were applied through irrigation (fertigation) at planting in May and on July 1, 14, and 28. Weeds were controlled using preemergent application of Dacthal + Dual herbicides at the time of plastic mulch laying. No other pesticides were applied throughout the field trial.

Visual observations were made on pepper plant size, phenotypic stability, life cycle, fruiting capacity, fruit size, and response to stink bug attack (which became a major problem during the fruiting stage). Based on these visual observations, 10 pepper types were selected which showed significant potential for consideration for further evaluation. For the 10 pepper types selected, 80 – 200 fruits (number varied with fruit size) were harvested each time at three intervals between September 25 and October 25, for appearance evaluation by a total of 99 randomly selected volunteers within and around Rutgers University, New Brunswick. Volunteers evaluated the peppers on appearance only, using a scale of 1-5, where 1 = "I do not like this pepper at all", and 5 = "I love this pepper". Results presented focused on the 10 selected pepper types.

Results and Discussion: The top 10 hot pepper selections from the 2011 field trial produced fruits that were attractive to different people to varying degrees. We observed some preferences that were ethno-culturally driven but overall the Caribbean type Habaneros (*C. chinense*) were most attractive to the evaluators. Forty percent or more ($\geq$40%) of the evaluators "love" EPV17, 19, 24 & 28 and no one "dislikes" EPV19, 22, and 24. All of these selections were Habaneros or Ajis (EPV24) with fruit size ranging from medium to large and typical Habanero shapes. The plant sizes based on vegetative growth ranged from small to intermediate and fruits were easily harvested. All pepper types were indeterminate giving each one significant prolific capacity. These five selections topped the list for future breeding considerations.

EPV02, 07, 12 and 20 belonged to the intermediate group with overall fruit appearance rating above 3 on a scale of 1-5. Based on plant size and fruit appearance EPV20 (rated 3.6 out of 5 points), a *Capsicum annuum*, was an attractive selection. It was also an attractive selection because of tolerance to stink bug attack. We saw this as a good replacement for jalapeno/serrano types in a stink bug attack prone ecosystem or year. For this reason, EPV20 was retained for further evaluation.

EPV02 and 12 were also attractive as they scored higher than 3 in overall appearance rating. In the 2011 field trial EPV02 (3.7 out of 5 points) segregated into yellow and red colors of attractive pepper shape that fell in between Habanero and *C. annuum* types. The fruit size also ranged between medium and large; and the plant size was intermediate. It was easy to harvest and highly prolific. The yellow fruit color was an attraction deserving of further investigation.

EPV12 (3.5 out of 5 points) was an African Habanero type. The fruit size was small and probably accounted for the low rating by evaluators. The plant was large with a spreading habit. It was highly prolific and indeterminate in growth habit. The aroma/flavor from EPV12, which is the primary

attraction in Africa, was unique. This makes the plant attractive for further investigation. We believe the aroma/flavor may be transferable to other Habanero types with larger fruit size.

EPV 07 (3.1 out of 5 points) shared many features in common with EPV06, the pepper that scored the least. The visible difference between the two was the fruit size which was slightly larger in EPV07 than in EPV06. EPV07 was retained for future studies in case there were some unique chemical properties in the fruit which might become a valuable material for future work.

EPV06 was rated least attractive (2.8 out of 5 points) probably due to the combination of shape and small/medium fruit size. Combined with the difficulty in harvest and highly vegetative growth, EPV06 was likely to be dropped from further consideration in future breeding program. However, a unique attraction for EPV06 was a distinct purple color of the fruit prior to ripening, which makes it a candidate for consideration as an ornamental pepper in future research.

Conclusion: Based on the studies conducted in 2010 and 2011 at RAREC, it was demonstrated that exotic hot peppers (chilis or chiles) may be grown successfully in New Jersey and most likely in other parts of the Mid-Atlantic with similar agroecosystems. It is desirable to develop through breeding and selection those unique hot pepper types that fit into the culinary preferences in this region, so that growers and consumers may derive maximum economic and health benefits from these uniquely important crops; and we may in the near future add them to the "***Jersey Fresh"*** tradition.

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Soil Fertility

SOIL QUALITY FOR VEGETABLE PRODUCTION

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Soils can be considered the basic life support of terrestrial ecosystems. In best-case scenarios, soils infiltrate and store water, provide habitat for millions of organisms, enhance decomposition of organic residue, accumulate and supply nutrients, allow diffusion of gases (oxygen in, carbon dioxide out), and moderate temperature for optimum growth of plants, which serve as the basis of the whole food web. In the context of agricultural fields, best management practices lead to sustained or improved soil quality for best yield. Soil Quality is defined as: the capacity of a soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality, and promote plant and animal health (Doran and Parkin, 1994).

With agricultural management practiced over the long-term, soils are susceptible to degradation. Soil structure may break down, leading to dense soils and loss of "transmission pores" which are primarily responsible for water and air movement through soil. Decreases in soil organic matter due to tillage and removal of crop residue harms the water- and nutrient-supplying function of soil. Excessive use of pesticide and/or misapplication of fertilizer products can harm the biological population needed to keep the agri-ecosystem in balance. Without remediation, degraded soils will experience declining yields on average, and crop production will not be sustainable at economical levels.

Fortunately, "best management practices" which maintain or improve soil quality and/or crop yield without extensive input have been identified. But how can we assess soil quality, and what are the symptoms of poor soil quality? Indicators of soil quality can include laboratory tests, such as pH, organic matter, and nutrients, as well as field tests, such as soil structure, earthworm counts, and hardness (penetration resistance). A review of various recommended indicator tests for vegetable farming will be presented.

SOIL FERTILITY & LIMING FOR BETTER CROPS

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Application of liming materials to maintain a satisfactory soil pH level for specific crops is a well established cultural practice. Many field trials have demonstrated that a liming program is essential to economically viable crop production. On farmland where liming programs have been long neglected, crop yield losses of 10 to 30% or more may be linked to soil acidity.

Beyond soil pH management, liming materials also supply nutrients to soil that are valuable to plants and animals. The focus of this presentation will be on how careful selection of liming materials improves soil quality, decreases plant disease, and supports animal health.

Calcium carbonate, or limestone, is a commonly mined mineral also known as calcite. This is an excellent type of liming material to use when soil test levels for calcium are low and magnesium test levels are already high. Unless soil test magnesium levels are low, a high calcium – low magnesium type of liming material should be selected. In terms of plant nutrition, calcium and magnesium compete for uptake. A consequence of excessive levels of magnesium in soil is reduced uptake of calcium. This may result in problems fruit quality and blossom end rot. A rich supply of calcium held on soil clays also helps to improve soil aggregation and structure.

Calcium magnesium carbonate is a type of liming material commonly referred to as dolomite. This is an excellent type of liming material to use when soil test levels for both calcium and magnesium are low. Magnesium is a component of the chlorophyll molecule that gives plants green color. Besides being essential for photosynthesis magnesium is an activator of many enzyme systems. Compared to calcium, magnesium tends to have the opposite influence on soil aggregation and structure.

As a percentage of the cation exchange capacity, measure by soil tests, a soil with about 68% calcium, 12% magnesium, and 5% potassium may be considered well balanced for most crops.

When carbonate liming materials are added to soil, the carbonate ion breaks down and releases carbon dioxide into the atmosphere. Calcium silicates and calcium magnesium silicates are suitable alternatives to common agricultural limestone. Depending on purity, silicate liming materials are about equally effective as carbonate liming materials for neutralizing soil acidity.

The major advantage of silicate liming materials is that they are an effective way to supply plant available silicon to soil. Silicon is beneficial substance lacking in many New Jersey soils. Of the many potential benefits associated with enhanced silicon nutrition, the one that may be most helpful to vegetable growers is effective suppression of powdery mildew disease and a reduced need for fungicides.

IMPROVING SOIL QUALITY AND DISEASE SUPRESSION WITH COVER CROPS

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The use of brassica cover crops for the management of soil-borne diseases has been gaining in popularity as an organic and cost effective alternative to conventional soil fumigation. All brassicas naturally produce glucosinolates, the compounds that make certain brassicas “hot”. Some new brassica cover crops have been developed to contain very high levels of glucosinolates; the higher the concentration of glucosinolates present, the greater the biofumigant potential. When the plant cells are damaged such as by chopping or mowing, the glucosinolates come in contact with an enzyme (myrosinase) and produce the natural gas isothiocyanate (ITC). ITC is similar to the active ingredient in Metham Sodium or the conventional fumigant Vapam (a.i. Methyl ITC). In addition to the soil biofumigation benefits, brassica cover crops are ideal for adding organic matter to the soil and improving many soil health related characteristics due to the large quantity of “green” biomass produced and added to the system.

A trial was established at the Long Island Horticulture Research and Extension Center, Riverhead, NY to evaluate the biofumigation effects of a mustard cover crop on the soil-borne pathogen *Phytophthora capsici*, the causal agent for the destructive disease known as phytophthora blight, in acorn squash. Treatments included a mustard cover crop, variety ‘Caliente 199’, compared to a no mustard control. The mustard cover crop was grown at three nitrogen (N) rates per acre (A); 0 lbs, 50 lbs, and 100 lbs N/A to determine any effects on biomass production and subsequent biofumigant ability. The experiment was established into a known phytophthora infested field and was arranged as a randomized complete block design with 4 replications. Treatment plots were 50 ft long by 2 rows wide. Rows were spaced on 68” centers and ‘Royal Ace’ acorn squash was seeded 2 ft apart within the row.

The field was plowed on April 7. Fertilizer was broadcast on April 8 onto corresponding plots at 3 nitrogen rates per acre; 0 lbs, 50 lbs, and 100 lbs in preparation for seeding the mustard cover crop. Mustard seed was no-till drilled into plots at a rate of 10 lbs/A on April 8. The no mustard control plots did not receive any fertilizer at this time. First bloom occurred on May 28. Plants were approximately 1.2’ tall. The mustard was allowed to grow for an additional 2 weeks before it was chopped and incorporated; plants were about 4.5’ to 5.0’ tall at that time. The additional time allowed for growth after flowering and before incorporation is critical since the mustard will likely double in height increasing biomass which translates to greater biofumigant potential and greater returns from organic matter additions. It takes approximately 6 weeks from flowering until viable seed is produced which allows for the extra growth period without a potential weed problem being introduced. Aboveground biomass

information was collected just prior to incorporation by cutting the mustard plants at the soil line within a 1' x 1' square, drying the plant material, then weighing.

On June 14, the mustard crop was flail chopped for maximum cell destruction. Immediately after, plant residue was incorporated to a depth of 4-6" with a roto-tiller and a coulter packer was then used in order to seal the soil surface to trap in the ITC gas produced. The plots were then irrigated to add moisture (needed for the chemical reaction) and to further seal the soil surface. The above practices were performed as close together as possible and early in the morning to reduce losses to volatilization. Wait 2 weeks before seeding the cash crop and lightly disk the field beforehand to release any remaining gas. On July 1, 'Royal Ace' acorn squash was direct seeded into treatment plots. The no mustard plots received 1000 lbs 10-10-10 prior to planting as did the mustard plots that received no fertilizer at the time of cover crop establishment. The mustard plots that received 50 lbs N/A at cover crop establishment received 500 lbs 10-10-10 just prior to seeding squash and mustard plots that received 1000 lbs N/A as 10-10-10 at cover crop establishment received 300 lbs/A 10-10-10 just prior to seeding squash. Insects and weeds were managed according to Cornell guidelines and fungicides were applied for powdery mildew and downy mildew but did not include any activity for phytophthora management. Supplemental irrigation was provided to equal approximately 1" of water per week. Data on phytophthora occurrence was recorded. Fruit were harvested from the center 20 feet of each row on October 21. Yield data and Brix (% soluble solids) were recorded and analyzed.

Results from the trial show that nitrogen fertilizer rate did have a significant effect on aboveground biomass production of the mustard crop with significantly more aboveground biomass produced at 100 lbs N/A compared to 50 lbs N/A which produced significantly more aboveground biomass compared to 0 lbs N/A. Similar results were observed in year one of the trial where mustard grown at 100 lbs N/A produced significantly more aboveground biomass compared to mustard grown at 50 and 0 lbs N/A (data not shown). Marketable yields of 'Royal Ace' acorn squash were not significantly affected by treatment. The number of phytophthora infected fruit was significantly more in the no mustard treatment compared to the mustard treatments at 50 and 100 lbs N/A. Additionally, fruit quality was improved with the use of a mustard cover crop. Brix levels (% soluble solids) of the acorn squash were significantly greater in the mustard treatment at 100 lbs N/A compared to the no mustard control.

The use of 'Caliente 199' mustard cover crop as a potential biofumigant to manage the soil-borne pathogen *Phytophthora capsici* in cucurbits has shown to be a promising cultural practice. In both years of the study (year 1 data not shown), acorn squash yield was increased with the use of a mustard cover crop and this increase was as high as 36% in year 1 and 30% in year 2. The number of phytophthora infected fruit was significantly decreased in year 2 with the use of a mustard cover crop seeded at both 50 and 100 lbs N/A and although not significant, reduced the number of phytophthora infected fruit in year 1 from an average of 5.3 infected fruit in the no mustard treatment to as low as 1.5 infected fruit in the mustard treatment at 100 lbs N/A. In both years, acorn squash brix levels were significantly increased with the use of a mustard cover crop improving overall quality.

Table 1. Height and aboveground biomass production of 'Caliente 199', a mustard cover crop, grown at different nitrogen rates at Riverhead, NY, 2010.

					Biomass Production[3]	
	Crop Height (in)[2]				Fresh Wt.	Dry Wt.
Nitrogen Rate (lbs/A)[1]	5/13	5/25	6/3	6/14	(lbs)	(lbs)
0	1.6	3.8	14.1	27.7	0.21	0.04
50	4.8	14.7	39.1	51.8	0.64	0.14
100	6.0	18.8	41.6	60.8	1.09	0.22
Fishers Protected LSD (0.05)	*(0.7)*	*(1.7)*	*(4.0)*	*(5.2)*	*(0.39)*	*(0.06)*

[1]10-10-10 fertilizer was broadcast prior to seeding the mustard to supply 0, 50 or 100 lbs nitrogen per acre

[2]Average of 3 measures per treatment replicate

[3]Biomass was determined by cutting the above ground portion of the plant in a 1' x1' square. Weights are an average of 3 measures per treatment replicate.

Table 2. Effects of the mustard cover crop 'Caliente 199' on marketable yield, total yield, brix and phytophthora incidence of 'Royal Ace' acorn squash grown at Riverhead, NY, 2010.

	N rate[1]	At Planting N[2]	Marketable Yield[3]		Total Yield[3]		Phytophthora	Brix
Treatment	(lbs/A)	(lbs/A)	# Fruit	Wt. (lbs)	# Fruit	Wt (lbs.)	# of fruit	%
No Mustard	0	100	54	71	74	97	3.3	8.3
Mustard	0	100	71	93	78	100	2.0	8.5
Mustard	50	50	62	82	67	88	0.5	9.1
Mustard	100	30	64	88	67	92	0.3	11.3
Fisher's Protected LSD (0.05)			*(ns)*	*(ns)*	*(ns)*	*(ns)*	*(2.0)*	*(2.1)*

[1]Nitrogen rate at the time of mustard cover crop establishment using a 10-10-10 fertilizer broadcast over treatment plots

[2]Nitrogen rate at the time of acorn suqash establishment using a 10-10-10 fertilizer banded in a row 2" to the side and 2" below the seed

[3]Marketable yields are the average number of fruit harvested from a 20 ft section

Improving Nitrogen-Use Efficiency in Potatoes and Sweet Corn with Controlled Release Nitrogen Fertilizers

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Environmental concerns over nitrate leaching into ground and surface waters from agriculture have prompted research into strategies aimed at increasing nitrogen use efficiency within the soil-plant system. Achieving synchrony between crop demand and nitrogen availability without excess or deficiency is necessary to balancing yield, profit, and environmental concerns. Controlled release nitrogen fertilizers were one strategy investigated to achieve this in both potato and sweet corn production systems on Long Island.

Controlled release nitrogen fertilizers are designed to deliver nitrogen to crops throughout the growing season. The controlled release technology relies on temperature controlled diffusion to meter nitrogen into the soil profile for plant uptake. As temperatures increase so does plant growth and nitrogen release rate thus, better matching nitrogen availability and crop demand. Several trials were established in a Haven loam soil in Riverhead, NY to evaluate the use of controlled release nitrogen fertilizers in potato and sweet corn production. The controlled release fertilizer used was ESN® (44-0-0), a polymer-coated urea from Agrium Inc. with an 80-90 day release profile. Due to the potential for increased nitrogen use efficiency with controlled release technology, the trials evaluated performance at two nitrogen rates; a grower's standard and one 20-30% below the standard. Previous trials in 2005 and 2006 concluded that a program utilizing 100% controlled release nitrogen was not cost-effective and that marketable yields were actually reduced compared to the grower's standard fertilizer program. As a result, the trials that followed evaluated controlled release nitrogen fertilizer blends where either 60 or 80% of the total nitrogen in the blend was controlled release and the remaining 40 or 20% of the total nitrogen was conventional sources like monoammonium phosphate (MAP) and ammonium sulfate (AS). The controlled release fertilizer blends were compared to conventional nitrogen fertilizers which consisted of a urea program and a MAP/AS program. Nitrogen rates in the potato study were 160 and 200 lbs N/acre while the sweet corn study evaluated N rates of 100 and 150 lbs N/acre. Nitrogen rates per acre were applied all at planting in the controlled release fertilizer programs and were split applied for the conventional urea and MAP/AS programs in both potatoes and sweet corn.

Results from the trials over several years are summarized in the graphs below. Marketable yield data for both the urea and the MAP/AS programs were at the higher nitrogen rate per acre for potatoes (200 lbs N/A) and sweet corn (150 lbs N/A) where marketable yield data for the ESN programs were at a reduced N rate per acre for potatoes (160 lbs N/A) and sweet corn (100 lbs N/A). Nitrogen for the conventional

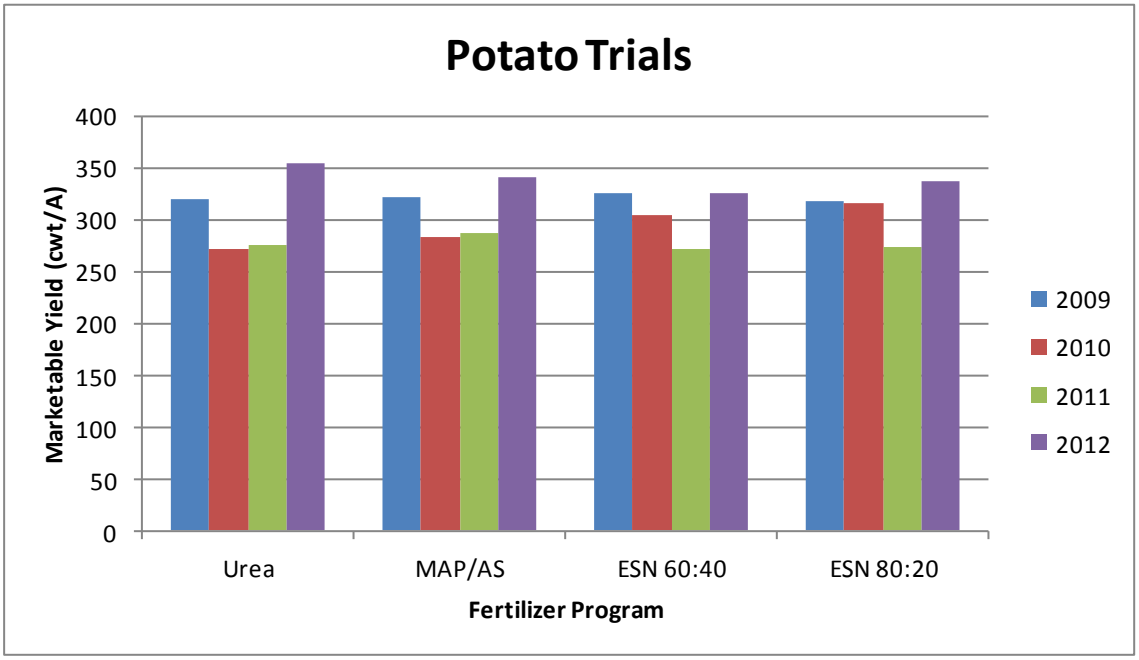
programs was split applied and nitrogen for the controlled release programs was applied all at planting. The coated technology prevents any “burning” or ammonium toxicity typical when high rates of nitrogen are applied close to the seed. Since all the nitrogen is applied at planting, sidedress applications are eliminated saving on fuel costs and time allowing for management to be directed elsewhere.

Potato Trials: Marketable yields in all 4 years in the controlled release fertilizer programs were similar to the conventional fertilizer programs. Additionally, nitrogen rates in the controlled release fertilizer programs were reduced by 20% compared to the conventional programs and marketable yields were maintained. In 2010, marketable yields were actually increased with controlled release fertilizer programs at reduced rates but in 2011 and 2012 marketable yields were slightly decreased. However, in both 2011 and 2012 controlled release fertilizer programs at 200 lbs N/A produced marketable yields similar or slightly above the conventional fertilizer programs also at 200 lbs N/A (data not shown).

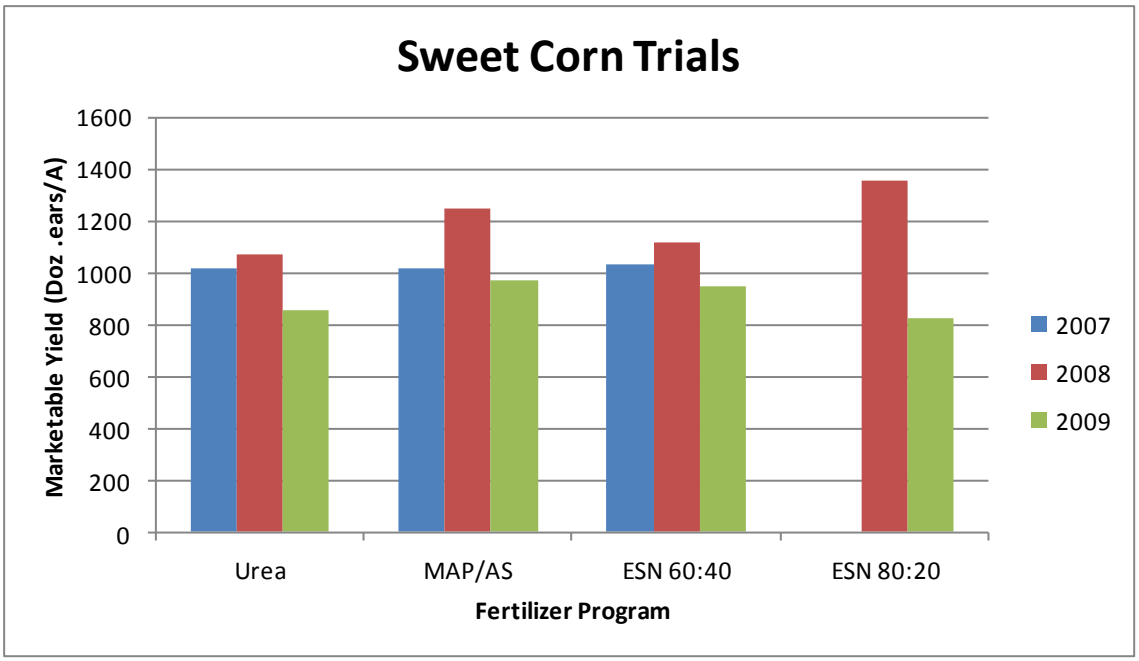
Sweet Corn: Results from these trials show a similar trend as in the potato trials in that marketable yields were similar or slightly higher in the controlled release fertilizer programs at 100 lbs N/A compared to the conventional fertilizer programs at 150 lbs N/A. However, in 2009 marketable yields in the ESN 80:20 controlled release program were lower than both conventional fertilizer programs while the ESN 60:40 controlled release programs were similar or greater than the Urea and MAP/AS conventional programs. When the controlled release programs at 150 lbs N/A were compared to the conventional programs also at 150 lbs N/A, marketable yields were either similar or slightly greater depending on the year (data not shown).

Controlled release technology better matches crop N demand with N supply enabling a reduction in nitrogen rates per acre anywhere from 20-30% below the grower’s standard practice with yields maintained in most years. Early season rainfall plays a significant role in fertilizer efficiency and nitrogen leaching. Conventional fertilizers can be easily leached out of the system if leaching rain events occur before crop demand is high, increasing the efficiency of controlled release products. However, if leaching rain events do not occur early in the plants’ growth, controlled release fertilizer products may not provide a significant increase in efficiency but would save time and fuel by eliminating any sidedress applications. Sweet corn is different than potatoes in that it requires more soluble fertilizer sooner in the growth cycle than potatoes as seen with better performance out of the ESN 60:40 blends compared to the ESN 80:20 blends. The larger seed of a potato can sustain the plant longer than a shrunken sweet corn seed. Therefore, a controlled release fertilizer blend with 80% of the total nitrogen as controlled release is better suited for potato production and a controlled release fertilizer blend with 60-70% controlled release nitrogen is better suited for sweet corn production. The cost of the product is roughly $0.15 - $0.20 more per unit N than urea. Urea is used in the price comparison as ESN® (44-0-0) is made by coating the urea granular with a polymer coating. The reduced rates along with eliminating the need to sidedress should offset any increased costs associated with using the technology.

Full reports and more information on the various trials can be obtained by contacting Sandra Menasha at srm45@cornell.edu.



Urea and MAP/AS programs at 200 lbs N/A
ESN 60:40 and ESN 80:20 programs at 160 lbs N/A



Urea and MAP/AS programs at 150 lbs N/A
ESN 60:40 and ESN 80:20 at 100 lbs N/A

GMO Food Crops- What's the Scoop

PUBLIC PERCEPTION OF GM FOODS

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Genetically modified (GM) foods are derived from plants or animals created through the process of DNA recombination; a form of biotechnology in which scientists transfer genes from one plant or animal into the genetic code of another plant or animal to take advantage of desirable traits such as disease, drought, insect, and herbicide resistance. While the subject of GM food is a major source of controversy in many countries, data produced by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) shows that GM crops have been adopted faster than any other crop technology in the history of modern agriculture.

With more than 170 million acres planted in GM crop varieties, the United States remains the largest producer of GM agricultural products, harvesting about 43% of the world's GM crops. According to USDA Crop Acreage reports, in 2011, 93% of the soy, 94% of the cotton, and 88% of corn produced in the United States were GM varieties featuring the two principal traits of insect resistance and herbicide tolerance, or combinations of the two. Moreover, despite controversy over their approval, 95% of the sugar beets grown by farmers in the US (more than a million acres) are herbicide-resistant GM varieties. In addition, American farmers grew millions of acres of GM herbicide-resistant canola and alfalfa (also despite some controversy), and virus-resistant squash and papaya.

Corn, soy, canola, sugar beets, and cotton seed oil are the source of some of the most common ingredients used by American food processors. GM varieties are also often mixed with ordinary varieties during shipping, processing and storage. As a result, estimates suggest that perhaps as much as three-quarters of the processed foods on American shelves contain ingredients derived at least in part from GM crops.

However, data collected in 2012 by the International Food Information Council (IFIC) suggests that most Americans (70%) are unaware that GM food products are available in US supermarkets. In addition, many of those who say that GM food products are on supermarket shelves are somewhat confused about what those products are. For example, while 19% were correct that products made with GM corn are for sale in the US, 18% also thought that GM meat, eggs, and fish are available for purchase (they are not) and 10% said that GM tomatoes are currently available in supermarkets (they have not been since 1997).

According to the 2012 IFIC data, while most Americans say they have heard something about “biotechnology”, only 10% say they have heard or read “a lot” about it. Instead, most say they have heard “some” (32%), or “a little” (32%), and more than a quarter (26%) say that they have heard or read “nothing at all”. As a result, the IFIC data, and data from other national studies (including our own earlier studies at Rutgers) suggest that Americans are generally uninformed about GM crops and GM food and are largely unaware of its presence in the food system and in their own diets.

Significantly, however, being uninformed and unaware does not stand in the way of expressing an opinion in the United States. Despite the fact than nearly a third of the respondents in the IFIC survey said that they had heard only “a little” about biotechnology and more than a quarter admitted that they had heard “nothing at all”, only 17% reported that they “didn’t know enough to form an opinion” about the use of biotechnology to produce food products. Instead, 38% reported that their overall impression was “favorable”, 26% said they had a “neutral” impression about using biotechnology to produce food products, and 20%

reported that their overall impression was “not favorable”. In addition, nearly half (49%) said that they had a favorable impression of farmers using biotechnology to grow more crops that would help meet food demand, while only 15% said their impression was not favorable, 25% had a neutral impression, and only 11% said that they didn’t know.

One reason that most Americans don’t know much about GM foods or the fact that they have likely been eating them for more than a decade and a half is that, unlike in the European Union, Asia, and many other parts of the world, GM foods are not required to be labeled in the US. The US Food and Drug administration *does* require special labeling of a GM food to alert consumers when the characteristics of a familiar food product have been substantially altered; for example, if an allergen is introduced, or its nutritional qualities have been altered. However, the labels do not need to indicate that the change was produced through the process of genetic modification. As such, there are no current regulations mandating that GM foods be identified as such.

However, efforts to require labeling have gained ground, most recently through state ballot measures such as California’s Proposition 37, which, though defeated at the polls, would have required retailers and food companies to label products made with GM ingredients. Proponents of the proposed regulation argued that consumers have the right to know whether a product contains GM ingredients, particularly if they believe that the long-term health impacts of such products are unclear. They further argued that mandatory labeling of GM food products would offer increased choices to consumers; giving them the freedom to exercise their religious, philosophical, or dietary preferences, and the ability to use market forces to express their political views in support or opposition to the use of GM technology.

Opponents of Proposition 37 argued that mandatory GM labels would unfairly stigmatize food products that have been scientifically proven as safe, causing consumers to reject otherwise healthy and wholesome products. They further argued that the law was poorly written and would likely lead to lawsuits and that the costs of complying with the law would lead manufacturers to raise food prices. Though opponents of the measure were able to raise more than $45 million to defeat it and were backed by powerful agribusiness companies including Monsanto, Dow, DuPont, and Syngenta as well as by large food manufacturers such as Kraft, The Hershey Co., Nestlé USA, Mars Inc., and PepsiCo, California voters only rejected the proposed regulation by six percentage points. Though outspent five-to-one, proponents of mandatory labeling were able to attract more than 4.2 million “yes” votes. More important, the debate over Proposition 37 provided new reasons for both consumers and pundits to think about and discuss the presence of GM foods in the US marketplace and perhaps provided greater momentum to efforts to label these products. Whether this has created any significant shift in consumer awareness or opinion regarding GM foods remains to be seen.

BUSTING THE MYTHS SURROUNDING GENETICALLY ENGINEERED FOODS

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Are genetically engineered foods as risky as some people believe? Do genetically engineered crops harm the environment? Do only seed companies benefit from genetically engineered (GE) seeds? Will genetically engineered plants and animals reduce hunger and food insecurity? These are just some of the many questions that surround the heated rhetoric and discourse that follows genetically engineered crops and the foods made from them. In this talk, some of the myths perpetuated by both the proponents and opponents of engineered crops and animals will be dispelled with the facts that exist today.[1]

Myth 1 – Creating new crop varieties in the laboratory is a recent phenomenon.

Reality – Scientists have been manipulating agricultural plants and animals in the laboratory for decades using techniques such as chemical mutagenesis, irradiation, and cloning.

Myth 2 – Monsanto and other seed developers are the primary beneficiaries of engineered crops

Reality – While the biotech seed developers clearly benefit from the sale of engineered seeds, there are many other benefits, although they vary depending on the crop and the environment where they are grown. Some farmers have benefitted through increased yields, increased farm income, and reduced farmer poisonings. Some non-GE farmers have benefitted from the overall reduction in pest populations from neighbors who planted GE crops with a built in pesticide. Also, there have been benefits to the environment from the reduction in the use of some harmful pesticides.

Myth 3 -- Foods made with genetically engineered ingredients are harmful to eat.

Reality – While each genetically engineered crop and animal variety needs to be thoroughly tested beforehand to ensure no food safety risk, the engineered crop varieties currently grown by farmers have no documented food safety risks. The U.S. Food and Drug Administration (FDA), the National Academy of Sciences, the European

[1] For more detailed information about the current status of genetically engineered crops and animals as well as their benefits, risks, and how they are regulated, please see "Straight Talk on Genetically Engineered Foods," which can be downloaded free of charge at http://cspinet.org/new/pdf/biotech-faq.pdf.

Food Safety Agency, and many other scientific bodies have reached that same conclusion.

Myth 4 – FDA approves GE foods and ingredients before we eat them.

Reality – FDA regulates foods under the Federal Food, Drug and Cosmetic Act, which was written decades before the development of genetically engineered crops and animals. Only "food additives" receive mandatory pre-market approval before they enter our food supply and engineered foods so far have not been deemed "food additives." To date, engineered crops receive a voluntary review by FDA but FDA does not provide an approval or safety determination.

Myth 5 – GE crops are environmentally sustainable.

Reality – Extensive use of herbicide tolerant GE crops has led to the development of more than 10 herbicide tolerant weed species that are estimated to cover 7 to 10 million acres of farmland in 22 states. Similarly, the use of GE crops that produce their own pesticide is leading to the development of resistant pest populations. Continued use of those crops without incorporating integrated weed and pest management systems will quickly make those crops unsustainable.

Myth 6 – GE animals are dangerous to humans and the environment.

Reality – There are only two commercial GE animals, the GloFish (a pet) and the Atryn goats (goats that produce a biologic in their mammary glands). These animals are not dangerous but future GE animals may expose humans and the environment to risks unless they are properly regulated by the federal government.

Myth 7 – GE is the best way to increase farm productivity and reduce world hunger.

Reality -- Under proper conditions, GE crops could help developing country farmers increase production. However, farmers need GE varieties of the crops they grow, education about their proper use, and credit to purchase fertilizer and other products that maximize productivity. Meanwhile, providing conventional technologies, such as irrigation equipment, quality seeds, and post-harvest storage facilities, could greatly increase developing farmer income.

THE SCIENCE OF BREEDING CROPS: GENETIC ENGINEERING VS TRADITIONAL BREEDING

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People have been breeding plants for thousands of years, taking plants out of the wild and selecting bigger and more productive seeds or fruit. The traditional breeding process, including making crosses and selecting progeny, is typically a slow and steady process with gradual gains over several years or decades. Dramatic improvements in yield, disease resistance and many other traits have been made through traditional plant breeding.

So why develop trangenic or GM Plants? For one thing, it speeds up the selection process for traits that are highly influenced by the environment. It can be used on traits for which there are no reliable selection procedures or on traits for which there is no genetic resistance or the genes for a particular trait do not exist in the species. It greatly expands the possibilities and capabilities of plant breeders beyond the limitations imposed by cross-pollination or selection techniques.

What is a GMO or Genetically Modified Organism? A transgenic or genetically modified organism is an organism (in our case a plant) that contains a foreign gene or genes that have been inserted into the plant. It is created through a process called genetic engineering which gives scientists the ability to move genetic material from an unrelated organism to another organism thus changing its characteristics.

In reality all plants are genetically modified. However, plant breeders are limited to the exchange of DNA or genes from individuals of the same or closely related species that were able to cross with each other. There are no limitations for GMOs. Genetic engineering was discovered in 1972. With this tool, scientists can transfer specific genes from one organism beyond the boundaries of species into another totally unrelated organism. It allows mixing of genetic material among species that cannot otherwise breed naturally. Genes from bacteria, viruses or animals may be transferred into plants to produce plants having changed characteristics.

There are several methods for transforming plants including the gene gun-microprojectile bombardment, Agrobacterium –mediated transformation and plastid transformation. Generally initial transformants do not contain all the producer and consumer qualities required for successful commercialization. This could be due to the activity of the introduced gene, unstable inheritance, un-intended effects on plant growth, yield, and quality. Therefore, repeated cycles of selection and variety testing are needed before a GM plant can be commercialized.

The majority of the transgenic crops on the market contain a gene for herbicide resistance (90%). Approximately 40% have insect resistance and approximately 20% have both herbicide and insect resistance. In the global market, 75% of the soybeans, 82% cotton, 32% maize and 22% canola are transgenic.

COEXISTENCE OF BIOTECH, ORGANIC, AND CONVENTIONAL CROPS

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"Coexistence" is the concurrent cultivation of biotech, organic, and conventional non-biotech crops in a manner that allows for meeting both consumer preferences and farmer choices. In other words, how do farmers grow these different crops in a way that prevents the unintended presence of biotech crops which could result in some farmers losing the intended market for their products? While coexistence is not something new to farming, the introduction of biotech crop varieties has raised new issues around coexistence and the United States Department of Agriculture ("USDA") currently is considering different policy options to address them. This talk will discuss what coexistence issues USDA is considering, the advice it has gotten from its Advisory Committee on Biotechnology and 21st Century Agriculture ("AC21"), and additional policy interventions proposed by the Center for Science in the Public Interest ("CSPI").

In 2011, Secretary of Agriculture Thomas Vilsack reestablished the AC21 to address coexistence between biotech, organic, and conventional non-biotech crops. His charge to the committee specifically asked what types of compensation mechanisms, if any, might address economic losses by farmers due to the unintended presence of genetically engineered (GE) material. If a compensation mechanism was warranted, he then asked the AC21 to identify what would be needed to implement the mechanism, including any eligibility standards. Finally, the committee was charged with providing advice on other actions that might help promote coexistence.

The AC21, which is composed of stakeholders representing many different perspectives on the issues surrounding coexistence, met five times over approximately 18 months to discuss the charge and draft a report to the Secretary. The report was submitted in November, 2012 and is available on line at http://www.usda.gov/documents/ac21_report-enhancing-coexistence.pdf.

In its report, the AC21 committee did not come to consensus that there was a need for the establishment of a compensation mechanism at this time. While there was some data that some farmers do have their crops rejected and re-channeled to other markets due to the unintended presence of GE material, there was little publicly available data on the extent of the problem. Therefore, the committee recommended that the Secretary obtain data on the extent of the problem and then set up a pilot

compensation mechanism based on a crop insurance model if the data supported such a policy intervention.

The AC21 also provided recommendations in three other areas. First, it identified actions that USDA could take to prevent the unintended presence of GE material in the first place, such as helping farmers better communicate with their neighbors and providing best management practices for both keeping GE material on farms planting biotech crops and off farms trying to take advantage of non-GE markets. Second, the AC21 identified research priorities surrounding coexistence, such as data on economic losses due to unintended presence, gene flow mitigation techniques, and seed purity. Finally, the AC21 made recommendations surrounding seed quality, such as requesting that USDA take actions to preserve non-GE seed varieties for different crops.

While the recommendations of the AC21 are a good first step in addressing some of the policy issues surrounding coexistence, CSPI believes they do not go far enough in reducing the potential economic losses from unintended presence of GE material nor do they provide a sufficient roadmap for the Secretary to establish a compensation mechanism.

The following are some additional activities recommended by CSPI that USDA should implement if they want to begin the process of making coexistences a priority of all farmers and seed developers:

- <u>USDA should propose actions to foster coexistence when it grants a GE crop non-regulated status</u>. USDA should provide to the GE crop developer, farmers of the crop (both the GE and non-GE varieties), and members of the food chain, recommended actions that will foster coexistence when that new GE crop begins commercial production. These should include best management practices for farmers of both the GE and non-GE varieties of the crop, testing protocols to identify unintended presence, actions to ensure seed purity for public and private seed varieties, and segregation tools for food chain actors.
- <u>USDA should require biotech seed companies to include coexistence measures as one of the many mandatory requirement in their seed contracts with GE farmers</u>. For the vast majority of farmers who already work with their neighbors to prevent unintended consequences on neighbors from their farming activities, such a requirement might not impose any new obligations. However, it would make such practices mandatory and elevate them as a critical farm management priority.
- <u>USDA should provide incentives for farmers to carry out measures supporting coexistence on their farms</u>. For example, USDA could reduce crop insurance premiums or provide other financial incentives for farmers who set aside buffer land between their GE crops and their neighbor's non-GE crop. Similarly, USDA could use its conservation programs and try to see if those lands also can be used to help farmers with coexistence (getting two benefits for the price of one).

Farm Safety

MAKING FARMING EASIER, SAFER AND MORE PRODUCTIVE

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As one ages it seems for various reasons that performing certain tasks becomes more difficult and tiring. This phenomena increases due to the ageing process and also due to chronic illnesses such as arthritis. This presentation will present ideas for making farming easier, safer and more productive.

The first challenge is making farming easier. It is apparent from tractor and equipment design that technology is at the forefront of making farming easier. Apparent examples that have been around for years include automatic couplers, ergonomic seats, robotics, environmentally controlled cabs, joy stick controls and much more.

Making farming easier will include mobility aids, improving access and efficient operation of equipment, technology for your farm shop and animal facilities, lifting aids and much more. A wide variety of technologies will be covered and many will be pertinent to your operation despite the type of your farming operation.

Making farming easier will also include information on work simplification, working smarter and diversifying your operation. The objective of each approach will be to reduce energy expenditures and increase efficiency.

The second challenge is to make farming safer. Farming is one of the most dangerous occupations in the United States and this discussion will investigate how one of the most productive industries can also be one of the most hazardous. This discussion will center on reducing risks and better managing risks on your farm. Reducing risks may include putting a shield on your equipment, using personal protective gear and better training. It certainly includes creating greater awareness of hazards and eliminating those hazards.

Farmers have to recognize that safety is a management responsibility. If management establishes safety as a core value and priority, injuries will be reduced. If safety takes the back seat, injuries will continue to occur. Once the farm manager recognizes that safety doesn't just happen, but needs to be managed, then real change will occur in making your farm a safe farm.

The third challenge is to make farming more productive. It is a given that newer equipment and better cultural practices will make farming more productive. It is also true that if it becomes easier, you will have more energy which will enhance productivity. It is also true that if farming is safer, it will be more productive. This third challenge is actually a result of success in making farming easier and safer.

This discussion on "making farming easier, safer and more productive" will offer ideas that you will be able to implement on your farm. It will be practical, informative and offer ideas and tools that you will be able to use in your farm business. These are challenges that you strive for on a daily basis and this discussion will help to make them attainable.

RETROFITTING FARM TRACTORS FOR NEW JERSEY FARMERS AND ADDITIONAL FARM SAFETY AND HEALTH RESOURCES

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The leading cause of work-related deaths on farms is the lack of rollbars and seatbelts on tractors.

In 2006, the New York Center for Agricultural Medicine and Health (NYCAMH) addressed this lethal problem with the introduction of its ROPS Rebate Program. By combining research, outreach and financial incentives to motivate farmers to upgrade older tractors by installing ROPS, rollover protective structures – rollbars and seatbelts – the program is essentially eliminating the risk of accidental tractor overturn deaths on farms. Based on its success in New York, the program has been expanded to serve farmers in New Hampshire, Pennsylvania, Vermont and Wisconsin.

To expand this lifesaving program, in March 2011, the ROPS Retrofit Program for Pennsylvania Farmers launched the ROPS Rebate Program for Pennsylvania Farmers, an effort to help provide farmers with rollbars and seatbelts. One-hundred percent of the rebate funds given to farmers to purchase ROPS were raised through fundraising. Costs related to administering the program are currently covered through a federal grant.

Consider:

- American farmers are eight times more likely to die while working than the average American worker.
- Tractor overturns are the leading cause of these deaths and injuries.
- National data confirm that the risk of fatal tractor overturns is highest in the northeastern United States.
- Sixty-two Pennsylvania farmers were killed by tractor rollovers in 2000-09.
- For each tractor fatality, there are five permanently disabling injuries.
- Approximately half of the tractors in the Northeast predate manufacturers' voluntary safety standards established in 1985.
- Over 40 percent of tractors in Pennsylvania lack rollbar protection.
- Seven out of 10 farm families will be forced to leave the farm within five years of a tractor overturn fatality.

Tractor overturns are deadly because tractors, particularly older models, which are most common, have a high center of gravity and are inherently unstable. When such a tractor rolls over, it doesn't flop on its side. It rolls over – and over – and over again, crushing anything in its path, including the tractor operator. Backflips are

particularly deadly because there isn't time for the operator to jump off. On average, when overturning, tractors pass the point of no return in 1.5 seconds.

ROPS: An Effective Solution

ROPS, rollover protective structures – rollbars and seatbelts – have been proven to be more than 99 percent effective in preventing fatalities, in the event of a tractor overturn. Built with high-grade steel and engineered to provide the tractor operator with a zone of protection, the rollbar saves lives. Rollbars not only protect the tractor operator, they limit most rolls to a 90-degree side-flop. Even without the advised use of a seatbelt, a rollbar protects most farmers from serious injury.

The ROPS Rebate Program

The ROPS Rebate Program was created by NYCAMH to prevent tractor fatalities on New York farms. To date, more than 1000 New York tractors have been equipped with rollover protective structures. The number of farmers who are applying to the program and are protecting themselves, their families and their livelihoods is steadily growing. Researchers at the Northeast Center for Agricultural and Occupational Health have documented a tenfold increase in the installation of rollover-prevention structures in the past three years. This life saving program is now available for Pennsylvania farmers through Penn State University.

Since the Pennsylvania program was launched in January 2011, over 290 farmers have called the hotline with 6 farmers in the process and 53 already receiving rebates. There are nearly 100 farmers on a waiting list until we secure more rebate funds.

Knowing farmers like a good deal, the ROPS Rebate Program was designed to address major barriers that have discouraged farmers in the past, specifically:

Cost: A ROPS can cost $800 to $2,500, depending upon the model. Few farmers can afford such costs in today's challenging economy.

Time: Repeated calls to dealers, manufacturers and shippers are often too time-consuming for most overstretched farmers to undertake.

The ROPS Rebate Application Process

A farmer contacts the ROPS Rebate Program and provides their tractor model and number. A ROPS program staff member informs the farmer on the type and cost of the rollbar that is needed. They also are given information on suppliers, shipping and delivery.

The single qualifying condition is that a farmer must be a resident of the state in which he or she is applying for a rebate. Upon submission of his receipts for all expenses and proof of installation, they receive a rebate check for 70% of the total cost of the ROPS kit and shipping, up to $765.

For registration and preapproval, farmers can: Apply online at the ROPS Web site, www.ROPSR4U.com, or Call the ROPS Rebate Hotline (1-877-ROPS-R4U or 1-877-767-7748).

Even though rebates are not currently available in New Jersey, efforts are underway to expand the rebate program to other states, and the website and hotline are available to assist in finding ROPS for your make and model of tractor.

Additional Farm Safety and Health Resources on www.eXtension.org

A new farm-related educational resource has been added to a national website that offers answers to hundreds of farm-related safety and health questions. Farm and Ranch eXtension for Safety and Health or FReSH located at http://extension.org/farm_safety_and_health, offers easy-to-navigate advice on farm safety and health issues for everyone from beginning farmers to veteran producers. Funding for the initiative was provided by the U.S. Department of Agriculture's National Institute for Food and Agriculture and CHS Inc.

Penn State's College of Agricultural Sciences is part of eXtension which is a consortium of 74 universities that provide online access to objective, research-based information to answer all types of agricultural-related questions.

The new Community of Practice (CoP) focused on farm safety and health is called FReSH and covers a wide range of topics such as animal handling, occupational health, traumatic injuries, and tractors. The FReSH CoP is comprised of over 70 individuals dedicated to agricultural safety and health. CoP members provide content for the site and are integral in the review process that requires all materials to be reviewed by two to four ag safety and health professionals. Therefore, all information found on FReSH is current, cited, and peer-reviewed.

This online resource will serve many groups, including educators, injury outreach specialists and farm workers, with valuable information that can be accessed anytime. And in an agricultural community where business is done all day, every day, there is never a down time for safety and health information. This online resource is available to serve hard-working men, women and families with up-to-date safety and health materials to protect a farm or ranch's most valuable assets: the farm and ranch workers.

FReSH also offers an online AgSafety4u certificate program taught by Dr. Aaron Yoder, instructor in agricultural and biological engineering at Penn State University. The course provides an overview of identifying and controlling hazards common to farms and agriculture-related rural businesses, focusing on hazards associated with machinery, structures, equipment, animals, chemicals and outdoor environments. To register for the course, visit the "Safety and Health" section at http://campus.extension.org.

WHAT ARE THE REAL DANGERS ON NEW JERESEY FARMS

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Agriculture has been one of the most dangerous occupations in the world for many years. In days gone by the predominance of farm accidents have been physical equipment injuries resulting in finger loss, limb damage, eye problems and back injury due to lifting heavy objects. For the sake of discussion here in New jersey we normally had to rely on farm injury data from other states, Canada, Europe, Australia and other regions who kept accurate data. In 2012, I was able to develop and fund a survey for New Jersey farmers to determine precise areas of concerns regarding farm injury. Funded by the National Agriculture project, a team consisting of myself, Ron Jester, Coordinator of the National Agriculture Project, and Troy Joshua, former director of the New Jersey branch of NASS (National Agriculture Statistic Service). Survey forms were developed and mailed to 1,000 farms from Atlantic, Burlington, Camden, Cape May Cumberland, Gloucester, Ocean and Salem Counties. The survey had an excellent rate of return of 437 farms being represented. The data collection period ended on May 15, 2012. The survey consisted of twelve different areas of interest regarding injuries and disabilities on New Jersey farms.

Section 1 dealt with the total number and % of New Jersey farmers who currently have some type of disability. At this time, 14% of New Jersey farmers have some type of disability that effects their farming operation.

Section 2 dealt with a detailed breakdown of the types of farm injuries in New Jersey. The highest frequency of disability was due to arthritis with 30% of farmers suffering from this potentially disabling ailment.

Section 3 further broke down what type of worker on the farm had the disability. For example, was the disability to the owner, employee, migrant or other family members? The overwhelming amount of disabilities occurred to the farm owner. Very few of the disabilities occurred to migrant workers. This could be due to a lack of reporting of injury from migrants out of fear of losing their jobs or lack of awareness of the disability itself.

Section 4 broke down the disability type between males and females. Males made up the majority of disabilities.

Section 5 categorized the type of disability according to various age groups. Generally, the older the age groups the more disabilities, which really is not surprising.

Section 6 detailed the length of time of the farmer had the disabilities. The average farmer had their disability of 10.2 years. However, some reported living with their disability for 50 years.

Section 7 revealed the specific origin of the disability.

Section 8 & 9 correlated the employment status with the number of years disabled and age groups. Data shows the highest frequency of farm disabilities occurred in the 70 year old and above.

Section 10 detailed the type of assistance services that farmers in New Jersey have used. Glasses and hearing aids were the highest categories, while 29 % used no devices.

Section 11 specifies which organizations have farmers sought assistance from. Hospitals, 17%, were the most utilized sources in dealing with farm disabilities.

New Jersey farmers in many respects mirror the overall farm disability rates. However, the average age of New Jersey farmers is higher than the overall farm population which probably resulted in some disabilities being higher than others. Hopefully, farm disability data information can be kept current here in New Jersey through assistance from the New Jersey Agrability program and other safety programs.

Agricultural Water Issues

WATER REUSE IN AGRICULTURE: RECLAIMED WATER AND TAILWATER RECOVERY

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Purpose of water reuse in agriculture: Reclaimed or recycled water is used in agricultural operations for a couple of key reasons. In areas where water is costly, the primary factor may be reduced cost, since reclaimed water may have lower costs per volume, and recycling runoff on-site may be less expensive than purchasing water. Often the primary motivation for considering water recycling is to comply with environmental regulations or to combat any negative stereotypes that agricultural operations contribute to water pollution in the form of nutrients and pesticides in runoff. If tailwater and stormwater runoff are captured on-site, this prevents any pollutants in that water from being released into nearly streams or lakes. This is probably the primary motivation of the adoption of on-site water recycling by nursery operations in some parts of the county. A further motivation is to increase the public perception that agriculture is a good neighbor and good steward of the land, since reusing water decreases the use of drinking water supplies. This is an important consideration in a state like New Jersey, where limited water supplies are increasingly taxed by residential, agricultural, and industrial uses, and where overdrawing from water supplies may have noticeable negative effects such as saltwater intrusion into groundwater, decrease flow in streams, and restrictions on water use in residential areas. Using reclaimed water for agricultural purposes also decreases water pollution, since that water, which still may be relatively high in nitrogen or phosphorus, is prevented from being discharged by the wastewater treatment plant. There may be other benefits of using recycled or reclaimed water, such as a having a source of water that is less prone to drought or does not require increased water allocation permits.

Definitions of water reuse: Terms for different kinds of water reuse can cause confusion, since they are not always used consistently (Merhaut and Mangiafico, 2013).

- "Recycled water" is an ambiguous term, but in agriculture usually means water that is collected, treated, and recycled on-site, as may be done by production nursery operations in New Jersey.
- "Reclaimed water" refers to wastewater—typically sewage—that has been treated in a wastewater treatment facility. It usually meets certain water quality standards, and so may be suitable for irrigation of golf courses, landscapes, nursery crops, or other crops.
- "Tailwater" is usually defined in agriculture as runoff created by excess irrigation, including the intentional leaching of water through containers in container nurseries. In this use it is synonymous with "irrigation runoff."
- "Stormwater" is runoff created by precipitation. In this use it is synonymous with "stormwater runoff."
- "Rainwater harvesting" refers to the collection of rainwater from the roofs of buildings or greenhouses. It's recycled in the sense that if this water were not collected it might not be used beneficially but instead would contribute to stormwater.

Reclaimed water: Reclaimed water is produced by the treatment of sewage or other wastewater at a wastewater treatment plant. It is relatively commonly used for the irrigation of golf courses, landscapes, roadsides, and crops in some areas including California, Washington, and Florida, and less extensively in may others. Guidelines in New Jersey allow for its use as irrigation for urban landscapes, non-food crops, and food crops (NJDEP, 2005; USEPA, 2004). It can also be used for other applications such as toilet flushing, ornamental ponds, or fire

suppression. These uses are also allowed by New Jersey guidelines (NJDEP, 2005; USEPA, 2004).

One motivation for an agricultural operation considering reclaimed water is that is it often a drought-resistant water source, because wastewater continues to be generated in drought conditions. In some areas of the nation, it may be cheaper than other sources of water, particularly than municipal water. Reclaimed water use also furthers the goals of water conservation and water pollution prevention.

Several drawbacks to reclaimed water use may discourage its use for agricultural irrigation. Among these is the need to maintain separate lines for potable water and reclaimed water. A second is the potential for reclaimed water to have contaminants like salts, boron, or human pathogens. Furthermore, the demands of dealing with additional regulations may further discourage its use. The potential for some human pathogens to remain in reclaimed water may be a particular concern for irrigating food crops, such as vegetables. By New Jersey guidelines, reclaimed water may be used for food crops if an irrigation method is used that precludes the direct contact of the water with the crop, or if the edible product will be skinned or cooked before consumption (NJDEP, 2005; USEPA, 2004). It should also be noted that the potential for human pathogens in reclaimed water represents a potential safety issue for any workers who come in contact with the water, requiring additional safety precautions for the operation.

Recycled water: Recycled water is tailwater or stormwater that is collected on-site and reused for irrigation. This type of water recycling is relatively common among container nursery and greenhouse operations in some areas of the nation. In New Jersey, it is becoming more common among production nurseries. A principal motivation is the desire to show the operation's commitment to water conservation and water pollution prevention. Drawbacks to implementing water recycling include the large initial expense of designing and installing the infrastructure including the water impoundment and water treatment equipment. A common concern is the potential to spread plant pathogens in untreated recycled water. Common water treatment options which are effective in destroying plant pathogens include chlorine, ozone, and ultraviolet light, among others. A separate concern is the potential to recirculate herbicides in recycled water. While there have been reports of crop damage by herbicides in recycled water, the potential for this problem has not been documented extensively.

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Greens/Herbs

EVALUATING FUNGICIDES IN 2012 FOR THE CONTROL OF BASIL DOWNY MILDEW

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Sweet basil (*Ocimum basilicum*) is an economically important fresh culinary herb grown in the United States. Basil is grown in the field and greenhouse and can be produced into fresh, dried and frozen commodities. In fall of October 2007, a new disease of basil, downy mildew (*Peronospora belbahrii*) was first reported in FL. Since then, basil downy mildew has resulted in significant losses throughout the United States. During the summer of 2012 at the Rutgers Agricultural Research and Extension Center (RAREC) in Bridgeton, NJ, 13 conventional fungicides and 1 organic fungicide were evaluated for efficacy in field trials with seven weekly fungicide applications over the course of the growing season. It is important to note that fungicide applications began after basil was infected with downy mildew. Basil downy mildew severity was recorded weekly by visually examining twenty-five randomly selected leaf samples per experimental unit. The fungicides K-Phite (phosphorous acid; FRAC Code 33), Pro-Phyt (phosphorous acid; FRAC Code 33), Zampro (dimethomorph; FRAC Code 40 + ametoctradin; FRAC Code 45), Reason (fenamidone; FRAC Code 11), combinations of Quadris (azoxystrobin; FRAC code11) + K-Phite, combinations of Quadris + Pro-Phyt, combinations of Ranman (cyazofamid; FRAC Code 21) + K-Phite (weeks 1,3,5) alternated with combinations of Presidio (fluopicolide; FRAC Code 43) + K-Phite (weeks 2,4,6), and combinations of Ranman + Pro-Phyt (weeks 1,3,5) alternated with combinations of Presidio + Pro-Phyt (weeks 2,4,6) provided the best level of control. Moderate control was obtained from Ranman and Quadris. Poor control was obtained from Regalia (*Reynoutria sachalinensis*), Presidio, Previcur Flex (propamocarb HCL; FRAC Code 28) and Revus (mandipropamid; FRAC Code 40). The best disease control is obtained when fungicide applications begin before the pathogen enters the field.

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!

DIVERSITY BY DESIGN: EXPLORING TRAP CROPS AND COMPANION PLANTS TO MANAGE FLEA BEETLES IN BROCCOLI

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The crucifer flea beetle (CFB), *Phyllotreta cruciferae* (Coleoptera: Chrysomelidae) is an oligophagous pest of *Brassica* crops throughout North America. Although crucifer flea beetles can be problematic on *Brassica* crops in NJ this project focuses on work conducted in Washington and Idaho. In the Pacific Northwest, many growers rely on *Brassica* crops as a major component of mixed-vegetable production and flea beetle damage lowers the marketable yields of these crops. Organic *Brassica* crops are valued at over $60 million annually and include arugula, broccoli, cabbage, kale and mustard greens. Adult flea beetles scar foliage, resulting in produce that is unattractive to consumers, and often kill seedlings and small transplants outright sometimes leading to total crop loss. For this reason many small-scale vegetable growers in the Pacific Northwest are unable to include *Brassicas* in their yearly rotations.

Organic producers are very limited in their options for controlling flea beetles, these being limited to the use of floating row covers, which can be costly and organic-approved insecticides that must be applied frequently as flea beetles continuously move into the crop from surrounding vegetation. The limitations of these strategies have led the industry to look for alternatives.

Trap crops represent one such potential management alternative. Trap crops are stands of plants that protect the target crop by attracting pest insects and/or providing a more suitable host plant (Hokkanen, 1991; Shelton and Badenes-Perez, 2006). Manipulating diversity within trap cropping may also provide improved pest suppression. We examined whether multi-species trap crop plantings were more effective than any single species at attracting the crucifer flea beetle (CFB) away from broccoli (*Brassica oleracea* var. *italica*) plantings.

We also examined the use of combining companion plants with trap crops to manage flea beetles. Companion plants are interplantings of a second marketable crop within the protection target that can visually and/or chemically masks the ability of a pest to find its desired host plant (Cunningham 1998, Finch and Collier 2000). Therefore, a trap crop situated near a companion plant intercrop may visually confuse, repel, block or slow the movement of flea beetles into broccoli and consequently steer flea beetles to the trap crop. In the work reported here, we attempted to further reduce the attractiveness of broccoli by interplanting it with the companion crops bunching green onion (*Allium fistulosum* x *cepa*), Yukon gold potato (*Solanum tuberosum*), dill (*Anethum graveolens*) or Golden Guardian marigold (*Tagetes patula*). These companion plants were chosen because of their aromatic qualities, size and physical appearance.

Our trap crop diversity results revealed that trap crop species not particularly effective when planted alone, nonetheless provided substantial plant protection when

planted in multi-species polyculture. However, results from our companion plant experiment were more complicated and revealed no effect of companion plants of any species tested on flea beetle numbers or damage. Thus, we conducted a second field-plot experiment wherein we manipulated the ratio of companion to broccoli densities, to determine whether different companion:broccoli ratios would generate an improvement in pest control. In this second experiment we again saw no improvement in broccoli protection. Altogether, our companion plant experiments revealed no evidence that companion-planting with these particular companion plants complemented trap cropping.

For more information on organic flea beetle management see the Pacific Northwest Extension publication: cru.cahe.wsu.edu/CEPublications/PNW640/PNW640.pdf

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Tomatoes

IDENTIFICATION AND MANAGEMENT OF TOMATO PHYSIOLOGICAL DISORDERS

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Physiological disorders are those problems with the plant and fruit that are not caused by infectious microorganisms, but rather by some other factor imposed on the plant in the environment. These environmental stresses can cause changes in growth and development at all stages of plant growth from seedling through growth and the development of the fruit. Identification of these disorders often involves some detective work which begins with knowing the environmental conditions leading up to the damage and the elimination of other likely causes, like plant pathogens. When these disorders occur, management strategies may be limited, other than to return growth to more favorable conditions. cgunter@ncsu.edu, 919-513-2807

Temperature: Crops and cultivars respond differently
Root and shoot temperature differences
Low: Reduce nutrient uptake
High: Thin stems, "soft" growth
High: Reduced calcium transport (fast growing areas)

Air Quality: Fuel Source
Pollution from Outside Sources
Check for: Heater Problems, Ethylene and Carbon Monoxide,Faulty Heat Exchangers, Dirty Fuel Openings, Incomplete combustion
Maintenance and Cleaning twice a year
Vent to outside
Stack outlet away from greenhouse vents
Ethylene
Epinasty
Downward curling leaves, not wilted
Service Equipment Regularly
Monitor Carbon Monoxide
Look for damage during periods of cold weather

Plant Nutrition: Obtain Soil Test Prior to Planting

Blossom End Rot: Localized Nutrient Deficiency (Ca)
Secondary infection possible
Cause and Control
Local Ca Deficiency
Fluctuations in Soil Moisture
Drought
Root Damage
Excessive Fertilizer

Puffiness: Light in Weight, Enlarged Cavities may lack Gel, Flat Sided or Angular
Day Temps Above 95F or Below 55F
Night Temps above 75F
Poor Pollination, Fertilization, Seed Development
Temperature Extremes
Improper Nutrition, Soil Moisture
Incomplete Pollination
Blossom Drop – Incomplete Pollination
Flower Withers and browns
Flower stem and Calyx Yellow's
Small Fruits Form but then Fall Off
Stress – High Temperatures (90F)
Low Temps (50F)
High Humidity, Excessive Wind, Improper Nutrition, Damage (insect or disease)

Heat Set Varieties (Pheonix, Fla 91, Solar Fire)

High Light: Sunscald, Fruit exposed suddenly to sun
- Pruning
- Natural Plant Growth
- Heavy Fruit Load
- Loss of Foliage

Leafroll:
- Normal in Some Varieties
- May worsen with hot, dry conditions
- Waterlogged Soils
- Root Injury
- Fruit Quality

Catfacing:
- Early fruit
- Large Fruited Varieties
- Low Temps (Below 60F) during flowering
- Abnormal Flower Development (herbicides)
- High N

Zippering:
- Anther Sticking to Fruit
- May cause a Hole in Fruit
- Begins when fruit is green
- Control – Remove fruit, non-marketable

Fruit Cracking:
- Concentric and Radial, Rain Checking
- Changes in Growth Rate
- Fluctuations in Moisture or Temperature
- Rain Check is tiny concentric cracks or russeting, Will not Ripen Properly
- Maintain Good Canopy Coverage
- Rain and Dew Can Increase Problem

Graywall or Blotchy Ripening:
- Absence of Red Pigment
- Climate – Prolonged Cloudiness, Low Light, High Humidity (High Tunnel), Low Temps
- Nutrition – Low K
- Cultural Practices – High Soil Moisture, Soil Compaction, Excessive Fertility
- Follow BMP's, Avoid Rapid Changes in Growth and Development
- Yellow Shoulder, Internal White Tissue
- YSD – Fruit Tops Don't Turn Red (Green or Yellow)
- Varieties Vary
- Soil K and Mg levels involved
- Will Never Ripen

Gold Fleck: Not a Physiological Disorder
- Damage of epidermal cells by arthropods resulting in gold discoloration of the fruit
- Ghidiu et al. (2006) Western flower thrips cause gold fleck on tomato
- May affect marketability of fruit
- Will *T. urticae* cause gold fleck on tomato fruit?
- Experiments conducted in the greenhouse, field and laboratory
- Result of mites feeding and damaging cells directly beneath the surface of the fruit
- Not previously documented for *T. urticae*

EFFICACY OF INSECTICIDES FOR CONTROLLING TOMATO PESTS

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Insect pest management is often critical to successful tomato production. In the Mid-Atlantic U.S. some important pests include the tomato fruitworm (= corn earworm), thrips, brown marmorated and other stink bugs, and aphids. Occasional or sporadic pests also include spider mites, armyworms, Colorado potato beetle, hornworms, leafminers, and tomato pinworm. To control this complex of pests most commercial tomato growers rely on multiple applications of insecticides. Even organic tomato producers may find it necessary to apply OMRI-certified natural insecticide products to protect their crops from pests. Because there are more insecticide products on the market than ever before and because the spectrum of pests that each controls is quite variable, the importance of insecticide testing and dissemination of the information to growers is at an all-time high.

Results of some recent insecticide efficacy trials conducted on tomatoes in Virginia are presented below.

Table 1. Information on insecticide products presented in our efficacy trials.

Product (company)	Chemical name (AI)	Application Method	Pests Controlled	Rate / acre	PHI (days)
Actara (Syngenta)	thiamethoxam	Foliar	Aphids, beetles, thrips, bugs	2 to 3 oz	0
Admire Pro (Bayer)	imidacloprid	Foliar & Soil	Aphids, beetles, thrips, bugs	1.3 to 2.2 fl.oz (foliar) 7 to14 fl. oz (soil)	21 / 0
Athena (FMC)	abamectin +	Foliar	Mites, beetles, bugs, leafminer	8 to 17 fl. oz	7
Aza-Direct (Gowan)	azadirachtins	Foliar	caterpillars, aphids	1 to 2 pts	0
Baythroid XL (Bayer)	Beta-cyfluthrin	Foliar	caterpillars, stink bugs, thrips, beetles	1.6 to 2.8 fl. oz	0
Belay (Valent)	clothianidin	Foliar & Soil	Thrips, Aphids, bugs, beetles, leafminer	3 to 4 fl. oz (foliar) 9 to12 fl. oz (soil)	21
Beleaf (FMC)	flonicamid	Foliar	Aphids, plant bugs	2 to 2.8 fl. oz	0
Belt (Bayer)	flubendiamide	Foliar	caterpillars	1.5 fl. oz	1
Brigadier (FMC)	Imidacloprid+bifenthrin	Foliar	Thrips, Aphids, bugs, beetles, leafminer	5.1 to 9.85 fl. oz	1
Closer (Dow)	sulfoxaflor	Foliar	Aphids, beetles	Not yet registered	
Coragen (Dupont)	chlorantraniliprole	Foliar & Soil	Caterpillars, potato beetle, leaf miner	3.5 to 5 fl. oz	1
cyazypyr 10SE	cyantraniliprole	Foliar	caterpillars, thrips, potato beetle, aphids	Not yet registered	
Danitol (Valent)	fenpropathrin	Foliar	Caterpillars, thrips, bugs	10.67 fl. oz	3
Durivo (Syngenta)	thiamethoxam + chlorantraniliprole	Soil / Drip	Aphids, caterpillars, thrips, potato beetle, leafminer	10 to 13 fl. oz	30 (soil only)
Endigo ZC(Syngenta)		Foliar	Aphids, beetles, thrips, stink bugs, caterpillars	4 to 4.5 fl. oz	5
Hero (FMC)	bifenthrin + zeta-cypermethrin	Foliar	Aphids, beetles, thrips, stink bugs, caterpillars	4 to 10.3 fl. oz	1
Lannate LV (Dupont)	methomyl	Foliar	Aphids, caterpillars, thrips,	3 pts	1

			stink bugs		
Leverage 360 (Bayer)	Imidacloprid + beta-cyfluthrin	Foliar	Aphids, caterpillars, beetles, thrips, bugs	3.8 to 4.1 fl. oz	0
Movento (Bayer)	spirotetramat	Foliar	Aphids	4 to 5 fl. oz	1
M-Pede (Gowan)	K salts of fatty acids	Foliar	Aphids, soft-bodied insects	2%	0
Mustang Maxx	zeta-cypermethrin	Foliar	caterpillars, stink bugs, thrips, beetles	2.24 to 4 fl. oz	1
Pyrafluquinazon (Nichino)	pyrafluquinazon	Foliar	Aphids	Not registered	
Radiant (Dow)	spinetoram	Foliar	caterpillars, thrips, leafminers	5 to 10 fl. oz	1
Vetica (Nichino)	flubendiamide + buprofezin	Foliar	caterpillars	12 to 17 fl. oz	1
Voliam Flexi (Syngenta)	chlorantraniliprole + thiamethoxam	Foliar	caterpillars, thrips, potato beetle, aphids	4 to 7 fl. oz	1
Voliam Xpress (Syngenta)	λ-cyhalothrin + chlorantraniliprole	Foliar	caterpillars, stink bugs, thrips, beetles, aphids	5 to 9 fl. oz	5
Warrior II (Syngenta)	λ-cyhalothrin	Foliar	caterpillars, stink bugs, thrips, beetles	1.28 to 1.92 fl. oz	5

TRIAL 1: CONTROL OF BROWN MARMORATED STINK BUG IN TOMATOES, BLACKSBURG, VA

VARIETY: 'Carbon' tomatoes; PLANT DATE: 7 June 2012; TREATMENT APPLICATIONS: All foliar treatments were applied on 26 July, 2, 8, and 15 Aug with a 3-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40 psi delivering 38 GPA. HARVEST: 20 and 28-Aug.

Treatment [z]	**Rate oz/ acre**	**% stink bug damage**		**% thrips damage**	
		20-Aug	**28-Aug**	**20-Aug**	**28-Aug**
UTC		31.3 a	32.5 a	11.3	6.3
Endigo ZC	4.5	13.8 b	2.5 c	5.0	18.8
Actara 25WG	5.5	15.0 b	8.8 bc	8.8	2.5
VoliamXpress	9.0	15.0 b	21.3 ab	10.0	11.3
Leverage 360	3.8	12.5 b	5.0 c	7.5	1.3
Baythroid XL	2.8	21.3 ab	10.0 bc	5.0	5.0
Belay 2.13SC +NIS	4.0	11.3 b	1.3 c	1.3	1.3
Belay 2.13SC +NIS	6.0	8.8 b	2.5 c	0.0	6.3
Danitol 2.4EC +NIS	10.0	15.0 b	3.8 c	3.8	10.0
Belay 2.13SC + Danitol 2.4EC +NIS	2.0 + 10.0	10.0 b	6.3 bc	7.5	5.0
P-Value from ANOVA		0.0009	0.0052	ns	ns

TRIAL 2: CONTROL OF BROWN MARMORATED STINK BUG IN TOMATOES - TEST 2, BLACKSBURG, VA

VARIETY: 'Carbon' tomatoes; PLANT DATE: 7 June 2012; TREATMENT APPLICATIONS: All foliar treatments were applied on 26 July, 2, 8, and 15 Aug with a 3-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40 psi delivering 38 GPA. HARVEST: 20 and 28-Aug.

Treatment	**Rate oz/ acre**	**% fruit with stink bug damage**	
		20-Aug	**28-Aug**
UTC		36.25 a	15.0 bc
Hero	6.4	13.75 bc	12.5 bc
Hero	7.1	8.75 c	6.25 c

Brigadier 2SC	8.0	11.25 bc	6.25 c
Athena	16.0	11.25 bc	8.75 c
Mustang Max	4.0	8.75 c	15.0 bc
Mustang Max plus Lannate LV	4.0 16.0	10.0 c	8.75 c
Beleaf	2.8	25.0 ab	30.0 a
Lannate LV	48	20.0 bc	21.25 ab
Vydate L	32	8.75 c	15.0 bc
P-Value from ANOVA		0.0078	0.0008

TRIAL 3: CONTROL OF LEPIDOPTERAN LARVAE IN TOMATOES VIA DRIP CHEMIGATION, PAINTER, VA

VARIETY: 'Phoenix' tomatoes; PLANT DATE: 17 Jul 2009; TREATMENT APPLICATIONS: All drip chemigation treatments were applied just before flowering with the use of chemilizers. Irrigation events for approximately one hour always followed chemical application (irrigation was run at least 3 times weekly for a minimum of 1 hour for each event). The foliar treatment (Warrior II) was applied with a Co2 backpack sprayer with a 3-nozzle drop-down boom. Dates for all treatment applications are found on the table.

				% lepidopteran fruit damage		
Treatment	**Rate / acre**	**Application Dates**	**Mean no. lep larvae[1] / 2 beat sheets (3 Sep)**	**3-Sep**	**14-Sep**	**24-Sep**
Untreated Contr.	-	-	10.3 a	32.5 a	35.0 a	39.2 a
Durivo	10 fl. oz	14 Aug	0.0 c	2.5 bc	1.7 c	5.8 c
Durivo	13 fl. oz	14 Aug	0.0 c	5.0 bc	3.3 c	4.2 c
Coragen 20 SC	5 fl. oz	14, 28 Aug	0.8 c	5.0 bc	5.0 c	0.0 c
Coragen 20 SC	7 fl. oz	14 Aug	0.3 c	7.5 bc	1.7 c	2.5 c
Admire Pro	7 fl. oz	14 Aug	6.8 b	32.5 a	23.3 ab	27.5 ab
Lannate LV	48 fl. oz	14, 28 Aug	1.3 c	2.5 bc	15.8 b	20.0 b
Vydate L	64 fl. oz	14, 28 Aug	6.3 b	15.0 ab	35.8 a	25.0 ab
Warrior II (foliar)	1.9 fl. oz	4 times	0.0 c	0.0 c	6.7 c	1.7 c

[1]80% cabbage loopers, 10% beet armyworm, 8% corn earworm and 2% yellow-striped armyworm
All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

TRIAL 4: CONTROL OF COLORADO POTATO BEETLE AND LEPIDOPTERAN LARVAE IN TOMATOES, PAINTER, VA

VARIETY: 'Solar fire' tomatoes; PLANT DATE: 12 Jul 2010; TREATMENT APPLICATIONS: 29 Jul (Durivo Soil only); Foliar treatments were applied 4 times: 20 Aug, 7, 13, 20 and 27 Sep with a 3-nozzle boom powered by a CO_2 backpack sprayer at 40 psi delivering 31 GPA.

			% tomato fruit damaged by fruitworm or armyworm	
Treatment	**Rate / acre**	**Mean no. Colorado potato beetles / 10 plants 24 Aug (4 DAT)**	**16-Sep**	**27-Sep**
Untreated Control		8.5 a	53.8 a	35.0 a
Belt + NIS	1.5 fl. oz	10.8 a	8.8 b	16.0 b
Durivo (SOIL APPLICATION)	10 fl. oz	0.0 b	17.5 b	15.0 b
Voliam Flexi + NIS	7 oz	0.0 b	6.3 b	5.0 c
Voliam Xpress + NIS	9 fl.oz	0.0 b	1.3 b	10.0 bc
Radiant	8 fl. oz	0.0 b	12.5 b	11.0 bc
P-Value from Anova		0.009	0.0002	0.0037

TRIAL 5: CONTROL OF TOMATO FRUITWORM WITH FOLIAR INSECTICIDES IN FALL TOMATOES, PAINTER, VA

VARIETY:'Phoenix' tomatoes; PLANT DATE: 17 Jul 2009; TREATMENT APPLICATIONS: Foliar treatments were applied on 19, 25 Aug and 8 Sep with a 3-nozzle boom powered by a CO_2 backpack sprayer at 40 psi delivering 31 GPA.

		% tomato fruit damaged by fruitworm	
Treatment	**Rate / acre**	**7 Sep**	**17 Sep**
Untreated Control		17.5 a	30.8 a
Coragen 20SC	5 fl. oz	0.0 b	2.5 b
Radiant	8 fl. oz	0.0 b	2.5 b
Vetica + Biosurf 80/20	13.7 fl. oz	0.0 b	1.7 b
Belt + Biosurf 80/20	1.5 fl. oz	2.5 b	0.0 b

50% beet armyworm and 50% tomato fruitworm.
All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (P>0.05).

TRIAL 6: CONTROL OF APHIDS ON TOMATOES, VIRGINIA BEACH, VA

VARIETY:'Florida 47' tomatoes; PLANT DATE: 18 Apr 2012; TREATMENT APPLICATIONS: All foliar treatments were applied on 10, 21, and 31 May with a 3-nozzle boom equipped with 8003VS spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 38 GPA.

		Mean no. potato aphids			
Treatment	**Rate / acre**	**17-May**	**31-May**	**14-Jun**	**26-Jun**
Untreated Control		22.3 ab	39.5 a	213.0 a	39.4 a
Closer	1.5 fl. oz	1.5 c	7.0 b	0.0 b	0.8 c
Endigo 2.06 ZC	4.5 fl. oz	0.0 c	0.0 b	0.0 b	1.0 c
Actara 25WG	5.5 oz	0.0 c	0.0 b	0.0 b	0.8 c
Voliam Xpress 1.25ZC	9 fl. oz	1.0 c	0.3 b	0.3 b	3.3 c
Leverage 360	4 fl. oz	0.3 c	0.3 b	0.3 b	0.3 c
Pyrifluquinazon	3.2 fl. oz	4.5 c	4.0 b	0.0 b	1.0 c
cyazypyr 10SE + MSO	20.5 fl. oz	1.3 c	0.0 b	0.0 b	1.0 c
Movento + MSO	4 fl. oz	0.3 c	0.0 b	0.0 b	0.0 c
Aza-Direct + M-Pede	12 fl. oz + 2.5% v/v	9.8 bc	2.0 b	17.0 b	7.5 bc
P-Value from Anova		0.0001	0.0002	0.0035	0.0001

GRAPE TOMATO VARIETY EVALUATIONS

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Introduction:

Sales of grape tomatoes have increased sharply since their introduction into the market in the 1990s. The quality of grape tomatoes sold in supermarkets however, now varies widely. In order to help New Jersey farmers take advantage of this market a superior flavored variety was identified and a brand name and logo developed (Jersey Jems TM). Grower cooperators have grown this select grape tomato variety and test marketed the brand through wholesale and retail channels and received good responses. Unfortunately, this variety may no longer be available from the seed company. In order find a suitable replacement, grape tomato variety field trials and taste evaluations were conducted.

Materials and methods:

Several grape tomatoes varieties were grown at the Snyder Research and Extension Farm, Pittstown NJ. The tomato plants were grown using typical commercial production methods and trellised using a stake and weave system on 8' stakes. Fruit was harvested ripe, washed and brought to several public locations/events for taste evaluations. Consumers were given samples of fruit coded so the variety name was hidden and asked to rated the fruit for sweetness, acidity, flavor, texture, overall on a 1-7 Likert scale (1=dislike very much 4 = neither liked nor dislike 7 = like very much).

Grape Tomato Variety Plant and Fruit Characteristics August 16, 2012

Variety	Plant Height	Avg Fruit wt (g)	Fruit Firmness[1]	External Color	pH[2]	Brix
Smarty	6'	13.6	3	4	4.60	6.4
Sugar Plum	6'	12.8	3	4.5	4.39	6.6
Cupid	5'	11.9	3	3.5	4.31	6.6
Sweet Olive	3'	11.6	3	3	4.34	6.1
Red Candy	6'	10.5	4	4.5	4.22	6.3
Sweet Zen	4'	10.6	4.5	3	4.25	4.5
Sweet Hearts	6'	8.7	3.5	4	4.25	5.1
Amai	5'	25.1	3.5	4	4.40	6.3
Sweet Elite	6'	28.2	2.5	3.5	4.21	6.5
Five Star Grape	6'	15.0	3.5	4	4.16	8.7
Montesino	6'	10.5	3	4	4.30	7.1
Seminis 9137	6'	8.6	4	3.5	4.30	6.0

[1]Firmness, external color, internal color: 1 = least/worst; 5 = most/best
[2]pH & Brix: homogenate of 20 fruit sample

Great Tomato Tasting Event, Snyder Research Farm, Pittstown, NJ
August 31, 2011

	Mean of Likert Rating				
Cultivar	**Sweetness**	**Acidity**	**Flavor**	**Texture**	**Overall**
Sweet Hearts	4.84	4.54	4.88	5.27	4.99
Smarty	5.01	4.25	4.84	5.06	4.96
Cupid	4.53	4.32	4.59	4.85	4.73
Amai	4.14	3.91	4.13	4.34	4.24
Montesino	4.92	4.66	4.80	4.93	4.88
Number of people surveyed = 185					

Denville Farmers Market, Denville, NJ
August 26, 2011

	Mean of Likert Rating				
Cultivar	**Sweetness**	**Acidity**	**Flavor**	**Texture**	**Overall**
Sugar Plum	4.56	4.48	4.85	5.26	4.96
Five Star Grape	4.69	4.43	4.81	5.12	4.91
Seminis 9137	3.42	3.52	3.70	4.17	3.86
Sweet Zen	2.78	3.13	2.89	3.54	3.19
Sweet Hearts	4.04	3.90	4.00	4.38	4.15
Smarty	4.48	4.02	4.40	4.42	4.56
Number of people surveyed = 105					

Great Tomato Tasting Event, Snyder Research Farm, Pittstown, NJ
August 31, 2011

	Mean of Likert Rating				
Cultivar	**Sweetness**	**Acidity**	**Flavor**	**Texture**	**Overall**
Montesino	4.81	4.09	5.12	5.18	5.20
Smarty	4.78	3.85	4.71	4.68	4.80
Seminis 9137	4.54	4.08	4.72	4.57	4.79
Cupid	4.14	4.15	4.40	4.70	4.43
Red Candy	3.96	3.81	3.95	4.36	4.23
Sweet Hearts	4.01	3.92	4.09	4.32	4.34
Number of people surveyed = 140					

Agricultural Labor

WORKER PROTECTION STANDARDS REVIEW AND COMPLIANCE

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The purpose of the Worker Protection Standard (WPS) is to reduce the risk of pesticide exposure to agricultural workers and pesticide handlers (persons who apply, mix or load pesticides) who work in farm, nursery, greenhouse and forest operations. This is accomplished by enforcing federal rules adopted into the state Pesticide Control Code and performing educational outreach regarding the WPS requirements for pesticide safety training, personal protective equipment, restricted entry intervals for pesticide treated fields, and other safety measures. Training workers and handlers, and the agricultural employers who hire them, is the foundation of the WPS program.

Trainer Information

Before training workers or handlers, a person must first be recognized as a trainer. To qualify for trainer recognition, you must meet one of the following criteria: be a licensed pesticide applicator; be currently qualified as a trainer in another jurisdiction recognized by New Jersey; or have completed an approved train-the-trainer program.

WPS Educational Pamphlets and Fact Sheets

Regulations require agricultural employers to distribute educational pamphlets titled “Protect Yourself from Pesticides” to their workers and handlers as part of new employee orientation and as part of the annual "refresher" training if the employee no longer has a copy. If the employee does not read English, the information must be supplied in their native language.

Regulations also require agricultural employers to keep pesticide Fact Sheets on file, and provide them to workers and handlers upon request. The following Fact Sheets (English version) are available for the chemical groups Acetanilides, Captan, Carbamates, Chlorothalonil, Dithiocarbamates, Organophosphates, Snythetic Pyrethroids and Triazines.

The educational pamphlets and the pesticide Fact Sheets can be downloaded from http://www.state.nj.us/dep/enforcement/pcp/pcp-wps.htm and kept on file for distribution:

Distributing the pamphlets to employees and keeping fact sheets on file is dependent upon the DEP making them available to agricultural employers. Currently, these materials are being distributed during inspections, at training sessions, and by calling the WPS Unit. Since these materials must be presented in a language employees can understand, they are also available in the following languages: Spanish, Chinese, Italian, Korean, Laotian, Vietnamese, Cambodian,

Haitian, and Tagalog. To request any or all of these, call the PCP at (609) 984-6920, and indicate the number of copies you wish to receive.

Inspections do occur regularly and employer compliance will be checked. When an inspector does a site visit, they will look for the following:

Worker Protection Standard Inspection Summary

WPS Requirements for Agricultural Workers

- Information at a central location (WPS safety poster, application records, location of emergency medical facility)
- Pesticide Safety Training for Workers
- Decontamination sites (water, soap, towels, etc)
- Emergency assistance (transportation and assistance)
- Restrictions during applications (do not allow workers in area)
- Special application restrictions in nurseries
- Special application restrictions in greenhouses
- Restrictions during restricted-entry intervals (and limitations on early entry)
- Notice about applications (oral warnings and treated area posting)

WPS Requirements for Pesticide Handlers

- Information at a central location (WPS safety poster, application records, location of emergency medical facility)
- Pesticide Safety Training for Handlers
- Decontamination Site (water, soap, towels, change of clothing, etc)
- Emergency Assistance (transportation and information)
- Restrictions during applications (do not allow pesticide to contact anyone directly or through drift)
- Monitoring handlers (if handling skull and crossbones pesticides anywhere or fumigants in greenhouses)
- Specific instructions for handlers (pesticide label information and how to use application equipment)
- Equipment safety (inspection and maintenance of application equipment)
- Personal protective equipment (provide, clean, maintain PPE, and prevent heat illness)
- Exceptions to personal protective equipment (closed systems, enclosed cabs, and open and enclosed cockpits)

WPS Requirements for Commercial Handlers

- Handler employees of your commercial pesticide handling establishment are given all the protections required by the Worker Protection Standard (WPS) (includes all the items listed above for Handlers)

Resources Used for this article:

- Rutgers NJAES Farm Safety Website http://njaes.rutgers.edu/farmsafety/WPS/wpsinspectchecklist.pdf
- NJ DEP Worker Protection Website http://www.state.nj.us/dep/enforcement/pcp/pcp-wps.htm
- National Agriculture Center: How To Comply With the Worker Protection Standard for Agricultural Pesticides: What Employers Need To Know http://www.epa.gov/agriculture/htc.html

KEEPING YOUR AG LABORERS SAFE & HEALTHY

Ray Samulis, Burlington County Agricultural Agent, 2 Academy Drive, Westampton, NJ 08060

Farm workers have been a critical component of New Jersey farms for hundreds of years. The climate, soil type, and proximity to bodies of water all make New Jersey ideal for horticultural crops of all types. As we all know, nursery crops require the largest amount of hand labor and workers.

In agriculture we often have to deal with public perceptions of our farms that may or may not reflect reality. Farm labor is one of those areas. The public while having a generally good opinion of farmer unfortunately sometimes view farmers as tough employers who care little about the health and welfare of their workers. As farmers we know this is not true. Most farmers understand that unhappy or dissatisfied workers are not in the best interest of running a successful farm. There are many farm operations that treat workers like family members baking them cakes for their birthday, and take them shopping and to the doctors. There are many areas of worker safety we could address, but U will choose the most important areas that pertain to the type of farms we have in New Jersey. Silo gas poisonings are significant throughout the United States but of much lesser concern in New Jersey due to the very limited number of dairy farms.

According to many reports and statistics, more than 85-95% of farm accidents are due to worker negligence. Accidents occur in many cases due to workers taking “short cuts”. Workers often resist reporting accidents for fear of being “written up”. Reporting is however extremely important in order to evaluate the cause of the accidents and prevent repeat occurrences. If a farm has a good spirited team approach to its worker, a negative “write up” can turn into a positive situation. If the farms response is positive rather than punitive, workers can report incidents about themselves or other workers without fear of reprisal or punishment.

There are some general areas of concern with farm workers which seem to continue to pop-up. One of these is the use of the box cutter in the packing shed. Some people feel the name is not correct and it should be called the “finger cutter”. Proper training and especially keeping the non-cutter hand away from the knife are essential work habits to avoid trouble.

Safety glasses are also important to worker to be trained in. However, safety glasses are only good if the person uses them, I remember visiting a chicken processing plant in Arkansas. I asked the supervisor what they do to protect workers from the noise. He responded that they supply ear protection to each worker. There was only one problem with that since the worker did not use the ear protection and had them hanging on the wall.

Another area of farm worker accidents occur from improper lifting is a back injury. Injuries to workers back result from: 20% Arthritis, 10% Injury, 70% Disintegration of the vertebrae discus All workers should be trained in proper lifting techniques particularly how to lift while using the knees. Disks in your back are fluid filled and under pressure. They also contain spinal cord nerves. Improper lifting and the extreme conditions of agricultural work wear out discus, cause fluid leaks, and result in life long problems. My AgrAbility study of New Jersey farms shows that back injuries in conjunction with arthritis comprise the majority of New Jersey farm disabilities.

Growing vegetables, fruits, nursery stock all require outdoor work in extreme heat. Studies have shown the essential nature of regular consumption of large amounts of water to protect against heat stroke. New Jersey farmers do provide workers with adequate water but we again must ask ourselves “ Are the workers utilizing it?” The essential nature of drinking water must also be instilled into your crew leaders work directly with the workers.

The reality is that agriculture will likely remain a dangerous occupation. We don’t have to accept that and adequate worker training will eliminate a high percentage of the accidents if taken seriously.

UPDATE OF AGRICULTURAL LABOR ISSUES – A FARM BUREAU PERSPECTIVE

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Overview of Health Care Reform and its Impact on Agricultural Employers (as of October 2012)

This is an overview of the employer mandate contained in the Patient Protection and Affordable Care Act (PPACA), the health care reform law - and the applicability of the mandate to agricultural employers. This overview is based upon the language of the PPACA statute, and guidance documents issued by government agencies interpreting the law.

While government agencies have thus far provided several guidance documents, the guidance provides limited information about how several important requirements of the law, including the employer mandate to provide health care insurance coverage, will be implemented and interpreted. As a result, the information in this overview is subject to change based upon future guidance, interpretations and regulations. This analysis is based on what is known (and reasonably presumed) about the law as of October 2012.

In general, PPACA requires certain employers with more than 50 employees to provide health care insurance coverage for their full-time employees, or pay a penalty, beginning in 2014.

Determining whether the employer mandate applies to a specific agricultural employer is a complicated process that involves analyzing numerous technical definitions and multi-step tests. In addition, agricultural employers need to be mindful of the special consideration PPACA provides for seasonal workers, which make up a great deal of the agricultural workforce.

This overview focuses only on the PPACA mandate that employers provide health insurance coverage to their employees. The pages that follow explain:

1) Whether an employer is required to provide health insurance;
2) Which employees must be provided with health insurance;
3) What type of health insurance coverage must be provided;
4) When must the insurance coverage be provided;
5) What penalties employers face for not providing coverage; and
6) Which employers do not have to provide coverage

I. HOW TO DETERMINE WHETHER AN EMPLOYER MUST PROVIDE HEALTH CARE INSURANCE COVERAGE IN 2014

The first step in determining whether an employer must provide health insurance to its employees in 2014 is to determine whether the employer is an "Applicable Large Employer." An Applicable Large Employer is the term PPACA uses to describe those employers that have an obligation to provide health care coverage to their full-time employees during that year.

A. Applicable Large Employers are those that employed an average of 50 or more full-time and "full-time equivalent" (includes some part-time) employees per month in the prior year.

1. A full-time (FT) employee is one that works on average at least 30 hours per week or at least 130 hours per calendar month.
2. Full-time equivalent (FTE) employees are determined by adding together all of the hours of part-time employees in a month (with a maximum of 120 hours per employee) and dividing the total by 120.

   Example: Employer Z has 27 full-time employees who each work 40 hours per week, and 30 part-time employees who each work 25 hours per week over 4 weeks.

- 30 part-time x 25 hours x 4 weeks = 3000 hours for the month
- 3000 hours / 120 hours in a month = 25 FTEs
- 27 FT employees + 25 FTE employees = 52 total FT and FTEs

3. In calculating FT and FTEs, "seasonal workers" are to be included pursuant to the number of hours they worked per week (part-time or full-time).

B. Repeat the calculation for each of the 12 months in the prior year (2013). Add up the total FT and FTEs for all 12 months and divide by 12 to get the average number of FT and FTEs per month over the prior year. If that average number is 50 or larger, the employer is an Applicable Large Employer that must provide health care coverage to its full-time employees in the next year (2014).

C. But, there is an exception for the employment of "seasonal workers," as that term is defined in PPACA. If the employer exceeds 50 or more monthly FT and FTEs during a 120 day period (4 months) or less, then any employee who performed seasonal labor for no more than those 120 days is not counted toward the total number of employees in those months. If the employer has any seasonal employee on the payroll after 120 days, and in that month also has more than 50 employees, the seasonal worker exemption is not applicable.

Example: Employer Z has 40 full-time employees from January - December, and 80 full-time seasonal employees October - December.

- 40 full-time employees x 9 months (Jan - Sept) = 360
- 120 full time employees x 3 months (Oct - Dec) = 360
- (360 + 360 = 720) / 12 = 60 employees on average per month

Although the employer "averaged" 60 employees per month, the employer actually only exceeded 50 employees for the 3 months (Oct. - Dec.) that he employed seasonal workers. Thus, the seasonal workers are not counted and Employer Z is not an Applicable Large Employer.

II. HOW TO DETERMINE WHICH EMPLOYEES MUST BE PROVIDED HEALTH CARE INSURANCE COVERAGE IN 2014

Only an Applicable Large Employer's full-time employees must be provided coverage. So, the second step in determining whether an employer must provide health insurance to its employees in 2014 is to determine whether the employer has any full-time employees.

A. Full-time status means working on average at least 30 hours per week or at least 130 hours in a calendar month.

B. If an Applicable Large Employer knows or expects that an employee will be full-time in the present year (2014), then that employee must be provided health care insurance.

C. If, however, an Applicable Large Employer is not certain if the employee will be full-time in the current year (2014), the employer must look back at the hours worked by that employee over a certain measurement period in the prior year (2013).

The IRS permits an employer to use a "measurement period" of at least 3 months, but no more than 12 months, in the prior year when calculating full-time status.

The test for determining full-time status differs slightly depending on whether the employee is (1) a current employee or (2) a new hire, variable hour, or seasonal.

1. Test for Determining Full-time Status of Current Employees in 2014
   a. An employee who worked full-time during the entire measurement period (from 3 to 12 months) in 2013 is a full-time employee and must

be provided health insurance for at least the next 6 months going forward (called the "stability period").

b. If the employer uses a measurement period of more than 6 months, the future stability period must be at least the same duration.

c. Employers are permitted to also utilize an "administrative period" of up to 90 days, between the measurement period and the stability period, during which employers can determine who is eligible for coverage and employees can enroll in coverage.

d. Note that coverage must be provided to current employees as of Jan. 1, 2014, so the measurement period and administrative period must conclude in time for the employee to have coverage on Jan. 1, 2014.

2. Test for Determining Full-time Status of New Hires, Variable Hour and Seasonal Employees in 2014

a. New hires, variable hour, and seasonal employees are subject to the same test for full-time status, but with a minor modification. Because the employee did not work in the prior year, the measurement period begins when the employee begins employment. The measurement period can last from 3 to 12 months.

b. For newly hired employees, the combined amount of time for the measurement period plus the administrative period cannot extend beyond the last day of first month beginning on or after the one-year anniversary of the employee's start date (for a maximum of 13 months and a few weeks).

Example: Employee B is hired on Feb. 15, 2014, and the employer is unsure if the employee will work enough hours to be considered full-time. The measurement period (up to 12 months) plus the administrative period (up to 90 days) cannot extend past March 31, 2015.

D. An Applicable Large Employer that hires a new employee who is expected to immediately begin working full-time should be offered health insurance coverage within 3 calendar months of employment (90 day administrative period). This requirement does not apply if the employer reasonably expects that the new hire will not work full-time for the entirety of the measurement period (up to 12 months).

Example: Employee C is hired Jan. 1, 2014, to work 40 hours per week from January through March. From April through September, Employee C is expected to work 30 hours per week. From October through December, Employee C is expected to work 20 hours per week.

Whether Employee C is considered a full-time employee depends on the length of the measurement period.

- If the employer's measurement period is 9 months or less (ends before October), then Employee C is a full-time employee for purposes of PPACA and must be provided health care insurance coverage.

- But, if the measurement period is more than 9 months long (includes at least October), then Employee C is not full-time because of the reduced hours worked in October through December.

E. Note that when determining if an employee is full-time and must be provided health care insurance coverage, the definition of "seasonal worker" is critical. The

government agencies that administer PPACA have not (and may not) settle on a single definition of "seasonal worker" that will apply in all circumstances.

The IRS, however, has stated that an employer can, at least through 2014, utilize its own reasonable definition of "seasonal" and determine an employee's full-time status by looking at a 12-month measurement period. Examining employment over a 12-month period leads to the conclusion that seasonal workers are not full-time employees that must be provided health care insurance coverage because although they may work more than 30 hours per week, they are not employed continuously for a 12-month period.

For purposes of determining which employees must be offered insurance coverage, H-2A foreign agricultural workers should be treated like other seasonal workers in determining full-time status.

III. WHAT TYPE OF HEALTH INSURANCE COVERAGE MUST BE PROVIDED

An Applicable Large Employer must provide to its full-time employees health care insurance that is both "affordable" and that meets "minimum essential coverage" standards.

A. The government has not yet provided a definition of "minimum essential coverage," but it is assumed that it will be major medical coverage.

B. "Affordable" health care insurance coverage means:

1. The plan must cover at least 60 percent of the value of benefits provided; and
2. The employee's share of the premium cost does not exceed 9.5 percent of the employee's household income or 9.5 percent of the employee's W-2 income.

IV. WHEN MUST THE HEALTH INSURANCE COVERAGE BE PROVIDED

The requirement for Applicable Large Employers to begin providing coverage to their full-time employees begins Jan. 1, 2014.

Therefore, employers will have to review employee hours for all 12 months of 2013 to determine whether the employer is an Applicable Large Employer on Jan. 1, 2014 (Step 1 above).

If an employer is an Applicable Large Employer, then for each employee in 2014 who has been employed since 2013, the employer will have to review the hours worked by that employee during a measurement period of between 3 and 12 months in 2013 to determine whether that employee has full-time status in 2014. (Step 2 above)

If the employer intends to utilize a 90-day administrative period following the conclusion of a 12-month measurement period, the employer would need to start reviewing hours of employees for the measurement period of October 2012 - September 2013. This would enable the employer to establish a 90-day administrative period from October 2013 - December 2013, and then begin providing health care insurance coverage on Jan. 1, 2014.

Applicable Large Employers that hire new employees who are expected to work full-time for at least the length of the employer's measurement period must be provided coverage within 3 calendar months of their start date. If the employer reasonably expects that the new hire will not work full-time for the entirety of the measurement period, then health care insurance coverage does not have to be provided.

V. WHAT IS THE PENALTY FOR NON-COMPLIANCE

If an Applicable Large Employer (1) does not provide health insurance coverage or provides coverage that does not meet the minimum essential coverage requirements, or (2) provides health insurance coverage that is not affordable; and (3) at least one of the employer's full-time employees receives a tax credit or subsidy through a State Exchange, then the employer is subject to penalties levied by the IRS.

A. Failure to provide insurance or minimum essential coverage

If the employer does not provide health care insurance or does not provide insurance that meets the "minimum essential coverage" standard, and at least one of the employer's full-

time employees receives a tax credit or subsidy through the State Exchange, then the employer is subject to a penalty of:

- $2,000 for each of employer's full-time employees. But, in calculating the penalty, the first 30 full-time employees are not counted.

Example: Employer has 50 full-time employees and does not offer minimum essential coverage. Just one full-time employee obtains a subsidy through the State Exchange.

Penalty: $2,000 x 20 full-time employees (50 - 30) = $40,000

B. Failure to provide affordable coverage

If the employer provides minimum essential health care insurance coverage, but (1) the insurance does not cover 60 percent of the value of the benefits, or (2) the cost of the premium exceeds 9.5 percent of the employee's household or W-2 income; and (3) the employee receives a tax credit or subsidy to purchase health insurance though the State Exchange, then the employer is subject to a penalty equal to the lesser of:

- $2,000 for each of the employer's full-time employees, but the first 30 full-time employees are not counted; or
- $3,000 for each of the employer's full-time employees that obtain a tax credit or subsidy through the Exchange

Example: Employer has 50 full-time employees and provides insurance that only covers 40 percent of the value of benefits. Ten of the full-time employees obtain a tax credit through the exchange.

Penalty is the lesser of:

$2,000 x 20 full-time employees (50 - 30) = $40,000 or

$3,000 x 10 full-time employees obtaining tax credit or subsidy = $30,000

So, the employer pays penalty of $30,000

VI. WHICH EMPLOYERS DO NOT HAVE TO COMPLY WITH THE MANDATE

Because of the complicated nature of determining whether an employer is subject to the mandate, it may be easier to first determine whether an employer falls into a category that would not subject it to the employer mandate to provide health care insurance coverage:

Employers not subject to the mandate (as of October 2012):

- Those that do not employ any full-time (30-hours per week) year-round workers.
- Those that do not have 50 or more employees in any month during the year.
- Those that have more than 50 employees a month, but only for 4 months (120 days) or less out of the year and employees number 50 and above perform seasonal work.

Employers that are Applicable Large Employers, but that employ 30 or fewer full-time workers are required to comply with the employer mandate to provide full-time workers with health care insurance coverage. The penalty provisions, however, exempt the first 30 full-time workers from the penalty calculation. So, even though an employer with only 30 full-time employees may not be in compliance with the law, it would appear that the employer will not actually pay a penalty for failing to provide health care insurance that meets the minimum essential or affordable coverage requirements.

Employers that average close to 50 employees or more per month over the course of a year, especially employers with any full-time year-round workers, will need to closely monitor their labor usage to ensure that they do not inadvertently trigger the requirement to provide health care insurance coverage to full-time employees.

The information above was prepared for the American Farm Bureau Federation by Leon R. Sequeira, Seyfarth Shaw LLP, 975 F Street NW, Washington DC 20024. The information in this memo is for general education purposes only. The information is not intended to provide legal or tax advice and cannot substitute for the advice of your own legal and tax professionals.

Small Fruit

STRAWBERRY IPM LESSONS FROM MAINE

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Strawberries play host to many insects, some of which are pests. Managing insect pests efficiently and effectively requires an understanding of pest biology and behavior, so that controls can be used to their best advantage. Preventing pest infestations is a major part of any pest management program. Removing alternate pest hosts, including weeds in and around the planting is critical for preventing insect and disease problems. Proper row spacing and narrow row widths allow good air movement through the plants to reduce disease infection. Finally, encourage natural enemies of pests, such as predatory mites, lacewings and lady beetles, by using pesticides only when necessary, and avoid broad-spectrum compounds that are very toxic to natural enemies.

An (IPM) program uses regular monitoring or "scouting" of insect populations and/or damage in a field to determine if and when control is necessary. A relatively small sample of plants or insects in a field can provide good estimates of the total number of insects or the amount of damage present. In order to have an accurate sample, a scout should stop at ten or more locations in a field following an "X" or "Z" pattern, and examine a certain number of plants at each stop, looking for the presence of pests or the damage they cause. Once a pest or damage is found, the amount is compared to an action threshold to determine if control measures are necessary. An action threshold is the level at which the cost of the pest damage will soon exceed the cost of controlling it. If only a few pests are present, control may not be justified by the cost. Using an action threshold is a more efficient way of controlling pests than methods such as calendar sprays (e.g. every 5 to 7 days), or plant growth stage (pre-bloom, petal fall, etc.), because these do not take into account whether or not a pest is actually present.

Strawberry bud weevil or "clipper": Expect these insects to become active soon as temperatures rise and flower buds emerge. The clipper is a small weevil, which girdles strawberry flower buds, causing them to dry up and fall off the flower stalk. Scout for damage by counting the number of clipped buds in two feet of row length at five different locations in a field. If the average number of clipped buds per two-foot sample exceeds 1.2, or if live clippers are found, control measures are recommended. Damage is usually first noticed at the edges of the field. Border sprays may be effective in keeping this insect from becoming a problem in larger fields. Fields with a history of clipper problems will typically exceed threshold nearly every year. Insecticide options for clipper include Lorsban®, Brigade®, Sevin® and PyGanic®.

Tarnished plant bugs: Adults can be seen when strawberry flowers open, and will lay eggs into flower and leaf stems. Once the eggs start to hatch, nymphs (immature stage) can be found feeding in the flowers. The nymphs are small, active, yellow-green insects. It is important to scout for them regularly, as they can appear very quickly in warm weather. Tarnished plant bugs feed on the open strawberry flowers, causing the berries to have seedy ends. To scout for the nymphs shake 30 flower clusters (six clusters in five different locations) over a plate. If four or more of the clusters out of the 30 sampled have any nymphs, control measures should be

taken. Insecticide options for tarnished plant bug include Malathion, Brigade®, Danitol®, Thionex® and PyGanic®.

Cyclamen mites: Plants showing weak growth and yellow, pinkish or blackened, crinkled leaves may be infested with cyclamen mite. Cyclamen mites are very small, smaller than spider mites, and reside in the crown of the strawberry plant feeding on the developing leaves and flower buds. They are very hard to see, even with magnification. Infested plants have shrunken distorted leaves and flower stalks, and produce few, if any, marketable fruit. Miticides such as Thionex® or Kelthane®, Temprano® and Portal® can be effective, but must be applied in lots of water to be sure that the material is carried down into the crowns where these mites reside.

Two-spotted spider mites: Growers with plants under rowcovers should be on the alert for these as soon as growth starts in the spring. This is often where we first find mite problems. Spider mites will reproduce rapidly when warm weather arrives, so it is important to scout for them often. Spider mites feed on the undersides of strawberry leaves, rasping the plant tissue and sucking the sap. Infested leaves will develop yellow flecking and a bronzed appearance. The plants become weakened and stunted. Fields that have had excessive nitrogen fertilizer and/or rowcovers tend to be most susceptible to mite injury. To scout for mites, collect 60 leaves from various locations in the field, and examine the undersides for the presence of mites. Mites are very small - you may need a hand lens to see them. Chemical control options for two-spotted spider mites include Acramite, Savey®, Zeal®, Vendex®, Oberon®, Brigade®, Danitol®, Thionex® and JMS Stylet oil ® (oils will cause plant injury if used in combination with captan or within 14 days of an application of sulfur).

Root weevils: Symptoms of strawberry root weevil and/or black vine weevil larvae is often noticed among plants in the spring. Infested plants appear week and stunted, usually in circular patches in a field. Digging under the plants reveals small (1/4 -1/2") crescent-shaped, legless grubs. Grubs begin to pupate when the plants are in bloom, but this may occur earlier under warm conditions. A soil drench of Platinum® (thiamethoxam) insecticide during the spring and/or fall when the grubs are active can provide control. However, Platinum® has a 50 day pre-harvest interval, so it must be applied early in the spring. Platinum® may also be used as a pre-plant or planting treatment for root weevils. A spring application of nematodes may also provide control of the grubs (optimal timing is about mid-May). Two species of nematodes appear to offer the best control of root weevil grubs. Heterorhabditis bacteriophora (Hb) appears to be the best candidate for control of root weevils when the soil temperature is above 60 degrees ('J-3 Max Hb' from The Green Spot; 'GrubStake HB' from Integrated Biocontrol Systems; 'Larvanem' from Koppert Biologicals).

Nematodes are living organisms and can be killed if they are misapplied. Order nematodes ahead of time and be ready to apply them through a sprayer or irrigation soon after they arrive, refrigerating if delay is necessary. Do not apply nematodes using a sprayer with a piston pump. Use clean equipment, removing all screens finer than 50-mesh. Apply early in the morning or evening in a high volume of water to already moist soil, pre-irrigating if needed. Apply another ¼ inch of irrigation after application to wash them onto and into the soil. 250 million nematodes (if banded in the row) to 500 million per acre, at a cost of about $100 to $200 acre depending on volume and source. Ironically, nematodes probably work best in the worst weevil-infested fields. High populations of weevil larvae allow explosive growth in nematode

populations, while low populations of larvae may not permit efficient nematode reproduction. Strawberry plants can recover their vigor remarkably well if crown feeding has not occurred and diseases haven't taken over the roots.

Once the adult weevils become active in July bifenthrin (Brigade®) will provide some control if used at the highest labeled rates. The best timing for this spray is at night during the peak feeding activity of adults, before they start laying eggs, or about the time harvest ends.

White Grubs: Weak spring growth may be the result of white grubs feeding on the roots of newer plantings. These grubs are the larvae of beetles, most likely Asiatic Garden Beetle, European Chafer or Japanese Beetle. They differ from the larvae of black vine weevil and strawberry root weevil in that they have legs and a swollen anterior (rear end), and they tend to be larger. Their feeding weakens the plants but reducing the number of roots. The grubs can be found by pulling up weak plants and sifting through the soil that surrounded the roots. Controlling white grubs once they have become established in a field can be difficult. These tend to be more of a problem in new fields that have been planted following a grass rotation crop, because the adults prefer to lay their eggs in sod. Admire® and Platinum® insecticides are labeled for control of white grubs. They should be applied within two hours of irrigation or rainfall to be sure the product gets into the root zone. Nematode applications in the spring and/or fall may also be effective (see above)

Strawberry Sap Beetle: Sap beetles are small (2-3mm) and dark brown. They chew small holes in ripe strawberries and may introduce fruit rot organisms as they feed. Although the damage may be obvious, sap beetles can be difficult to find because of their habit of dropping to the ground when disturbed. Sanitation is an important part of managing sap beetles. They are highly attracted to fermenting and decaying fruit, so keeping strawberry fields free of over-ripe fruit through frequent harvests can keep them from becoming a problem. There is some evidence suggesting that early renovation of strawberry beds after harvest may reduce sap beetle populations the following year. Trapping beetles using baskets of over-ripe fruit (strawberries or pineapple chunks) placed between the edges of the field and wooded areas may also reduce infestations. Insecticide sprays including Brigade®, Danitol® and Assail® may be applied to control sap beetles, but because this occurs during the harvest period, the potential benefits must be weighed against the likely customer resistance to spraying.

Spotted Wing Drosophila (*Drosophila suzukii*): This is a new pest which may be a concern for late ripening strawberries, and will definitely impact day neutral strawberries. This small fruit fly lays its eggs on fruit as it ripens, resulting in fruit contaminated with small white larvae at harvest. Infested fruit quickly rots and has no shelf life. Drosophila can complete a generation in less than two weeks, with each female laying hundreds of eggs. Thus, millions of flies can be present soon after the introduction of just a few into a field. They can be very difficult to control, and frequently repeated insecticide sprays (2 to 3 times per week) have been needed to prevent infestations once the insect is established in a field. Spotted winged drosophila can successfully overwinter here, but may not build up to damaging levels until most June bearing strawberries are harvested. However, day-neutral strawberries will need to be protected.

CURRANT AND GOOSEBERRY PRODUCTION

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Introduction: *Ribes* is the genus name of currants, gooseberries, and crosses of the two. Currants and gooseberries were once grown extensively on a commercial basis in the US. At the beginning of the century, the largest collection of currants and gooseberries in the country was in Geneva, NY, and the state ranked number one in red currant production in the 1930's. There are over 150 species of gooseberries in the world, and hundreds of currants and selected and hybridized cultivars. One British nurseryman told me in 1999 that he refers to a variety publication from earlier this century that lists over 1,500 varieties of gooseberries alone, and some researchers report that about 4,000 have been reported over the years (possibly a number are duplicates). Many cultivars have been lost, or are very rare, and they are in danger of being lost as funding is cut for germplasm repositories.

Even though currants and gooseberries are in the same family, they appear quite different. The crosses may look like either parent, some like currants and others like gooseberries. The variety in shapes, colors, texture, and flavor make *Ribes* a good candidate for development in gourmet and specialty markets. Fresh fruit can decorate plates, salads, and desserts. Cooked or processed fruit makes delicious sauces, pastry, wine, vinegar, and preserves. The juices have great flavor and health benefits that make them appropriate for popularizing as common breakfast or snack drinks. A comprehensive cookbook is currently available for *Ribes,* and recipes can be found in old cookbooks, cooking magazines.

Description: **Gooseberries** grow on a bush approximately 3 to 6 feet tall and about 3 to 4 feet wide. Most gooseberries have spines or thorns at each of the leaf nodes. The spines may be single, double, or triple, and they may be large, (10 to 15 mm) to small (l to 5 mm). The habit of the plant may vary from low spreading to upright and tall. Berry color may vary from green to yellow/green, to yellow; or white, to pink, to red, to dark red or purple. The size of the berries varies from about 1.5 grams to more than 12 grams. The average is about 3 to 6 grams. The berries are usually borne in ones, twos, or threes, and hang under the branches. The taste ranges from very tart to very sweet. In the US, gooseberries ripen starting about mid-June and the latest are ripe about mid-August. The seasons may vary a week or more either way, depending on the weather and your location.

Gooseberries are generally classified as dessert berries, those that are used raw, and culinary, or “cookers” that are used primarily for processing or cooking. There are some that fall into both categories depending on the stage of ripeness when picked. Generally the dessert berries are larger and used when completely ripe. The culinary berries are generally smaller, very tart and used before they are fully ripe. Some growers use some of the dessert type berries while still unripe as cookers and as a means of thinning and using the crop. The remaining berries become larger and are used as they ripen.

Some of the cultivars used as dessert berries in North America are:
Achilles, Captivator, Early Sulphur, Hoenings Earliest, Invicta, Hinnomaki Red, Hinnomaki Yellow, and Whinham's Industry.

Some of the culinary cultivars are:
Careless (dual use), Oregon Champion, Poorman, and Red Jacket, (Pixwell less recommended).

There are many other cultivars available in varying supplies that could be used in plantings for berries for sale at farmer's markets or roadside markets.

Currants grow on a bush that is generally larger than a gooseberry bush with thicker wood. There are no thorns or spines, and bushes can be spreading or upright. There are two major different types of currants, black currants (R. *nigrum)* and red currants (R. *rubrum).* The red currants also include the pink, white, and yellow currants, which are color phases of the red.

Almost all **black currants** are processed into juice or other products such as syrup, jam, jelly, tea, yogurt, pie fillings, candy, nutraceuticals, and wine. There has been an increase in consumption of black currant flavored beverages, and fresh consumption is growing, although demand remains relatively low because berries have a strong pungent flavor. The flavor is great for those who are accustomed to it, either fresh, or for cooking.

Some available black currant cultivars that may be used: Ben Sarek, Ben Lomond, Ben Alder, Titania, (Ben Nevis, Consort....less recommended).

Red currants are used both fresh and processed. They grow in bunches similar to grapes called strigs and may have from 10 to 35 berries. Fruits are often made into juice which can be consumed as a beverage, or used for preserves or other products. Currant jelly is an ingredient in many recipes to produce a tart flavor or to glaze. Red currants are used in sauces for meats, poultry or fish as well as a dessert topping on ice cream, cake, puddings, and creams.

Some red currant cultivars that may be used:
Red Currants: Jonkeer Van Tets, Rovada, and Tatran.
White and Pink Currants: Primus, Blanka, White Imperial, Pink Champagne, and White Versailles.

There are **other hybrids** and species of *Ribes* that don't fit into the above classifications. One of these is Crandall. It is often grouped with black currants, but is actually another species, *R . odoratum,* and looks like a black currant, but has a milder flavor and is often eaten as fresh, raw fruit. It is quite large, and late for a black currant. Josta berries, and selections called ORUS are actually hybrids of gooseberry and black currant.

Deciding Whether to *Grow Ribes:* *Ribes* crops definitely have a place in a grower's diversification formula. Local consumption by gourmet enthusiasts, small scale processors, and ethnic markets should be one's first target. Know what your market is before planting. Remember that larger scale production is more risky. As an example, the production of red currants as of 2012 has grown so much that it is a challenge to sell them all during the season. However, CA storage could be considered as a way to extend season and increase prices.

One should be conscious of any regulations that restrict *Ribes* production in the local area. Consider proximity to white pines, and the information about white pine blister rust. Labor or proximity to a harvester is also a critical factor.

Considerations in Choosing a Variety: As with other crops, no ideal varieties of *Ribes* crops have been developed. Certain varieties are better suited to certain geographical locations, Fruit quality on a given variety might be excellent, while lack of disease resistance or poor plant growth habit could be a flaw. When you consider varieties for commercial production, consider the following factors: availability of plant material, ease of propagation, plant patents, local laws,

market audience final use of fruit, yield, ease of picking (length of strig), fruit color, size and quality, plant: thorns, growth habit/size, disease resistance.

Culture: Spacing - Planting rates for gooseberries and currants that are being used in pick-your-own operations should be about 3-4 feet in the row and in rows about 6-8 feet apart, depending on your training system and equipment. It is very important to know about the growth habit of your selected varieties and the space requirements of equipment, especially if you plan to mechanically harvest. Field spacing can be planned according to the defined parameters. For example, the black currant Ben Lomond would be planted a little closer in row, while Titania could be spaced wider, due to size differences of plants. Mechanically harvested plants are spaced closer in the row, at about 18", with alleys spaced wider so that equipment can pass. One grower in England advocates planting at 12" in-row spacing, insisting that a tight hedgerow is critical for success in mechanical harvesting. Twelve feet minimum are left between rows.

Mechanical harvesting is also possible for gooseberries (and red currants). Gooseberries that are planted for processing are planted closer in row, and are 'stripped' of berries while still fairly green (un-ripe) and hard. Gooseberries picked for fresh market are often planted about 3.5 feet in the row unless trained to vertical cordons. Fresh market berries are generally hand-picked.

Both red currants and gooseberries are most efficiently trained to cordons if they are to be used for fresh fruit production. Please contact my office for a detailed article on this training system.

Soil and Water - *Ribes* are best grown in good soil with at least 3-5% organic matter content and a pH of about 6.5, (however they can tolerate lower readings). High nitrogen should be avoided as this produces too much vegetative growth and may predispose plants to more mildew problems. A British rule of thumb is to add 50 kg per hectare each of N and K (actual) for crops producing 10 metric tons per hectare. (A 10 m t/ h crop will extract the following kg of actual nutrient per hectare: N 20, P 5, K 44, Ca 8, Mg 3, S 4.) *Ribes* need about 0.6-1 inch of water per week during the fruiting season. Drip irrigation and mulching with straw, chips, or plastic is beneficial.

Pruning and Training - The best fruit is borne on 2 and 3 year old wood, and wood should be pruned out after 4 years. Many training systems have been developed over the years, and continue to be developed. One alternative for black currant is to prune plants to the ground every other year, and to harvest alternate years. The crop is essentially grown as a "field crop" with as little as 15 hours of labor per year per acre. The Dutch have developed a mechanical pruning system that removes 1/3 of the bush per year on rotation. Systems will vary by use of fruit, harvest method, and other factors.

Pest Control - The lack of registered chemicals has been a problem from time to time for *Ribes* producers. (Check with your local extension office for the latest recommendations.)
1. Mildew tends to be the major disease problem, but trials are showing that it can be controlled by stylet oil. Gooseberry fruits are blemished and deformed by the disease. Shoot tips are deformed. The disease was once the limiting factor preventing success with European cultivars in North America.
2. Leaf spot has been a serious a problem on all *Ribes* crops. Leaf yellowing and premature defoliation weakens the plant and affects yield. Copper sprays and weed control help to control the disease.

3. White pine blister rust has been the cause of *Ribes* restrictions in the Northeast which are being reconsidered for modification. Immune cultivars are advisable especially near white pine stands. Gooseberry and red currant are resistant to the disease.
4. The British are controlling cane borers with pheromone mating disruption. They are sometimes a problem in the Northeast.
5. Aphids sometimes cause a red deformation on red currant leaves.
6. Reversion virus is common in black currant in Europe, but not found in the US. It can reduce the useful life of a black currant planting to as few as eight years. Quarantine has kept the disease out so far. The disease is spread by big bud mites.
7. Currant Cane Blight, a fungus disease that was a problem in the past (when ribes were previously cultivated in large acreage), has become a problem again. It is caused by *Botryosphaeria ribis*, and causes branches to yellow, wilt, and die.
8. Imported currant worm, is a green larva that can defoliate a plant in a matter of days. They are easily controlled with insecticide, but contol measures must be taken quickly, because they can defoliate a plant in a couple of days.
9. The effect of spotted winged drosophila and marmorated stink bug remain to be determined.
Recommendations for pest control can be found in the *Cornell Small Fruit Crop Pest Management Recommendations* or other local extension publications.

Harvest/Postharvest: As with all berries, harvest and post harvest care of fruit can extend the shelf life of fruit. Some varieties hang longer on the plant than others. Generally speaking, red and black currants will sweeten as they hang, and fresh eating quality improves. Most people have a tendency to pick these fruits on the green side. Gooseberries will ripen off the plant. They ripen slowly in cold storage. Gooseberries lose their distinct veination as they ripen and become overripe. They develop a stronger, mustier flavor, lose acid, and can become mealy. Gooseberries and red currants can be kept a number of months (up to seven) with palletized CA storage.

Hand Harvesting: At harvest, one should avoid pricking gooseberries on thorns, and leave the blossom and stem end of the berry intact. Avoid bruising fruit. Red currants are left on strips, and should be picked carefully to avoid smashing berries closest to the plant. Cultivars with long strigs, not heavily clustered are easier to hand pick. Black currants would follow the same generalizations as the red currants. Often harvest of black currants is best started as the first ripe berries in the top of the plant are beginning to fall off. In all *Ribes,* free moisture should be avoided, and berries should be shaded in the field and chilled as rapidly as possible. Fruit of all three types can be held at 36-40 F for two to three weeks. I have held fruit at 33F for as long as six weeks. CA storage methods are being developed for these fruits.

Machine Harvest: Proper adjustment of shakers is critical so that a thorough job of harvesting is done and the bushes are not badly beaten. Some machines are gentle enough to harvest gooseberry and black currant fruit suitable for fresh market. Red currants are more desirable intact on strigs for fresh market, and this is not possible with machine.

Useful Resource:

Currants, Gooseberries, And Jostaberries: A Guide For Growers, Marketers, And Researchers In North America by Danny L., Ph.D. Barney and Kim E. Hummer

A LOOK AT STRAWBERRY VARIETIES FOR MATTED ROW PRODUCTION

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Strawberry production in northern New England is limited by a relatively short growing season, severe winter conditions, and red stele root rot (*Phytophthora fragariae*). The market for strawberries is almost exclusively local and, because nearly all of the fruit is being sold fresh as either "pick-your-own" or at nearby farm markets, excellent fresh quality is essential. Demand for fresh fruit is strongest near concentrated population centers. However, suitable land for strawberry production is often very limited in such areas, requiring plantings to be high yielding in order to both meet demand and be profitable. There are presently no strawberry breeding programs in the northern New England region. Thus introductions from breeding programs in other regions must be tested in order to evaluate their adaptability and performance under northern New England growing conditions and cultural practices.

The trial was established at Highmoor Farm, part of the Maine Agricultural and Forestry Experiment Station, in Monmouth, Maine. Twenty-one strawberry cultivars were planted from dormant crowns on June 8, 2011 (Table 1). The site had a silt loam soil, previously planted to sweet corn. It was amended with 10-10-10 fertilizer at a rate of 500 lbs./acre prior to planting. The plots were established as narrow matted rows atop 8 inch high, 18 inch wide raised beds with a single drip irrigation line buried approximately 2 ½ inches deep in the beds. Crowns were planted 12 inches apart in rows four feet apart. Each plot was 18 feet long. Each cultivar was replicated four times in a randomized complete block design. Flowers were removed during the planting year, and runner plants were allowed to root to fill out the rows to a width of 0.5 m. Straw mulch was applied over the planting for winter protection on in the late fall of 2011. The mulch was raked off of the plants in late April of 2012. Calcium nitrate was applied over the plants at a rate of 85 lbs. /acre on approximately three weeks after mulch removal. The planting was sprayed three times with a combination of recommended fungicides and insecticides during the bloom period to control fruit rots, tarnished plant bug and strawberry bud weevil. Harvest began on in late June of 2012 and continued twice weekly through late July. Fruit was harvested from each plot, graded, counted and weighed.

Extended dry periods throughout the growing season of 2011 appeared to inhibit runner production and rooting, leading to a more space plant population than desired, but most varieties established fairly well with the exceptions of 'Cabot' and 'Valley Sunset' which showed poor survival and growth after planting. 'Valley Sunset' was eliminated from the trial, and 'Cabot' results are likely not reflective of the true potential of this variety. The cultivars 'Record', 'Cavendish', 'US1463', 'Mesabi', and 'K0412' produced the highest yields of marketable fruit in this trial (Table 1). 'Sable', 'Jewel', 'Daroyal', 'US1033' and 'Brunswick' also produced acceptable yields. 'Cabot', 'Clancy', 'Orleans', 'St. Laurent', 'Donna' and 'L'Amour' produced relatively low yields. 'Galletta', 'Record' and 'Cabot' produced the largest fruit in the trial, followed by 'Cabot', 'Darselect' and 'Wendy'. Others with good fruit size included 'Clancy', 'US1033', 'K0412' and 'Cavendish'. 'US1463' and 'Sable' had the smallest overall fruit size in the trial. Fruiting patterns showed a range of peak harvest dates, harvest durations, and reductions in fruit size among cultivars. Based on the first fruiting year of this trial, 'Cavendish', 'Mesabi', 'Sable', and 'Jewel' appear to be cultivars with high potential for northern New England, producing very good yields and having good fruit quality characteristics. 'Record' had very high yields and large fruit, but the light color, softness and flavor may lower its market potential. Other varieties with good overall performance this season included 'Brunswick' and 'Wendy'. Of the newest selections trialed, 'US1463', 'K0412', 'US1033', 'Galletta' and 'Daroyal' appear to be worthy of further trial in this region. The harvest patterns of the top yielding cultivars continue to indicate a need for both very early and late maturing cultivars that produce large fruit and higher yields in order to extend the harvest season.

Future breeding efforts for this region should also consider incorporation of resistance to the prevalent races of *Phytophthora fragariae*.

Table 1. University of Maine Strawberry Variety Trial: Narrow matted row, raised bed system, Highmoor Farm, Monmouth, Maine, 2012.

Variety	2012 kg/plot	Number of Fruit	Berry Wt. (g)	%Cull Wt.	Yield Rank	Comments
Brunswick	4.84	479	10.1	19	10	Early-midseason; firm, dark red fruit, fair flavor
Cabot	1.71	132	12.9	45	20	Late; large fruit, irregular, bright red, soft, high gray mold
Cavendish	8.02	710	11.3	20	2	Early-midseason; med-large, firm fruit, dark, white spot, nice flavor
Clancy	2.50	212	11.8	24	19	Late; large firm fruit, low yield
Daroyal	4.93	456	10.8	20	8	Early-midseason, good look, soft, mild flavor, uniform
Darselect	4.07	319	12.7	23	14	Midseason; large, attractive, firm, melon flavor, leaf scorch
Donna	3.55	364	9.7	23	16	Early-midseason; red-orange, firm, very sweet, uniform shape
Galletta	4.71	324	**14.5**	28	11	Early; large, firm fruit; attractive, tart
Jewel	5.69	582	9.8	27	7	Midseason, bright red, firm, good yield
L'Amour	3.89	336	10.6	26	15	Early; firm, dark, nice flavor, low vigor and yield
Mesabi	6.97	713	9.8	28	4	Early-midseason; dark, firm, acid, many small fruit; picks hard.
Mira	4.44	445	9.8	21	13	Mid-late; light red, firm, acid
Orleans	2.76	266	10.4	18	18	Late; orange-red, firm, faint flavor, variable size, shape
Record	**10.70**	739	**14.5**	20	1	Late; large, orange-red, uniform conic; sweet, musky, soft
Sable	5.97	652	9.1	21	6	Early; dark, soft, sweet, many small fruit late
St. Laurent	3.41	320	10.6	28	17	
Wendy	4.66	366	12.7	22	12	Early, large, bright red, attractive, good flavor; leaf spot
US1033	4.89	418	11.7	25	9	Early; large, attractive, nice flavor, leaf spot
US1463	7.73	873	8.85	18	3	
K0412	6.69	578	11.6	**15**	5	Early-midseason; large, good color, intense flavor, crunchy, long season
HSD 0.05[1]	5.80	506				

[1] Data within a column must differ by this much to be considered statistically different according to the Tukey's HSD test (95% confidence level). Plots 18' long x 1.5' wide raised bed matted rows, planted 2011.

CURRANT AND GOOSEBERRY PRODUCTION

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Various uncommon fruit producing trees, shrubs, and vines are being considered or tried by growers as alternatives over the more traditional fruit crops. Select retail and commercial nurseries offer a group of edible fruit varieties chosen for good flavor, showiness in the landscape, cold and disease resistance, and general ease of growing. Most folks are not aware that many of the less common fruits are also more nutritious than the popular fruits. Some of them are native to the US, and some have been imported.

General advantages to uncommon fruits are as follows:
a. No competition and higher prices paid to producers,
b. Publicity and notoriety that comes from the uniqueness of growing an “oddity”,
c. Possibilities for unique packaging and value-added opportunities.

Disadvantages to uncommon fruit include:
a. Most fruit specialists will have had limited experiences with the crop, and pest or cultivation practices recommendations may be hard to come by,
b. The public will be unfamiliar with the fruit, so special marketing strategies will be needed,
c. Storage and ripening recommendations may be hard to find.

In this article, I will summarize observations I have made in the Northeast for selected plants and incorporate comments from growers who have actually tried raising the plants on a trial commercial basis. I will review the benefits and challenges of the crops considering cultural practices, quality of product, and marketability/marketing options. My top choices include the following crops: persimmons, Cornelian cherries, elderberry, honeyberry, gooseberry, and possibly hardy kiwi. More information is commonly available on the internet, in nursery catalogs, and in Lee Reich’s book, *Uncommon Fruits for Every Garden*.

Trees

Persimmons (*Diospyoros virginiana*): American persimmon fruits are small to medium-sized, and must be ripened and eaten soft to remove astringency. They are much more fragrant and flavorful than the common ‘Fuyu’, and ‘Hachiya’ varieties grown on the west coast. Trees are medium-sized, slow growing, and free of pest problems. Trees are usually partially self fertile, but benefit from cross-pollination. The fruits lend themselves to packaging in quart baskets, and should have consumer education material about ripening. ‘Prok’ and ‘Szukis’ are two varieties recommended for fruit quality and plant hardiness in the Northeast.

Paw Paws (*Asimina triloba*): Trees are hard to transplant and seedlings benefit from shade. The very slow growing, large trees are slow to bear, but fruit is delectable with tropical fruit (*Annona*) flavor. There are many varieties that have different colored flesh; all are filled with large black seeds. Fruit needs to be soft to eat. They could be tray-packed or packed in baskets.

Mulberries (*Morus spp*) Fruits are like blackberries, but less acid flavored and fragile coming in red, black, or white colors. Be sure varieties you choose are cold tolerant. Selected trees have larger-sized fruit than those that come up wild. Trees are fast-growing. Fruit would best be shaken from the tree and collected on tarps. One disadvantage is that fruits ripen over a two to four week period, so harvest is labor

intensive. Berries would probably best be sold frozen, or already made into processed products due to their fragile nature, and damage sustained during harvest.
Medlar (*Mespilus germanica*) Small tree bears plum-sized fruit in 3-4 years. Fruits soften on the tree to become edible and have an apple sauce texture and flavor. Trees are heavy producers. Fruits vary in size, but the 'Breda Giant' variety has produced fruits up to 7 cm in diameter. This fruit has an interesting history as a common home garden fruit, and it appears often in old European paintings.
Cornelian Cherries (*Cornus mas*) The plant is a bush to small-sized tree. It is related to Dogwood, and the tree has a similar size. Large fruited varieties from Russia are now available. 'Red Star' and 'Sunrise' are recommended varieties. The fruits have a pear shape or are oval with high acid content. As fruits soften, they become sweeter and more palatable, but with less shelf life. If the climate is moist with rain or high humidity, leaves can become spotted or shrivel entirely with a fungus disease. When choosing varieties, select those which are disease resistant if at all possible. This is a fruit that can be packed in baskets, and has an untapped ethnic market. Plants are hardy to minus 34 C.
Mountain Ash (*Sorbus spp*) The plant is a 12-15 foot tree with yellow to red showy fruit. Fruit is often bitter and needs processing, but is commonly used for making jelly and liquor. 'Rabina' is recommended as producer of fresh fruit that can be eaten raw. This fruit grows at the tips of branches and would be a challenge to hand-harvest. Training and pruning of the tree would help with ease of harvest. The fruit will probably be best sold as processed products.
Shipova (Sorbus aucuparia X Pyrus sp) A hybrid of pear and mountain ash produces a small to medium-sized tree with delicately flavored fruit similar to a small pear. Fruits must be soft-ripe to eat. One advantage over common pear varieties would be the disease and cold resistance of the plants. The fruits are small, large plum-sized, and could be marketed in baskets

Shrubs
Aronia (*Aronia melanocarpa*) This shrub grows rapidly and suckers profusely. It produces the highest antioxidant fruit which is astringent and sour, but when processed has a great flavor which is also good blended. Commercially, the fruit would need to be machine harvested and would probably not be sold fresh. Plants are not commonly found in commercial quantities, and they are very high-priced considering how easy they are to propagate.
Elderberry (*Sambucus nigrum*) The flowers and fruits of this shrub are edible, useful in processed products, and very high in antioxidants. Both flowers and berries can be sold and used fresh. Elderberry is touted by some as the new natural cold remedy since it does not have the side effects that Echinaceae does. This use is expected to increase demand for this fruit which yields up to 10 or 12 tons of fruit per acre. The plants can be trained and pruned as a bush that has its branches cut out annually after they have fruited. The imported 'Samyl' and 'Samdyl' varieties have the most desirable growth habit and have full clusters of large-sized fruit.
Honeyberry (*Lonicera caerulea*) Related to the honeysuckle, this fruit is very soft and mild-flavored. The berries are very beautiful, and could have uses in culinary art. Berries could be packed in half-pint baskets and sold fresh. Even though they are soft, their shelf life can easily be a couple of weeks. Shrubs only grow to about two to three feet high and could be grown as a hedgerow.
Ribes (Ribes spp) Gooseberries and currants can be included in this group. Gooseberries are the easiest fruit to sell in this group since very few are produced. One can sell culinary or dessert varieties that are suited for cooking or eating fresh. Plants should be trained as vertical cordons to help avoid thorns interfering with pruning and

harvest. Thornless varieties are also available. 'Pixwell' is a variety that has been commonly sold in the US because it is disease resistant and easy to propagate. However, most gooseberry enthusiasts recommend choosing other varieties since the size and flavor of 'Pixwell' is so inferior. Mildew, leaf spot, and imported currant worm are the biggest challenges to growing gooseberries in the Northeast.
Of the red currants, 'Rovada" is the commonly available and superior red fruiting variety. 'Pink Champagne' is the common pink variety, which is among the sweetest red currants, and can be eaten out of hand. Its drawback is that the strigs are often not filled with fruit due to drop, and the incomplete strigs make picking tedious, and detract from the pack. Currant cane blight is a fungus disease that has been a problem of the past, and has appeared as a problem again in the Northeast for all red, pink, and white currants.
Finally, black currants have promise as a machine-harvested fruit. Also, a couple of varieties are being considered for fresh fruit production because of their large size and sweet flavor. White pine blister rust and mildew-immune varieties should be selected. The processed market for this fruit has much promise, and the crop is well worth considering.
Sea Buckthorn (*Hippophae rhamnoides*) Tall-growing shrubs with ferny leaves are showy for the garden. The orange berries are touted for health benefits and must be cooked for use except for in a few varieties. Hand labor is needed to harvest this fruit. Harvest is completed by cutting half of the twiggy branches on the bush, freezing the branches, and then shaking off the fruit. No effective machine harvesting techniques have been developed for this fruit, so its promise for commercial development in the US is limited.

Vines
Kiwi (*Actinidia spp*) The fruits of hardy kiwi are smooth-skinned with superb flavor. They taste sweeter and more fragrant than the commonly grown 'Hayward' variety from the west coast. Fruits come in a variety of shapes and colors. Vines must be trellised and kept in control, but not pruned too severely. Plants are slow to fruit, taking four to six years to produce fruit. Fruit is best packed in baskets.
Akebia (*Akebia spp*.) Two varieties are needed for pollination. Fruits are similar in shape to a starfish. The flesh is sweet but bland and without much flavor. The purple to pink color and shape of fruit make it a curiosity item for farmers' markets.

Ground Cover
Lingonberry (Vaccinium vitis-idaea) The plants need acid, organic soil like blueberry. They are sensitive to over-fertilization and like some shade. Plants can be a challenge to establish, and are susceptible to Phytophthera root rot Berries are smaller than cranberry, a challenge to harvest, but very much in demand fresh or frozen.
Alpine Strawberry (Fragaria vesca) A cousin of the wild strawberry. These fragrant fruits have plants that are started from seeds. They like organic, slightly acid soils. The fruit size is very small. Plants can be a challenge to find, and are very expensive. Fruits are small and a challenge to harvest.

Other uncommon fruits not reviewed here could also have potential for commercialization and are worth experimenting with. More emphasis is being put on specialty crops as alternatives, and funding is available at the state and national levels for their development. Labor, energy, and other costs of production and marketing will impact the feasibility of growing these crops and determine which ones will eventually be developed. Health benefits, special flavors and colors, and ethnic demand will help them to find potential markets.

Food Safety

Bad Bugs in the Packinghouse – Where to Look and How to Manage Them

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Packinghouse design, size and function vary in the fresh fruit and vegetable industry, but all operations must address equipment, personnel and product food safety processes. The focus in straight forward: Stop a contaminant from entering the packinghouse and control cross contamination. To address these areas you have to focus on six areas:(1) Know what you are looking for (2) How do the "Bad Guys" get into an operation (3) Where do the hide and survive (4) Measures to rid your operation of them, (5) How do you know your program was successful, and lastly (6) if the program is not successful, what should you do.

Knowing what to look for is not as straight forward as one might believe. Of course, you are focused on pathogenic bacteria such as Salmonella, E. coli O157:H7, EHEC and Listeria monocytogenes. But there are instances you do not monitor these specific pathogenic organisms but rather indicators that are not pathogenic such as Listeria species, Total Aerobic Plate (TPC), Generic E. coli, and/or Total Coliforms (TC) to understand if there is a potential risk. An ATP monitor is often used. These basically measure if there is anything that is still alive or respiring in the area you monitored. If cleaning is done properly ATP levels are low. When high it can be due to plant debris and/or a microbe. It does not differentiate between the two.

There are many avenues how the "Bad Guys" can enter a packinghouse. Most GAP programs address how not to transfer a potential field pathogen into a packing environment. Pathogens can enter a shed on product, packing materials, pallets, equipment and/or from personnel. You have to assume that "Bad Guys" can be present so every step should be taken to eliminate sources of potential contamination and ensure that procedures control cross contamination. Procedures in a packinghouse have to be focused on controlling cross contamination and having a sanitation process that eliminates the "Bad Guys", controls their spread and ensures that personnel understand that their actions may cause a contamination. Personnel practices to focus on can include, but are not limited, to pallet handling, moving mats around, having a good color coding process to identify what is for clean-up and to come in contact with product.

Unfortunately these organisms are extremely small and can exist in areas you may not be aware of. Just a few areas to focus on include, but are not limited to: cracks on the floor, areas where there is free standing water, under legs of tables, rollers used to move conveyor belts, contact surfaces, anywhere with wood, equipment that is difficult

to clean, tires on forklifts, worker shoes…and the list goes on. It almost seems like an impossible task. The key is to know the areas of potential contamination and use all means possible to keep food contact surfaces clean and stop employees from contaminating product.

I will not cover wash water handling systems due to time, but needless to say, if your water system is not working properly…your wash water system will cross contaminate product.

Measures to control unwanted microbes require trained personnel who understand how to clean properly. It is critical to have dedicated scrub brushes and other utensils for sanitation. This will help control cross contamination. Cleaning methods may vary, but consistency in your practices is essential. Records should be kept on sanitizer mixing and a measurement that the right concentration is being used. Also, many companies are now using a foam sanitizer so that you can "see" that the sanitizer did cover all surfaces and penetration into hard to clean places may be better. Anything wood is a concern and this includes bins, pallets, and tables. Companies that supply sanitizers are excellent sources of information.

One key question that you have to answer… "Is my sanitation program successful?" Process verification must be done. The simplest procedure is a visual check using a pre-operation inspection sheet. This will normally identify if debris was left anywhere. If this is noted you must react and clean again. Validation will become a term all of us will become overly familiar with. Validation will note if your procedure was to control microbes…did it? Only one way to do this…measurement.

Many use ATP testers since they give a numeric reading on how clean a surface is immediately. Critical levels can be supplied by the manufacture, but it is best to do trend analysis. If readings are 500 units time after time and then you note 10,000 you have to accept that something has changed and you should clean again. Some monitor non-pathogenic bacteria and this is recommended. Results from reliable methods normally take at least 10 hours, but will give you information that qualified people can react to and advise you how to proceed.

Lastly, if you are going to monitor something you have to be ready to react to your findings. How you will react must be agree to before you start any testing or monitoring program. Corrective action records can be in a table form. These tables list date of monitoring, who did the monitoring, where the issue was, what was the issue, why do you think it occurred, what will be done, when, by whom, and that is was taken care of.

Packinghouse control of "Bad Bugs" requires process management, training and management that will clearly communicate that there are no compromises. New methods for monitoring pathogens or indicators are evolving. Programs are not costly, but a mistake will be.

HUMAN AND PLANT PATHOGENS IN SURFACE IRRIGATION WATER

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Water is critical to the production of fruit and vegetable crops. In some years, supplemental water is required and growers often use water that is sourced from ponds, streams, rivers, and canals to irrigate their crops. This surface water is open to the environment and susceptible to plant and foodborne pathogen contamination. When contaminated surface water is used for irrigation, plant disease or human illness could result. A surface water pathogen survey was conducted in over thirty actively used surface water irrigation reservoirs in New York throughout the growing seasons of 2010 and 2011 (Figure 1). Survey results indicate that there is an exposure risk of crops to both human and plant pathogens through surface irrigation water. An ultraviolet (UV) processing unit developed for food safety applications could be a solution for contaminated surface irrigation water. The processing unit has shown promising results and is continuing to be evaluated for irrigation applications.

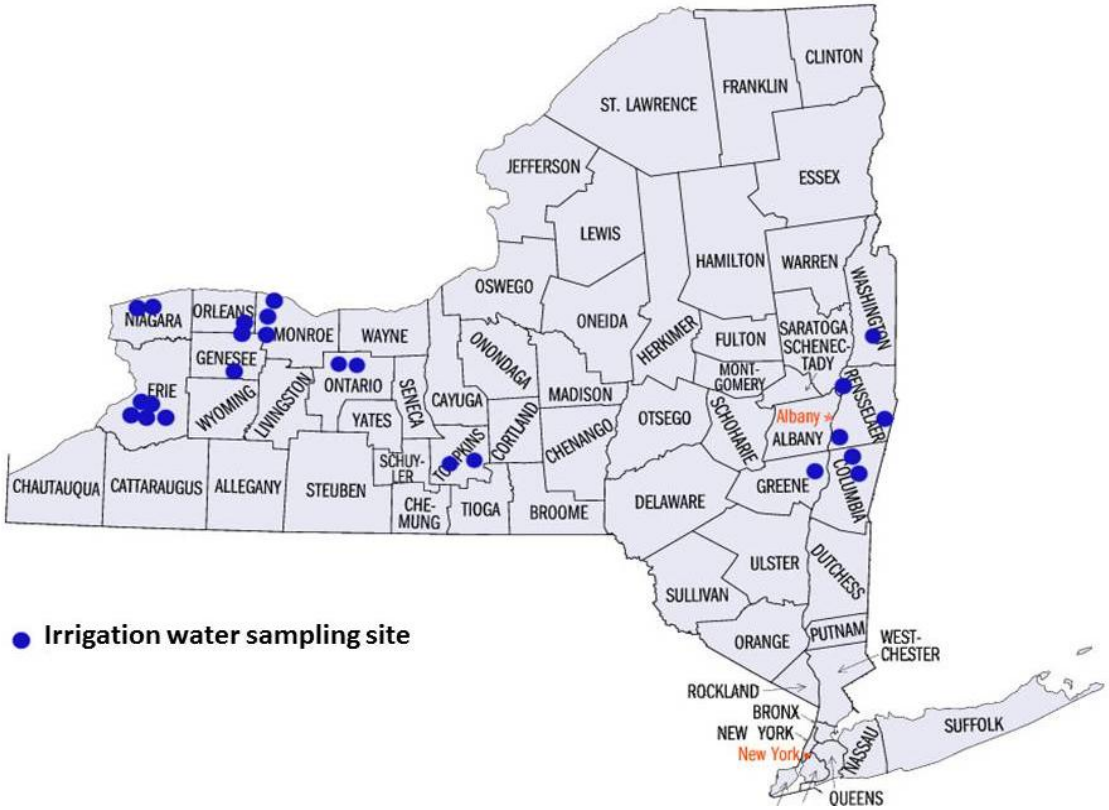

Figure 1

Many potential human and plant pathogens have been isolated from the irrigation water survey samples. Nonpathogenic *Escherichia coli* bacteria are only indicators of wildlife or other fecal contamination, their presence does not confirm that human pathogens are present. *E. coli* and *Salmonella* species were found frequently throughout the survey (Table 1).

Table 1: Percentage of survey samples testing positive for *E. coli* and *Salmonella* spp.

Organism	Total Samples	% positive
E. coli	166	30%
Salmonella spp.	165	38%

Over 1000 water-molds have been isolated and characterized from the survey. Twenty-eight species of water-molds have been identified (Table 2), many of these species of water-molds can be pathogenic to plants.

Table 2: Water-molds isolated from survey samples.

Phytophthora hydropathica	*Pythium helicoides*
Phytophthora irrigata	*Pythium litorale*
Phytophthora lacustris	*Pythium sterilum*
Phytophthora citricola	*Pythium vexans*
Phytophthora capsici	*Pythium marsipium*
Phytophthora cryptogea	*Pythium irregulare*
Phytophthora nicotianae	*Pythium oedochilum*
Phytophthora sansomeana	*Pythium catenulatum*
Phytophthora gallica	*Pythium mercuriale*
Phytophthora gonapodyides	*Pythium pyrilobum*
Phytophthora megasperma	*Pythium inflatum*
Phytophthora spp.	*Pythium undulatum*
	Pythium amasculinum
	Pythium diclinum
	Pythium myriotylum
	Pythium spp.

Water quality parameters, pH and turbidity, were recorded for each sample (Table 3). These parameters dictate which method of water treatment can be used effectively.

Table 3: pH and turbidity averages and ranges grouped by surface water source.

pH

Source	Average	Range
Canal	8.33	8.13 - 8.55
Creek	8.31	7.30 - 8.77
Pond	8.43	7.15 - 10.92

Turbidity (NTU)

Source	Average	Range
Canal	7.93	7.29 - 8.71
Creek	3.61	0.78 - 17.0
Pond	15.7	0.60 - 60.3

A commercial UV processing unit, originally developed for the treatment of unfiltered apple cider that may harbor pathogenic *E. coli*., was chosen as a potential decontamination method for surface water because it is capable of continually adjusting for varying solids content and turbidity. Also, this method is not affected by pH. Decontamination studies with spores of the plant pathogen *Phytophthora capsici* show promising results (Table 4.)

Table 4: UV Inactivation of spores in water.

UV Treatment Results

Spores L^{-1}	% Inactivation
10^3	100
10^4	100
10^5	99.995

The UV system will continue to be tested with multiple surface irrigation water sources and in the presence of multiple human and plant pathogens. This system could be implemented by growers to reduce the potential contamination of human and plant pathogens introduced by irrigation water.

Insect Hot Topics and Brown Marmorated Stink Bugs

REGIONAL PATTERNS IN CORN BORER AND FALL ARMYWORM POPULATIONS: IMPLICATIONS FOR MANAGEMENT

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Sweet corn is the most commonly grown vegetable crop in the Pennsylvania. Most is grown for fresh-market. Stringent control is required to meet market standards and most acreage (~80%) is sprayed to control corn earworm, fall armyworm, and European corn borer. Recent studies have shed new light on the regional patterns of two of these– the European corn borer and the fall armyworm. This talk will summarize those studies and discuss implications for management in the Mid-Atlantic.

Regional patterns of the European corn borer (ECB) have been dramatically influenced by the adoption of Bt-field corn. This is most evident from the Midwest. Long-term (~50 year) datasets, dating back to the 1960s, tracked statewide averages of densities of overwintering larvae from 3 states. Densities followed cyclic patterns, with peaks occurring about every 6 to 7 years. In the discipline of population dynamics, this type of pattern is called "inverse density dependent": which simply means that when densities are very low, the population typically grows fastest in the next year, and when populations reach historical peaks, they tend to crash the next year. These types of patterns are often seen in populations where pathogens, other natural enemies, or competition, strongly influence population growth rates.

In the mid-1990s, Bt-field corns were commercialized. All cultivars expressed proteins that were (and still are) very effective controls for ECB. What happened, over time, to the ECB populations? At the geographic scale of statewide averages, during the next ~ 10 years, the cycles dampened, the moving averages decreased, and population growth rates declines. The structure of the population changed. Bt-field corn is acting as a sink. ECB adults lay their eggs in either Bt-cultivars or non-Bt cultivars. The eggs laid in the Bt-cultivars are a dead end. This process, repeated for each ECB generation, and over multiple years, causes regional declines. Recent papers have shown the rate and degree of this decline, and how it can be directly modeled as a function of the adoption rate of Bt-field corn. Additional economic analyses estimated the dollar savings, and parsed out the amount associated with the Bt-acreage itself, and also to the surrounding non-Bt-acreage which gained a benefit without incurring the additional cost of the seed. These papers make a strong argument for retaining some non-Bt acreage for resistance management, noting that there is economic benefit accruing to this non-Bt acreage.

These studies use data from the Midwest, where the long-term time series of larval data are present. Is this decline in ECB happening in the Mid-Atlantic? I think so, but it is harder to say due to the absence of long-term data on larval infestation rates. Also, Midwestern ECB populations are less complex. The Midwest only has the ECB strain that responds to the 'Z'-sex pheromone, whereas the Mid-Atlantic has this 'Z' strain, but also an 'E' strain, and hybrids. However, I do think, at least in parts of Pennsylvania, we are witnessing regional declines in average ECB densities, and the chance of this happening is increasing as adoption of Bt-field corn increases.

What are the implications of regional patterns in ECB populations for management of sweet corn and other vegetables? First, these results suggest that you and your neighbors can influence the ECB population dynamics in your landscape by whether, when (what planting dates), and how much Bt-corn is in your landscape. The possibility now readily exists to include Bt-sweet corns from two seed companies. These results also call into question why declines might not be happening if Bt corns have been common, for multiple years, in your landscape. One possibility is that there are much more 'E'-strain moths, utilizing a higher proportion of plant hosts other than corn.

Another implication that we are seeing is greater adoption of biocontrol for managing pests in peppers. In Pennsylvania, ECB and aphids tend to be the primary pests in peppers. Declining ECB makes it easier to rely on biocontrol, using innundative release of egg parasitoids, coupled with conservation biocontrol of aphids. Although the recent invasion of brown marmorated stink bug can upset this, in the parts of Pennsylvania where this bug is less common, we are seeing increased use of biocontrol in peppers.

The second pest species where science is shedding new light on population patterns is the fall armyworm. This is a migratory species. It cannot overwinter in our area – populations successfully overwinter in southern Florida and southern Texas. A breakthrough in understanding population patterns has come from very detailed studies of the genome. USDA scientists discovered 4 haplotypes in one of the strains of fall armyworm (the corn-strain), and the ratio among the haplotypes can be used to map populations to either Florida or Texas. As the populations breed and move northward, annually re-invading the continent as far north as Canada, they carry these signals in their genome. So populations captured at any point in the continent carry a signature that can determine if they arose from populations that overwintered in Florida or Texas.

By collaborating with USDA, we determined that populations captured in central Pennsylvania, on the western edge of the Appalachians, had overwintered in Texas. Additional work is suggesting that most of the continental interior is annually re-populated from sources originating in southern Texas. The populations that migrate out of Florida tend to hug the coast, moving also somewhat into southern Alabama and Georgia. Studies are underway to determine the stability of these patterns, to connect them to air-flow patterns in the lower atmosphere, and to estimate how migratory species such as fall armyworm could be influenced by climate change.

One implication for management is to realize that if these patterns continue to hold, then coastal areas in the Mid-Atlantic can expect to have less pressure from fall armyworm than those closer to the continental interior. For example, in Pennsylvania, we see much lower fall armyworm populations towards the southeast and areas close to New Jersey, in comparison to consistently high populations to the west, near Lake Erie.

In summary, though analyses of long-term trends in population dynamics, and capitalizing on techniques from molecular biology and genetics, we are finally able to confidently describe area-wide, regional patterns of pests, including pests of sweet corn and other vegetables. The studies suggest that we can alter the regional population densities of ECB through adoption patterns of Bt-corn, and we can begin to understand migration patterns of fall armyworm.

EFFICACY OF NEW INSECTICIDES FOR CONTROLLING WORMS, APHIDS, AND STINK BUGS IN SWEET CORN, PEPPERS AND COLE CROPS

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Vegetables in the mid-Atlantic U.S. are attacked by a wide range of insect pests including lepidopteran larvae ("worms"), aphids, leaf-feeding beetles, thrips, and stink bugs. For conventional producers, insecticides continue to be the chief management tool by which damaging insect pests can be controlled immediately and economically. For conventional vegetable growers, synthetic pyrethroids have been a popular tool for the past 3 decades and today still represent "the best bang for your buck" for growers. Pyrethroids are registered on the most vegetables crops, kill the broadest spectrum of pests, and are generally the cheapest insecticides on the market as many have gone generic. The most commonly-used pyrethroids in the mid-Atlantic U.S. include: permethrin, bifenthrin, lambda-cyhalothrin, zeta-cypermethrin, cyfluthrin, beta-cyfluthrin (Baythroid XL), and esfenvalerate (Asana XL). However, repeated use of these insecticides has led to resistance problems in several key pests including Colorado potato beetle, diamondback moth, two-spotted spider mite, beet armyworm, green peach aphid, melon aphid, western flower thrips, cabbage looper, and corn earworm. Use of pyrethroids also destroys natural enemies, which can lead to resurgences of secondary pests. Thus, it is important that vegetable growers avoid complete reliance on these chemicals for pest management. Implementing IPM practices through pest scouting and minimizing the impact on natural control agents is clearly a more sound and sustainable approach. Today there are many IPM-friendly insecticides that provide effective control of their target pests on vegetables in the U.S. (Table 1). We have evaluated the efficacy of most these insecticides over the past decade in Virginia.

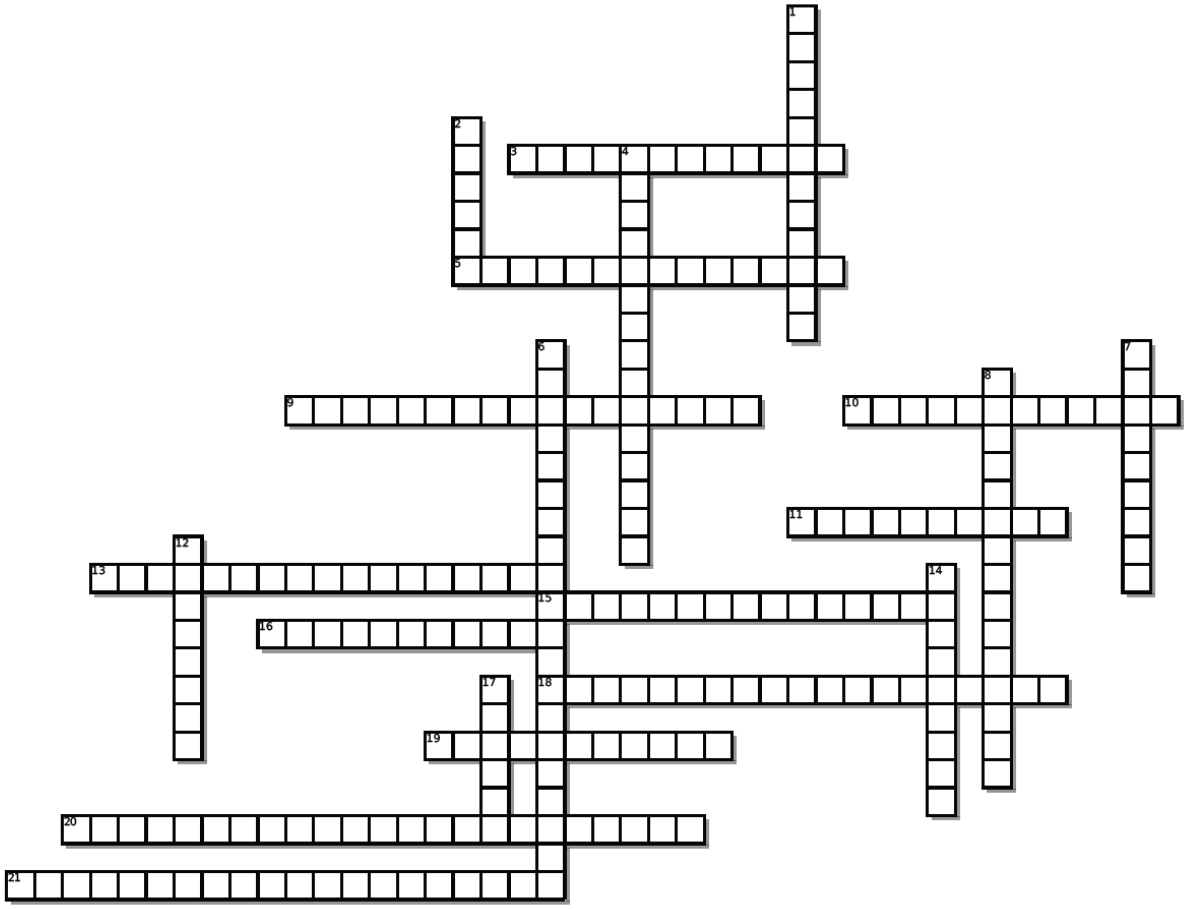
Table 1. Some IPM-friendly insecticide options for key pests of vegetables in the U.S.

Product (company)	Insecticide (AI)	Some of the major veg groups labeled						
		Brassicas	Beans	Cucurbits	Leafy veggies	Sweet corn	Tomato/ Pepper	Potato
Lepidopteran larvae (caterpillars)								
Aza-Direct (Gowan)	azadirachtins	x	x	x	x		x	x
Belt (Bayer)	flubendiamide		x	x	x	x	x	x
Blackhawk (Dow)	spinosad	x	x	x	x	x	x	x
***Bt* products (several)**	*Bacillus thuringiensis* sbsp. kurstaki, aizawai	x	x	x	x	x	x	x
Coragen (Dupont)	chlorantraniliprole	x	x	x	x	x	x	x
Durivo (Syngenta)	chlorantraniliprole + thiamethoxam	x		x	x	x	x	x
Intrepid (Dow)	methoxyfenozide	x	x	x	x	x	x	
Neemix (Certis)	azadirachtins	x	x	x	x		x	x
Proclaim (Syngenta)	emamectin benzoate	x			x		x	
Radiant (Dow)	spinetoram	x	x	x	x	x	x	x
Rimon (Chemtura)	novaluron	x	x	x	x		x	x
Synapse (Bayer)	flubendiamide	x						
Vetica (Nichino)	flubendiamide + buprofezin	x			x		x	
VoliamFlexi (Syngenta)	chlorantraniliprole + thiamethoxam	x		x	x		x	x

Product (company)	Insecticide (AI)	Some of the major veg groups labeled						
		Brassicas	Beans	Cucurbits	Leafy veggies	Sweet corn	Tomato/ Pepper	Potato
Aphids								
Beleaf (FMC)	flonicamid	x		x	x		x	x
Fulfill (Syngenta)	pymetrozine	x		x	x		x	x
Movento (Bayer)	spirotetrmat	x	x		x		x	x
Requiem (Agra-quest	Terpenes from extract of Chenopodium	x		x	x		x	x
Thrips								
Blackhawk (Dow)	spinosad	x	x	x	x	x	x	x
Radiant (Dow)	spinetoram	x	x	x	x	x	x	x
Spider mites								
Acramite (Chemtura)	bifenazate			x			x	
Oberon (Bayer)	spiromesifen	x		x	x	x	x	x
Portal (Nichino)	fenpyroximate			melons			x	
Zeal (Valent)	etoxazole			x			pepper	
Stink bugs								
Belay (Valent)	clothianidin	x		x	x		x	x
Scorpion (Gowan)	dinotefuran	x		x	x		x	x
Venom (Valent)	dinotefuran	x		x	x		x	x
Colorado potato beetles								
Aza-Direct (Gowan)	azadirachtins	x	x	x	x		x	x
Blackhawk (Dow)	spinosad	x	x	x	x	x	x	x
Coragen (Dupont)	chlorantraniliprole	x	x	x	x	x	x	x
Durivo (Syngenta)	chlorantraniliprole + thiamethoxam	x		x	x	x	x	x
Radiant (Dow)	spinetoram	x	x	x	x	x	x	x
Rimon (Chemtura)	novaluron	x	x	x	x		x	x

Insect Pests of Vegetables

By Tom Kuhar (Virginia Tech)



ACROSS

3 A sporadic green caterpillar pest that is typically found in mass feeding on pigweed, lambsquarters, and numerous vegetables including pepper, tomato, and cole crops.
5 Larval stage of a fly that attacks corn, bean and cucurbit seeds.
9 Lepidopteran larva that tunnels into potato stems, bean pods, as well as stalks, tassels and ears of corn. Bt corn has reduced numbers of this pest.
10 Colorful black orange and white stink bug that attacks cole crops.
11 aka cotton aphid
13 Phytophagous ladybeetle that defoliates green beans.
15 Small green caterpillars that feed on cole crops and that wriggle violently when touched. This pest has developed resistance to many insecticides worldwide.
16 Tiny Chrysomelids that cause small shot holes in leaves of eggplant, tomato, and cole crops.
18 Pest of broccoli that is the larval stage of a commonly-seen white butterfly.
19 Number one pest of sweetcorn in Virginia.
20 A relatively new invasive piercing sucking insect in the mid-Atlantic U.S. that has become a major pest of pepper, tomato, sweetcorn,eggplant, and okra as well as tree fruit.
21 Large striped Chrysomelid beetle that is the number one pest of potato in North America.

DOWN

1 A migratory sub-tropical lepidopteran pest that attacks corn, grasses, and various vegetables late in the summer.
2 Most important vectors of plant viruses in general.
4 Deposits a row of black eggs that project out from asparagus spears.
6 small acarine pest that can build up in huge numbers during hot, dry conditions, or following certain pesticide applications.
7 Nymphs are greenish gray >1/4" in size piercing sucking feeders on pumpkins and squash.
8 Large cream-colored moth larvae found in the base of stems of pumpkin or squash.
12 Subterranean larval stage of a click beetle that attacks roots and tubers.
14 Larval stage of scarab beetles that feeds on plant roots.
17 Insect vector of tomato spotted wilt virus

Blueberries

MANAGING SPOTTED WING DROSOPHILA IN HIGHBUSH BLUEBERRIES

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The new invasive insect pest Spotted wing Drosophila (*Drosophila suzukii*) was first detected in Michigan blueberry fields during fall 2010. Over the past few years we have observed earlier first detection (early July in 2011, late May in 2012) and increasing population size. In the first full growing season, SWD caused some damage to a few fields in Michigan (2011), but damage has been more widespread in the last year (2012) with reports of this pest across the United States and major fruit producing regions of the northern hemisphere. This pest is a significant challenge to blueberry production, and its management is a high priority as growers prepare for the coming season.

In this presentation, I will provide an update on research underway at Michigan State University that aims to provide growers with information on how to control SWD using available insecticide options. Although not highlighted in this proceedings article, I will also discuss non-chemical approaches including physical exclusion, trapping out, rapid picking, and fruit cooling as components of an integrated SWD management plan. Full details of MSU's information on SWD management can be found at our website – www.ipm.msu.edu/SWD.htm

Methods

Several sets of insecticide trials were conducted in a blueberry field at TNRC in Fennville, Michigan during the summer of 2012 to test for efficacy against SWD. Two-bush plots were sprayed with insecticides using a CO_2-powered backpack sprayer operating at 50 psi in a volume of water equivalent to 120 gallons per acre and equipped with a single head boom and a TeeJet 8003VS spray nozzle, or were left unsprayed. At different times after treatment shoots containing 10 leaves and 5 ripe berries were collected from the bushes and placed in water picks inside 32 oz cups. Ten adult SWD (5 males, 5 females) were added to the cups and left for 7 days at which point the fruit was collected and aged for an additional 2 days before being assessed for the presence of Drosophila larvae and pupae using a boil method for larval detection. Bushes were exposed to natural environmental conditions in most of the experiments except during rain events when the bushes were covered with tarps. We ran four trials in 2012, described below.

1. Standard Trial. Chemicals tested include Delegate 25WG (4.5 oz), Entrust SC (6 oz), Imidan 70WP (1.33 lb), Lannate 90SP (1 lb), Malathion 8F (2 pt), Mustang Max (4 oz), and Pyganic EC (64 oz). Bioassays were conducted at 1, 3, 5, 7, and 10 DAT.

2. Malathion Rate Trial. Chemicals tested include Malathion 8F (1.25, 2, and 2.5 pt), Assail 30SG (5.3 oz), Bifenture 10DF (16 oz), and Sevin XLR (2qt). Bioassays were conducted at 3, 5, and 7 DAT.

3. Assail, Bifenture Trial. Chemicals tested include Assail 30SG (5.3 oz), Bifenture 10DF (8 oz), Mustang Max (4 oz). Bioassays were conducted at 1, 3, and 7 DAT.

4. Rain Trial. Chemicals tested include Delegate 25WG (4 oz), Imidan 70WP (1.33 lb), Lannate 90SP (1 lb), Malathion 8F (2 pt), Mustang Max (4 oz), and Assail 30SG (5.3 oz), with half of the bushes exposed to a rain event (0.81 inches at 24 hours after chemical treatment) and half protected from the rain event with tarps. Bioassays were conducted at 3, 5, and 7 DAT.

The number of larvae and pupae per berry data were analyzed using a Kruskal-Wallis test. Percent control data were arcsine transformed before ANOVA followed by Fisher's LSD test for means separation.

Methods

Standard Trial. There were significant differences in the percent control among chemical treatments at all time periods (Fig. 1. 1 DAT: $P<0.001$, 3 DAT: $P<0.001$, 5 DAT: $P=0.003$, 7 DAT: $P=0.049$, 10 DAT: $P<0.001$). At 1 DAT all treatments were effective at preventing larvae and pupae in the fruit except for Pyganic which was significantly lower than the other treatments. At 3 DAT, Pyganic again provided poorer control and Malathion also showed signs of decreased control, although not significant. The same trends were evident at 5 DAT with the addition of a significant decrease in effectiveness of Delegate. At 7 DAT there was a large drop in the effectiveness of Malathion. By 10 DAT, several treatments showed decreasing control, but only the Malathion and Pyganic showed a significant lack of control.

Malathion Rate Trial. All treatments provided a high level of control at 3 DAT except for Sevin, which provided only 50% control (Fig. 2). The same trends were evident at 5 DAT, although Sevin increased to 95 % control, only to drop again at 7 DAT. All of the treatments showed a drop in percent control at 7 DAT, especially the 1.25 and 2 pint Malathion treatments. While there were no significant differences among treatments with regards to percent control, there were significant differences among treatments in the number of larvae and pupae per berry (3 DAT: $P=0.009$, 5 DAT: $P<0.02$, 7 DAT: $P=0.098$).

Assail, Bifenture Trial. All of the insecticides tested provided a high level of control at 1 and 3 DAT. At 7 DAT, there was a slight non-significant decrease in the percent control in the Assail and Bifenture treatments (Fig. 3). The Mustang Max treatment remained at 100 % control for all three time periods. There were significant differences in the number of larvae and pupae per berry between chemical treatments and the untreated control at all three time periods (1 DAT: $P=0.002$, 3 DAT: $P=0.005$, 7 DAT: $P=0.012$).

Rain Trial. Most of the insecticides tested provided a high level of control through the 7 DAT bioassays with only Malathion and Assail showing slight non-significant decreases in the percent control. Rain had a significant impact on the effectiveness of all the insecticides (Fig.4. 3 DAT: $P<0.001$, 5 DAT: $P<0.001$, 7 DAT: $P<0.001$), with Delegate, Malathion, and Assail showing the greatest decrease in control.

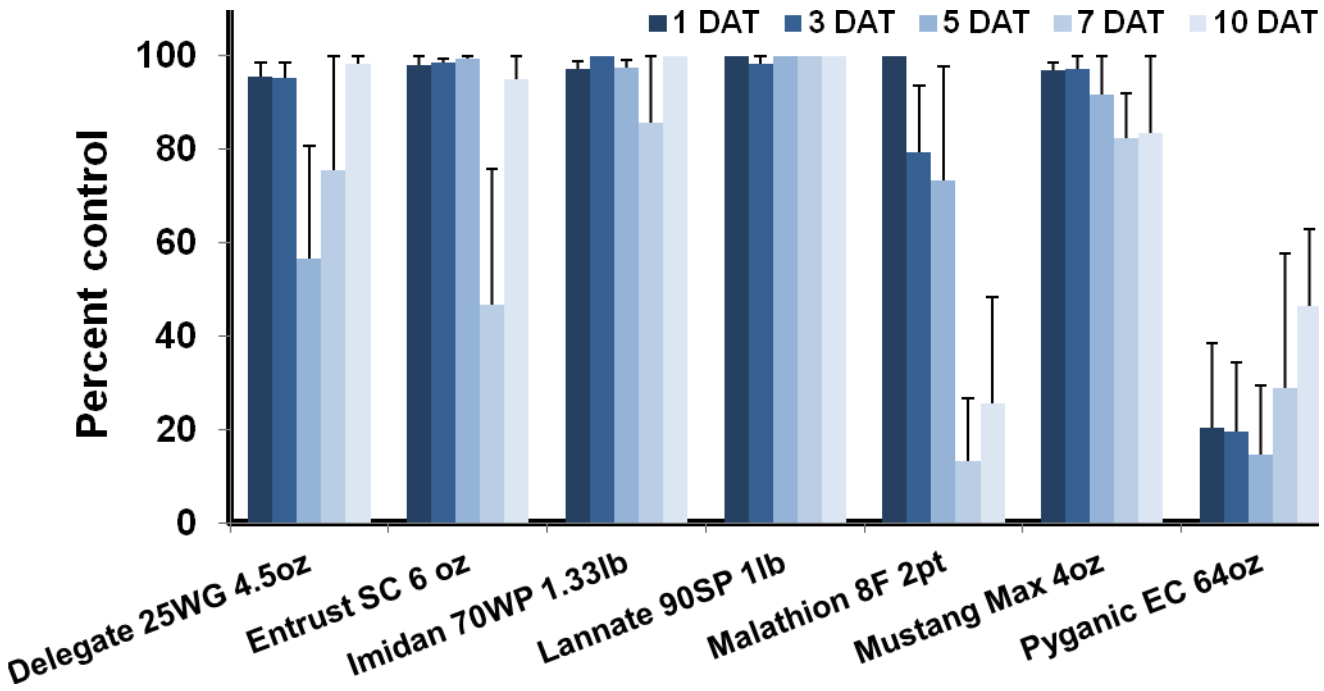


Figure 1. Average percent control of SWD larvae and pupae per berry. Adult flies were present with the berries for 7 days before larval assessment. Percentages are presented ± standard error.

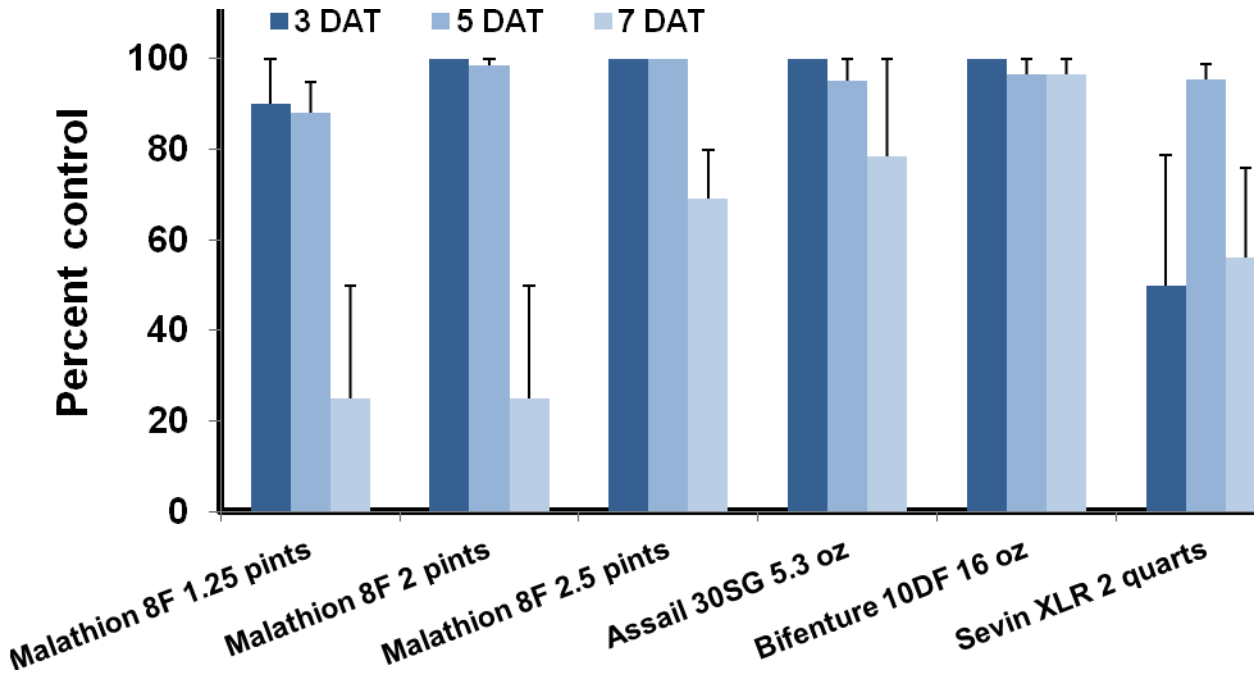


Figure 2. Average percent control of SWD larvae and pupae. Adult flies were present with the berries for 7 days before larval assessment. Percentages are presented ± standard error.

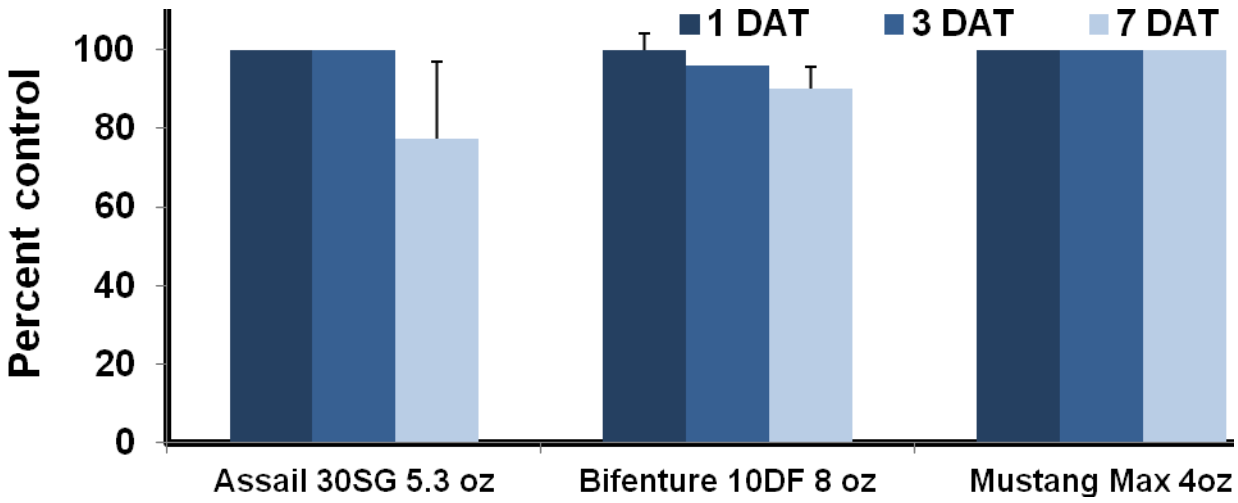
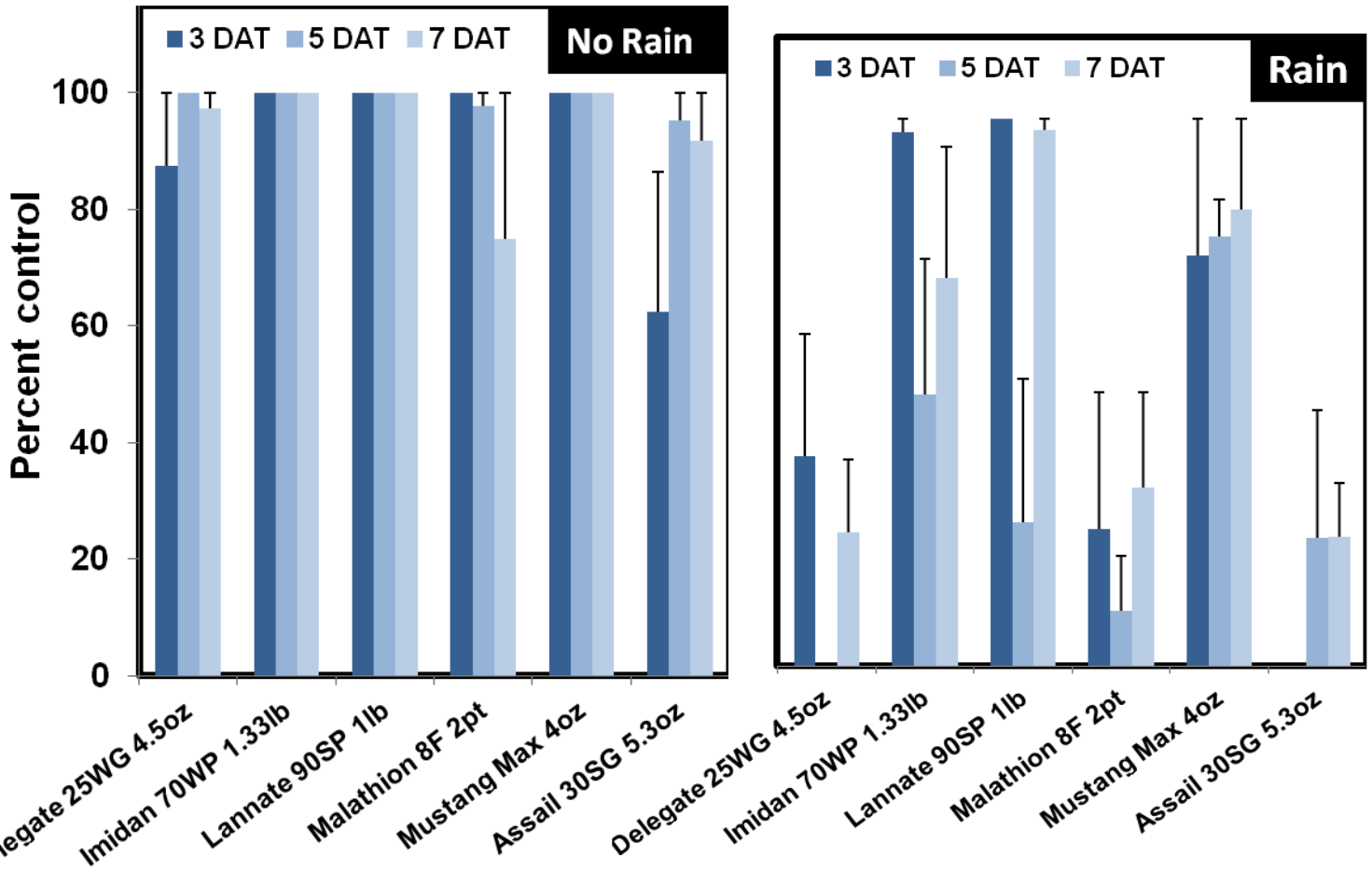


Figure 3. Average percent control of SWD larvae and pupae. Adult flies were present with the berries for 7 days before larval assessment. Percentages are presented ± standard error.



Our thanks to Agrochemical Companies, MBG Marketing, Project GREEEN, and the EPA for their financial support that made this research possible.

SPOTTED WING DROSOPHILA - AN UPDATE

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Introduction

Spotted wing drosophila (SWD, *Drosophila suzukii*) is a small but devastating pest of soft skinned fruits, including blueberries, that was first detected in the western US in 2008. It has since expanded its range throughout the eastern US. We first caught SWD in New Jersey blueberry fields in late June 2011. This recent range expansion puts our farms and communities at risk because of the potential loss of revenue from reduced fruit quality and lost sales. It is particularly important to develop monitoring and management tactics for SWD for blueberries in New Jersey.

SWD is a highly polyphagous fly that feeds on many economically-important crops including blueberries, caneberries, peaches, apricots, cherries, strawberries, grapes, pears, plums, apples, figs, and persimmons, in addition to other common wild and cultivated hosts. During the 2011 growing season, SWD infestations were reported in the eastern US, resulting in economic losses in raspberries, blackberries, and blueberries. Presence of the larvae in fruit prevents marketing as high value, fresh market products, and fruit are either down-graded or left to rot on the plants. It is essential for the survival of the New Jersey blueberry industry that management programs are developed and delivered to growers regarding how best to prevent infestation of fruit with SWD while also maintaining control of the current pest complex.

In 2012, we conducted studies to: a) test various insecticides against SWD; b) evaluate new monitoring tools; c) identify new attractants; c) evaluate cultural practices; d) identify habitats associated with SWD abundance in blueberry farms. Here I will report on our work on the efficacy of various insecticides against SWD.

Methods

The objective of this experiment was to compare the efficacy of Danitol 2.4EC, Delegate WG, Assail 30SG, Bifenture 10DF, Imidan 70WP, and two unregistered compounds (compound A and X), as well as two combined treatments of Assail with Bifenture against SWD in highbush blueberries var. 'Bluecrop' in New Jersey. The field was located at the P.E. Marucci Blueberry/Cranberry Center in Chatsworth, New Jersey. Each treatment was applied to a single bush and was replicated four times in a complete randomized block design. A two-bush buffer separated each treated bush. Applications were made with an R&D CO_2 backpack sprayer, using a 0.5 liter plastic bottle. The sprayer was calibrated to deliver 50 gal of vol per acre at 35 psi, using a single ConeJet TXVS 4 nozzle, yielding 156.4 ml (5.29 fl oz) per bush. Treatments were applied on 2 July 2012. A single cluster of ripe blueberries was taken from each

treated bush 24 h after treatment (3 July). The clusters were placed in assay containers. The assay container consisted of a 32 oz deli container with a hole cut in the bottom in which a florists' water pick fit tightly. A total of 10 adult SWD (5 females and 5 males) were removed from a lab colony and kept in rearing tubes in a 25°C Incubator for 2-3 hours before being released into the assay containers. SWD flies were 1-3 days old at the time of use to ensure sexual maturity. After SWD was added to the assay containers, the containers were placed on a light bench in the lab under a 14L:10D photoperiod, and were kept at 25-28°C during the 7 days of observation. Adult fly mortality data were collected 1, 3 and 7 days after exposure to the treated fruit. Larval data was collected by a salt water extraction method to get larvae to leave fruit and then counting larvae and/or pupal cases. Number of larvae per 100 berries was calculated from the number of larvae and the number of ripe/ripening fruit in the cluster. Data were analyzed using ANOVA and means separation by Tukey tests at $P = 0.05$. Percent data were arcsine square-root transformed. Count data were natural log (x+0.5) transformed prior to analysis.

Results

All insecticides increased SWD mortality and reduced larval infestation as compared with the untreated control (Table 1). Among them, Delegate, Imidan, Bifenture, Assail + Bifenture, Compound X (high rate) provided the best control (shown in bold, Table 1).

Table 1. Efficacy of various insecticides against spotted wing drosophila in blueberries

Treatment	Rate	% Mortality (Mean±SE)			Larvae/10 fruit
		d1	d3	d7	
Danitol	**16 floz/ac**	45.0	72.5	80.0	8.5
Danitol	**10.7 floz/ac**	22.5	80.0	85.0	8.2
Assail 30SG	**5.3 oz/ac**	50.0	67.5	72.5	13.3
Assail + Bifenture	**5.3 + 8 oz/ac**	**61.1**	82.5	86.7	**3.3**
Assail + Bifenture	**5.3 + 12 oz/ac**	**81.1**	**100.0**	**100.0**	**0.3**
Bifenture 10DF	**16 oz/ac**	**87.2**	**100.0**	**100.0**	**2.2**
Imidan 70WP	**1.33 lb/ac**	**97.5**	**100.0**	**100.0**	**0.2**
Compound A	**14 floz/ac**	22.5	50.0	50.0	13.1
Compound X + MSO	**20.5 floz/ac**	50.0	95.0	**97.5**	**1.0**
Compound X + MSO	**13.5 floz/ac**	40.6	71.4	85.0	4.3
Delegate	**5.2 oz/ac**	**82.5**	**97.5**	**100.0**	**1.6**
Control		5.0	42.5	45.0	27.2

OCCURRENCE AND MANAGEMENT OF ROOT AND CANE DISEASES IN 2012

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Root and stem diseases are increasing in the New Jersey production area. These diseases can take a serious toll on yields and it is essential for growers to diagnose the problem before implementing management strategies. Some of these diseases infect plants without causing obvious symptoms. Plants may be stunted or chlorotic (yellowing) and produce slightly less crop. The disease often progresses from a chronic state to an acute state (killing the plant) during periods of environmental stress. It is therefore important to properly diagnose diseases early and if possible take corrective actions. In this talk I will discuss diagnosis and current management schemes.

Stem blight is caused by the fungus *Botryosphaeria dothidea.* It is frequently isolated from dying Bluecrop and Duke crowns and canes. At the early stages of the disease development, symptoms are limited to individual canes. As the diseases progresses the fungus will penetrate the crown and kill young plants. Cane infections are typical in young plants (less than 3yr old) that became infected before crowns are developed. In well-established planting entire plants may be killed when infestations of termites colonize wood killed by the stem blight pathogen and then promote increased colonization of the crown. Recommendations for reducing the impact of this disease include intensive pruning methods that limit the amount of dead canes and stubble remaining on the plant.

Phytophthora Root Rot is caused by the plant pathogen *Phytophthora cinnamomi.* This disease has increased significantly over the past ten years. New plantings are especially vulnerable. It appears that the disease may be introduced through infected planting stock or contaminated irrigation water. In replant situations the pathogen may already be present, especially if the field was not left fallow. Tests show infection rates may exceed 50% of the plants in a field. Symptoms include stunting, and slight yellowing of the foliage during the growing season and early reddening of the foliage in the fall. The disease will cause significant crop loss and eventually kill the entire plant. Different fungicide options are available however, selecting clean planting stock, proper water management and maintaining optimal soil drainage are the first line of defense

Phomopsis Twig Blight is caused by the fungus *Phomopsis vaccini.* This disease is particularly severe on cultivars such as Berkeley and to a lesser extent Duke as well as newer cultivars such as Sierra. Symptoms begin to appear during early bloom and will continue to increase until shortly after fruit set. The disease can reduce a crop by over 70% if it is not controlled. However, it takes several years to reach these levels and excellent controls are available. Use of the proper fungicide during early bud break will provide excellent control.

Black Shadow is a superficial disease sometimes referred to as sooty mold. It is caused by a complex of at least four fungal species. It is very common on healthy

blueberry stems and normally does not cause a significant yield loss. The disease is transmitted to new wood in late fall and fungicide applications should target this timing if the disease has reached sufficiently high levels to cause a crop loss. Of all the cane diseases Black Shadow has only a minor impact on crop performance.

Crown Gall is a bacterial disease caused by *Agrobacterium tumefaciens*. This is a relatively rare disease on blueberry however, has been seen at high levels on a few local farms. Once a blueberry plant is infected it is very difficult to cure therefore the best approach for control is to prevent introduction. It is likely that most infections originate in the cutting beds. Although the bacterium is a good soil colonist it is reported to die off at low pH values, so survival in blueberry fields is unlikely. There are some formulations of root dip treatments effective at preventing infection from occurring however, once a plant begins to yellow and wilt it should be rogued from the field and destroyed.

Bacterial Wilt is a new disease to blueberry caused by an undetermined species of *Ralstonia.* This bacterial disease causes stem lesions and will induce rapid wilting of leaves on individual canes. First discovered in 2012, the disease causes rapid dieback of plants. It can be easily diagnosed by checking for a symptom known as bacterial streaming.

Nematode diseases are caused by two species of nematode in New Jersey, the stunt nematode and the stubby root nematode. Both species are capable of causing reduced establishment rates and yield loss. Infested fields should be left fallow or planted to nematode effective cover crops for at least one year before replanting. Sanitation practices of cutting beds and field nurseries are essential to prevent introduction of nematodes.

Rhizoctonia Root Rot is a relatively new and rare disease of blueberry in New Jersey. It is found in cutting beds where the roots are prevented from developing and causes a rapid spreading decline. The disease can be prevented by thoroughly cleaning propagation beds before planting the cuttings each season.

NATIVE BEES AND BLUEBERRY

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Native bees are important pollinators of many agricultural crops and often supplement the pollination services of domesticated honey bees. To assess the contributions of native bees to pollination in blueberry, we measured bee activity at 16 farms on three days during peak bloom in each of three years (2010-2012). Sites varied in quantity of agricultural land use around the farm at two scales: local (300 m from the focal field) and landscape (1500 m from the field). Local-scale agricultural cover varied from 37% to 98%, while landscape agricultural cover varied from 14% to 82%. We collected two kinds of data on native bee visitation: observational data and netted specimen data. These were collected such that they could be pooled as a measure of visitation rate, in addition to using the netted specimens to measure species richness. We also collected data on the per-visit effectiveness of seven of the most common groups of pollinators by offering virgin flowers to bees and measuring how much pollen was deposited in a single visit. We used these data to answer the following questions:

How much pollination service is provided by native wild bees?

Over three years, we found an average of 10% (range: 0 to 100% across farms and years) of visits to flowers were by native pollinators (primarily bees), while the remaining 90% (range: 0 to 100% across farms and years) were honey bees. The most effective pollinators were the bumblebees (*Bombus spp.*) and the southeastern blueberry bee (*Habropoda laboriosa*), which were about twice as effective as honey bees per visit (Figure 1). We also found that honey bees deposited as much pollen as bumblebees when they were collecting pollen. However, pollen collecting only accounted for 1% of observed honey bee visits; the majority were nectaring visits. Although they are less efficient, honey bees still perform the majority of pollen transfer at most farms.

How does the landscape affect wild bee abundance and diversity?

Overall, farms in less intensely farmed landscapes had more native bees than farms in more intensely farmed landscapes. We also found that bees of different body sizes responded to land use at different scales. Small bees (smaller than a honeybee) only responded to cover at the local scale. Large bees (honeybee sized and larger) responded to vegetation at both scales, but had a much stronger response to land use at the landscape scale; this probably reflects their capacity for greater flight distances.

We collected 44 species of native bees visiting blueberry flowers (Table 1); the most abundant single species was *Andrena bradleyi*, a *Vaccinium* specialist bee (19% of netted specimens). Species richness over three years was negatively correlated with agricultural cover. Further, preliminary results indicate that, with increasing biodiversity, there is an increase in stability in pollination provided by wild bees.

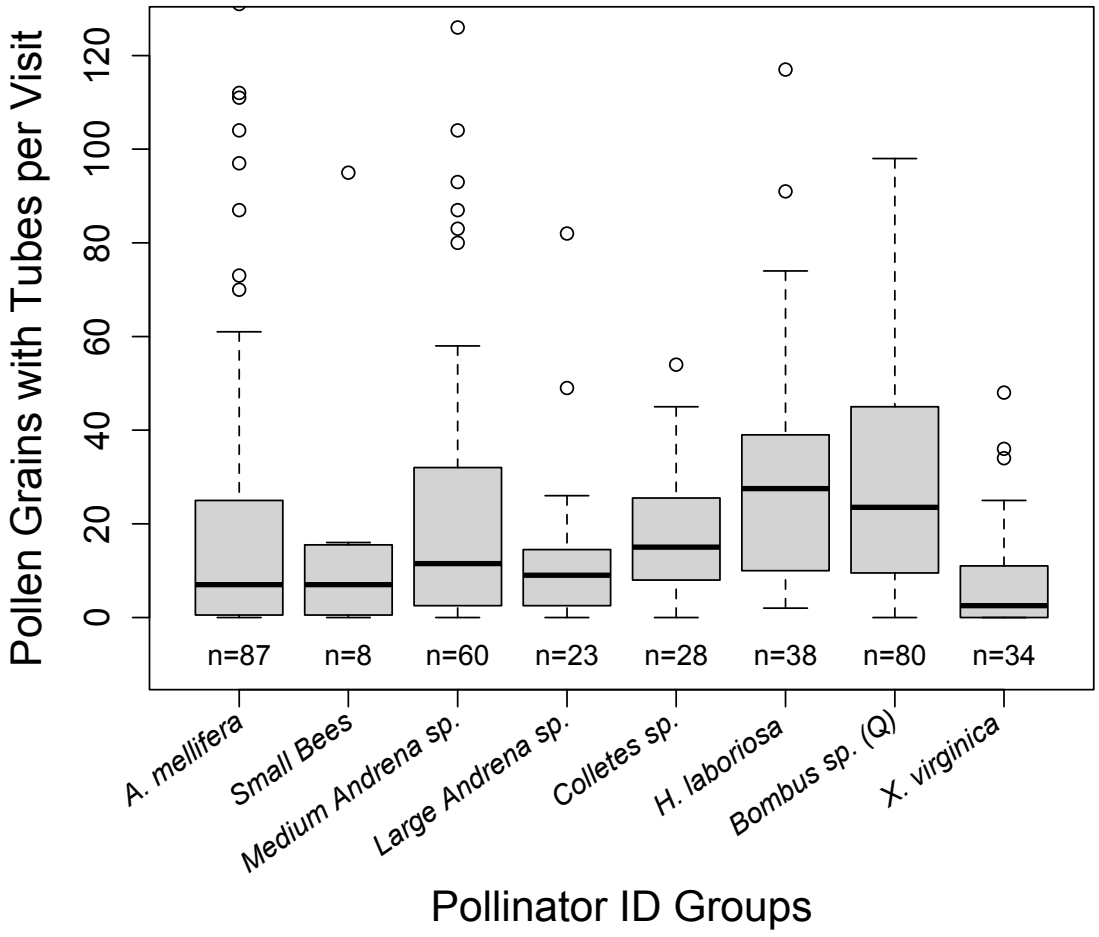

Figure 1: Pollen deposition (pollen grains with pollen tubes per stigma) by species ID group. Black bars represent median value, boxes are first and third quartiles and whiskers are 95% confidence intervals. Numbers below boxes are sample sizes. Species groups are arranged along x-axis in order of increasing intertegular distance from smallest to largest, with honey bees included at left for comparison. Y-axis is truncated at 125 for better readability.

ID Group	Species included	Total collected	Group information
Large Andrena	Andrena carlini, A. vicina	85	Small to medium sized bees in Family Andrenidae. Ground nesters. *A. bradleyi* specializes on Vaccinium flowers.
Medium Andrena	*Andrena banksi, A. barbara*, A. bradeyi, *A. carolina, A. cressonii, A. fenningeri, A. ilicis, A. imitatrix, A. mandibularis, A. morrisonella, A. screpteropsis*	218	
Bombus	Bombus bimaculatus, B. griseocollis, B. impatiens, B. perplexus, B. vagans	272	Bumblebees; Family Apidea. Nests in cavities or in the ground.
Colletes	Colletes validus, C. inaequalis, C. thoracicus	218	Ground-nesting bees that line their nests with a cellophane-like material. Family Colletidae.
Habropoda	Habropoda laboriosa	83	The Southeastern Blueberry bee; specializes on *Vaccinium* flowers. Nests under blueberry roots. Family Apidae.
Xylocopa	Xylocopa virginica	162	Carpenter bees; excavate nests in dead wood. Family Apidae.
Smalll bees	*Augochlora pura, Augochlorella aurata, Lasioglossum acuminatum*, *L. coeruleum*, *L. fuscipenne*, *L. leucocomum*, *L. oblongum*, *L. pilosum, L. versatum*, *L. weemsi*, *L. zephyrum*	41	Small, often metallic bees in the Family Halictidae (the "sweat bees". Augochlora and Augochlorella are recognizable for their bright green color; many Lasioglossum are gold or bronze.

Table 1: Groups of species corresponding to the single-visit groups in Figure 1. Some genera (*Nomada*, *Osmia*, and *Sphecodes*; 9 specimens of 6 species total) have been omitted; these three genera together accounted for <1% of total netted specimens.

Enterprising New Crops

SUNFLOWERS AND CUT-FLOWERS

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Flowers can be a great addition to your farm, provided that you become educated on cultural methods and special considerations such as site selection, weed pressure, labor, post-harvest issues and protection materials. Flowers tend to be more delicate than vegetables. We will discuss these special considerations and how you can successfully integrate growing flowers into your farm products.

I. Why Flowers?
- Make more $
- Make $ earlier in the season
- Diversify investments
- Attract customers
- Easy transition
- Attracting Customers
- Appealing display- both alive and harvested

II. Entering the World of Floriculture
- Species & Variety Selection Factors
    - Income potential (THIS INCLUDES MARKETING 1ST!)
    - Cultivation methods
    - Disease resistance- especially mildews
    - High production per sq. foot
    - Ease of harvest
    - Post-harvest life
    - Long production period
    - Direct seed vs. transplants
    - Clean, certified product

- Selecting Varieties
    - Cut-flower type
    - Relatively small head size
    - Customer preferences
    - Branching or single stem?
    - Your experience
    - Pollen-less

- Advantages of Pollenless Varieties
    - No shedding of pollen after consumer purchase
    - Does not “dirty” other flowers in an arrangement
    - Still produce nectar for bees and butterflies
    - Less allergenic?

    * But, more expensive.

- Species to Consider

    - Alliums
    - Anemone
    - Bachelor Button
    - Celosia
    - Gladiola
    - Larkspur
    - Lilies
    - Statice
    - Sunflowers
    - Yarrow
    - Zinnia

- Site Selection
    - Full sun
    - Avoid locations with early or late frosts
    - Access to irrigation
    - Mildews & weeds are predominant pest issues
    - Wildlife
    - Low wind
    - Labor: Plant Supports & Staking

- Remember: grown specifically for long stems and clean, unblemished appearance
    - Windbreak!
    - Types of supports may include:
    - Open wire / nylon mesh net
    - Steel fence posts / sturdy wooden stakes
    - Hand tied wire supports

- Crop Protection Materials
    - More expensive for ornamental crops
    - Smaller quantities
    - EPA registration process is costly
    - Not worth the effort by manufacturing co.
    - IR-4 for floriculture too
    - Toxicity to pollinators
    - Weeds and flowers often closely related

- Weed Control
    - Control weeds in the fall prior to spring planting
    - “Sterile/stale” seed bed
    - Pre-emergent herbicides
    - Get perennial weeds under control first

- Pest Control
    - NEVER grow flowers in the same greenhouse as vegetables - Thrips and aphids: virus transmission
    - Some pesticides and fungicides can be used on both, but formulations may be different (read the label… again)
    - Harvesting
    - Harvest early in the day- dew dry, still cool, or early evening
    - Use sharp, clean tools (harvest & handling)
    - Specific maturity levels for each crop
    - Remove old flowers and leaves from the plants routinely
    - Remove leaves from the crop!

- Handling

- Remove field heat immediately
- Walk-in cooler
- Cool grading, processing, packing area
- Clean and sterile
- Post-Harvest: Leaf Removal
- Goal is to prevent transpiration: evaporation of the water from inside the plant
- Transpiration will expend the flower's energy and cause it to die more quickly

- Post-Harvest: Water
  - Must be clean, including buckets
  - Low pH preferred 3.5-5.0
  - Only bulb crops in cold water
  - Most in tepid to warm water: 100ºF
  - Roses and Zinnias- water warm enough to wash your hands in
  - Low soluble salt content

- Post-Harvest: Flower Preservative
  - Food source (1.5-2% sucrose)
  - Lowers pH to 3.5-4.0
  - Reduces, prevents bacterial and fungal growth
  - Extends vase-life

III. Integrating with Veggies

- Bed Set-up
  - Plastic Mulch and Trickle-tape
  - 4-6" high beds
  - Rows 125' long max, 3.5' wide
  - P-Y-O use 3'x 25' beds with ground cover in the aisles
  - Mulch to reduce weeding and watering
  - Water-wheel transplanter works great

- Planting Styles and Procedure
  - Double rows with a cole seeder
  - Bare ground
  - Planting Styles and Procedure
  - 7' centers
  - direct seeded by hand into quadruple rows (4" apart)
  - raised beds, black plastic mulch, drip tape
  - Quadruple Rows

Summary

Growing flowers can give you an economic advantage. It is important, however, to balance complexity (the number of species and varieties) with your capabilities. There are some specific things that need to be learned first- post harvest, ethylene damage, staking, pest control. But many tools, techniques and marketing strategies are applicable to vegetables as well as floriculture. Important items to consider are good crop health in the field, harvesting should be cool, quick and clean. Remove leaves and use preservative.

"Flowers are like fish. They're freshest at harvest; it's all downhill from there."

NYGER AS A POTENTIAL CROP FOR NORTHEAST PRODUCERS

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Agricultural producers are constantly looking for new crops to increase revenue potential or to diversify their operations. Nyger *Guizotia abyssinica* is a relatively new crop for the northeastern United States. This oilseed crop is native to Ethiopia and has been imported into the United States for over 40 years. Nyger seed is marketed primarily to the birding industry and is sold mainly for use in backyard feeders. This seed is a favorite of goldfinches and is sought after by many bird enthusiasts. In 2008, more than 30,000 tons of Nyger seed was imported into the United States.

In 1982 dodder (Cuscuta sp.) was found in imported Nyger seed leading to the implementation of a sterilization procedure of all imported Nyger seed. Although the suggested treatments are effective for dodder control, they are not proven to be effective against other potentially invasive weeds. The suggested heat treatment may also decrease the palatability and shelf life of imported Nyger and may be less nutritious for birds.

EarlyBird Niger™ is marketed as a short-season variety that may be acceptable for production in northeastern growing conditions. Since 2011 Rutgers Cooperative Extension has been evaluating this variety as a potential new crop for New Jersey producers. In 2012, a consumer feeding study was initiated to assess feeding preferences by migratory birds. Participants were given imported nyger and EarlyBird Nyger™ and asked to monitor feeders and comment on bird feeding habits.

This presentation will present the findings of this feeding study and the results of a two-year agronomic production study. These findings demonstrate that EarlyBird Nyger™ may be a viable option for production in New Jersey and may be an economically viable crop for value-added production in the northeastern United States.

PRODUCING AND MARKETING ETHNIC HERBS AND GREENS

Jim Simon[1], Chung Park[1], Albert Ayeni[1], Robert Payne[1], Peter Nitzsche[2], Bill Sciarappa[2], Rick VanVranken[2], Stephen Komar[2], Ed Dager[3], Qingli Wu[1], Brian Schilling[4], Ramu Govindasamy[1,4], Kathleen M. Kelley[5]

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Ethnic consumers represent a growing market in New Jersey and the Eastern USA. For example, Asian and Latino consumers are identified as a substantial ethnic niche market opportunity, as a result of their prevalence and significant growth in the United States, and even more notable growth in the Northeast, as well as their substantial buying power. Asians are the fastest growing single race segment in the nation in terms of population growth (48%; Census 1990 to Census 2000), and their absolute growth in the Northeast is the largest of any other race category in the region (increase of 795,000 people; Census 1990 to Census 2000). Since ethnic Hispanics and Asians of U.S. combined populations had a purchasing power of almost 1.5 trillion in 2009, they represent a major market opportunity for the United States farmers, especially the Eastern region of the U.S. While the introduction and commercialization of new crops and botanicals is not new (Janick and Simon, 1990; 1993), earlier initiatives have been production driven rather than market driven.

In 2011, Rutgers, in concert with the University of Florida, Pennsylvania State University, and University of Massachusetts were awarded a USDA/SCRI initiative on Ethnic Greens and Herbs of relevance to the Asian Indian, Chinese, and Hispanic communities. In Year 1, we focused on surveying consumers from these ethnic populations and buyers to identify the leading Ethnic greens and herbs from Chinese, Asian Indian, Mexican and Puerto Rican communities. With the data collected, we then subjected the top plants and products to a selection matrix criterion to assess their potential as commercial crops grown in the Eastern USA (Govindasamy et al. 2007). Over the last two growing seasons, we have introduced the most promising ethnic greens and herbs to field trials in Florida, New Jersey and Massachusetts to develop baseline production, yield and economic cost data. This presentation reviews each of the ethnic greens and herbs tested in New Jersey, discuss problems identified (low seed germination, insect pests, and more) and provide an interim progress report on the adaptability of each plant. Impact to New Jersey farmers will be the availability of new crops for their viewing, learning and educational programs accompanying the field studies. In addition, we are conducting nutritional analyses on these ethnic greens and herbs with the hypothesis that if one provides fresh, affordable, healthy, high quality vegetables, greens and herbs to populations that demand and seek produce from their country of origin, we may be able to improve health and nutrition if access accompanies affordability and availability.

This trial was conducted in a randomized complete block design with 29 ethnic varieties replicated three times with the exception of a few entries, which exhibited poor germination, were evaluated in the field with unreplicated or two replications only. Nine, 150 ft. raised beds with black plastic mulch were made on a single plot that measured 215 x 108 ft. Trickle irrigation lines were placed down the middle of each raised bed under the plastic. Replications

measured 15 ft., with three foot spacing between each bed. Each product was evaluated for yield, appearance (visual freshness, cleanliness, aesthetic appeal, free from insect/disease and other damage) and subsampled for nutritional composition.

Among the promising crops were several traditional horticultural greens and herbs as well as others that are considered as weeds. These included: amaranth, Bok Choy, sugar pea, purslane, roselle (hibiscus for leaves), lambsquarter, Malabar spinach, papaloquelite and lemon balm. From all those field-grown, the most challenging ethnic greens and herbs were Fenugreek (*Trigonella foenumgraecum*), Epazote (*Chenopodium ambroisiodes*), Culantro (*Eryngium foetidium*) and *Solanum* spp. (nightshade consumed for its leaves) as they exhibited very low germination/poor seedling growth. Although results indicated that many of the ethnic crops can be grown in New Jersey, improved sources of the germplasm are needed, and that a wider number of lines and/or varieties should be tested. The 2013 field studies will focus on multiple harvests, and scheduling the sowing/transplanting under sequential time periods to extend the market window.

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PRODUCING AND SELLING PEPPADEW® PEPPERS

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Peppadew® is the tradename for a sweet and tangy pepper (Capsicum baccatum) that has a mild "heat" level. Peppadew® fruit was discovered 16 years ago in Tzaneen, South Africa on a tea plantation. The farmhouse was originally owned by a world traveled botanist and, as such, many exotic flora were found on the property. The Peppadew® bush was one of those unique plants.

Peppadew® Fresh Farms is located in the scenic town of Morganville, Monmouth County, New Jersey. The farm is licensed by Peppadew® International, South Africa and was established for the purpose of cultivation, demonstration and education of the U.S. consumer, chef and retailer on Peppadew® fruit; its unique story, novel flavor and widespread applications. Pierre Crawley is the managing director of Peppadew Fresh Farms and a Cornell University graduate with 30 years experience in the food distribution business, He has an exclusive arrangement to produce and harvest both the gold and red colored cultivars in North America.

Year 2012 was Crawley's first attempt at cultivating the gourmet crop on his refurbished farm, although earlier tests occurred in Florida. The field season for the gold color cultivar takes about 90 days. Due to a lengthy 160-day production period, Peppadew's red piquante peppers are grown in South Africa and imported to the United States. They have already found widespread success with European consumers and interest as rapidly increasing in the United States. Potential season extension or high tunnel production may be possible and tested in the Garden State.

The Peppadew Gold® seedlings currently are produced at a New Jersey greenhouse and planted at the end of May. The 120-day growing cycle product is ready to harvest by September on through October. This first year, all products were grown on site at Peppadew Fresh Farms, but some off-site production will be considered in future years as other local farmers involve themselves with Peppadew peppers. This new enterprise may empower local farming operations and businesses.

Research and development efforts by NJAES-RCE have helped form enterprise avenues and shape plans. The Rutgers Food Innovation Center was contacted to investigate processing and food science issues while Rutgers Cooperative Extension focuses on production problems as soil fertility, transplant operations, irrigation, pest management, deer control and

identification of insects, diseases and weeds. Standard American plasticulture procedures appear promising and fit this new crop well.

Interest in Peppadew Gold® has been high among retailers and restaurants in the Garden State. The mid-atlantic region is perfectly suited as the base of operations in North America, owing to the fact that central New Jersey is in close proximity to major markets of Boston, New York, Philadelphia and Baltimore-Washington, DC. Additionally, the region has a diverse population that is accepting of a wide range of flavor profiles, which works well for a relatively new product like Peppadew®.

Peppadew Fresh Farm received a $259,000 grant from the U.S. Department of Agriculture earlier this year. That is the largest amount USDA has ever given to a New Jersey venture. Additionally, the grant will allow other farmers in the state to grow the product and diversify their farms. It may also help create a number of jobs both locally and nationally, when investments in machinery and equipment are considered.

New Jersey Secretary of Agriculture Douglas Fisher (photos above) chatting with Pierre Crawley, managing director of Peppadew Fresh Farms, prior to a ceremony at Peppadew Fresh Farms, where the company was awarded a Value Added Capital Working Grant from the U.S. Department of Agriculture. The grant promotes a wider distribution of the new value added product and agri-business expansion by offering cooking classes and boosting agro-tourism.


To educate the public on the Culinary applications of Peppadew® fruit, Fresh Farms has chosen Chef Monica Cipully C.E.C.; focusing on new, exciting and tasteful menu applications for the Peppadew pepper. The newly designed Peppadew Fresh Cooking Studio was constructed to demonstrate the versatility of the Peppadew® fruit to the professional chef and consumer alike in using the peppers to make mustards, horseradish, seasonings and salsa.
For more information, visit www.peppadewfresh.com

Grape Production

SO YOU WANT TO START A VINEYARD?

Gary Pavlis, Agricultural Agent
Rutgers NJAES Cooperative Extension of Atlantic County

First, I've got to ask, how much money have you got? There is an old axiom in the wine business that states if you want to make a small fortune in the wine business start with a large fortune. Doesn't sound too promising does it? As a county agricultural agent with Rutgers Cooperative Extension I meet with 6-10 prospective vineyard/winery owners every month and the economics of the business is certainly one of the considerations that must be taken into account. I find that most of these people fall into two categories; farmers that are looking for something to grow that will actually make money and what I call the 9/11 people. Today's farmers must make a decision, grow a profitable crop or sell the land to the developers. The 9/11 people are from all walks of life and since that fateful day have realized that life is precious and working in a job that they hate is a waste of a life, better to grow grapes and make wine.

The first visit I have with prospective growers is usually over lunch. I figure I have to eat lunch anyway and since 2/3 of these people will never start a winery once they hear what is involved I'm not really wasting my time. I usually start the discussion on a positive note. New Jersey is 5th in wine production in the US and 5th in per capita consumption of wine in the US. So we make a lot and we drink a lot. Given this, it is interesting to note that only 1% of the wine we drink is made in New Jersey. That translates into a tremendous marketing potential for New Jersey wines if we can tap into the other 99% of sales, which we are slowly doing. In addition, even in this down economy, wine sales in the US have continued to increase and the number of wineries in New Jersey has steadily increased. Lastly, New Jersey has some of the best sites in the east for quality wine grape production. This is important because to make great wine you need great grapes. Sounds logical but you would be surprised how many people are only concerned with what the wine label will look like, or the tasting room decor. I had one guy who had already bought the cappuccino machine for the tasting room. He didn't really want to talk about the vineyard and what it takes to produce quality grapes. He's long gone now. That's because owning a vineyard and a winery is farming first. If you get all wrapped up in the romance of wine and having your name on the wine bottle, failure is just around the corner.

The next order of business is to talk vineyard establishment, i.e. how much, where, how, and what grapes. It will cost approximately $8,000 to $12,000 per acre to establish an acre of grapes. That includes the plants, the posts and wire, the irrigation, the land prep, etc. Then you'll need a good, narrow tractor, maybe $40,000 for a good one. You'll need a sprayer to control diseases, say $1,000 to $10,000 depending on size and type. And no, we can't grow wine grapes in the Mid-Atlantic States organically. This region gets too much rain during the summer and the fungal disease pressure is just too intense. Rutgers is conducting research to change this but so far it just can't be done. After all this, I usually lose many of the prospective growers. In the past, I would sugar coat all this but farming grapes is expensive and better to know the facts up front then to loose your shirt later. It has been said that one of the biggest reasons that wineries fail is that they didn't know what they were getting into financially and were under funded.

Now we need to talk site. Where are the grapes and the winery to be? Do you already own the land? Farmers of course already have the land. 9/11 folks usually don't but if they do they ALWAYS tell me how great their soil is. Soil is not the top priority for site selection. First of all, I want to know how cold it gets on their land in the winter. If it gets to -10 degrees

Fahrenheit routinely the grapes are going to die. It won't matter that the soil was great. In New Jersey it rarely gets below 0 in Cape May County but routinely gets there in Sussex County. If you want to grow Merlot in Sussex it is not possible. You'll have to grow Concord or the cold hardy varieties from the Minnesota grape breeding program which can withstand -35 degrees F. Matching the site with the grape variety has been the essence of fine wine for thousands of years.

From there we will cover trellis types, fertility, plant spacing, row covers, row orientation (always north/south), and site length of season. Cabernet sauvignon needs a growing season of 182 days, that's the time from the last frost in the spring to the first frost in the fall. Sussex County for example, is at least 30 days short. Only an early maturing variety will ripen here.

After all of this and a whole lot more, some people decide to start a vineyard and a winery. Of course, they will also have to learn how to make wine and build a winery. That takes more money, time, experience, a lot of reading, and maybe hiring a consultant. Many of the 54 wineries in New Jersey have started in this way. I like to think that I'm not only helping the wine business in this state to grow but also preserving farms and open space. The New Jersey Wine Industry is keeping the "Garden" in the Garden state but to be a part of it takes a lot of planning and learning.

AN OVERVIEW OF THE NEW JERSEY GRAPE AND WINE INDUSTRY

Dan Ward Asst. Extension Specialist, Rutgers/NJAES

The following guide is meant to complement the topic of my talk at the convention, and give interested parties direction in their planning.

PLANNING TO START A VINEYARD IN NEW JERSEY

By: Pete Nitzsche, Dan Ward, Jerry Frecon, Gary Pavlis,
Rutgers Cooperative Extension

This document provides guidance and suggests resources to a person thinking of starting a vineyard, so that they may develop a preliminary plan. Good planning is crucial in starting a successful viticulture operation.

What do you need to learn?

Assessing your own level of knowledge and taking steps to educate yourself in areas where you are lacking is a critical activity. If you are experienced in commercial fruit production, you may understand many of the relevant issues, but still need to learn how to manage grapes as a crop, as well as market the fruit. If you have little or no experience in production agriculture you may also need to learn about regulatory issues, labor issues, marketing, and crop management.

The agricultural agent in the local office of Rutgers Cooperative Extension in the county where your vineyard is to be established may be able to direct you to many resources to assist in the planning of your vineyard, http://njaes.rutgers.edu/county/

The New Jersey Department of Agriculture (NJDA), State Agriculture Development Committee (SADC) provides a website, *Resources for New and Aspiring Farmers*, which has links to information to help those who are new to farming get off to a successful start. http://www.nj.gov/agriculture/sadc/farmlink/resources/newfarmers.html

What are your Objectives?

Why do you want to grow grapes?

Before you decide to grow grapes, you have to consider why you are planting them. Will you grow for your own personal use? Do you plan to start a vineyard to sell grapes to wineries? Do you want to grow grapes for your own winery? These questions need to be answered before coming up with a business plan for your endeavor.

What are your Farm and Family Goals?

Planting a vineyard is a long-term commitment and setting reasonable goals for yourself and your family is necessary to be a successful grower. Having set goals for yourself helps you, as a grower, to better plan for the future of your vineyard.

Should you plant grapes?

This is one of the most important questions to consider before deciding to start a vineyard. Many factors determine whether planting a vineyard is a good or bad idea. For what purpose will you use your grapes? Is there a market for your product? Is the site or sites you are considering acceptable to grow grapes? Is your plan to eventually operate your own winery at your vineyard site to use your grape production? Considering these answers, is planting in your region profitable and economically feasible?

What is your business Plan?

Creating a business plan is the first step in starting a successful vineyard. The links below are helpful guides for preparing your own vineyard business plan.

Key Steps for Completing a Vineyard Business Plan - Dr. Maurus Brown of The Ohio State University provides a very good fact sheet on preparing a vineyard business plan. http://ohioline.osu.edu/hyg-fact/1000/pdf/1432.pdf

Vineyard Business Plan Workbook – The following link is to an Illinois-based business plan workbook that can be used as an outline for the business plan of any vineyard. It contains references to useful books, publications and information on vineyard supplies. http://www.commerce.state.il.us/NR/rdonlyres/E24BD84D-6D4F-4C95-B48C-E7AFB869F526/1760/Winery.pdf

How much does it cost to start a vineyard?

Before deciding to plant a vineyard, you must think about how much the start up and operating costs will be. The sources below are useful tools in estimating specific vineyard costs; however establishment generally costs in the range of $10,000-$12,000/acre.

Wine Grape Production Guide for Eastern North America (NRAES-145) - This production guide is the best single reference for grape growers in the East. Authors from throughout the region contributed to this edited volume. The first chapter, "Costs and Economic Returns of Vineyard Establishment and Operation" should be read carefully and early in their learning by anyone considering starting a vineyard or winery in New Jersey.
http://www.nraes.org/nra_order.taf?_function=detail&pr_id=178&_UserReference=7297949E469CE79D4E02592C.

A Penn State fact sheet for new or experienced farmers is the Agricultural Alternative enterprises sheet for grapes, with corresponding budget, found at:
http://extension.psu.edu/ag-alternatives/others/wine-grape-production

How much time and money will it take to break even and make a profit?

Starting a vineyard is a time and money-consuming endeavor. It may take years before it starts yielding a profit so considering how much money you can afford to invest in those beginning years is important in determining if planting a vineyard is right for you.

In addition to the years required for the vines to become profitable, the hours of labor required to achieve this end must be considered. Growing grapes is labor intensive! How the labor requirement for vineyard establishment, maintenance, and management will be met is a huge component of vineyard plan.

How will you market and utilize the grapes?

Identifying markets for your product is one of the most important factors for new growers. Before you grow the grapes, you need to know if you will be able to sell them. Is there a market for your fresh grapes? Is it profitable to sell your grapes in that market? Should you process the grapes and make juice or wine to market? Will customers come to your vineyard to pick grapes? If you are able to make wine, will it sell? Will you need to operate an ancillary agritourism business to help market my fresh grapes or processed product?

What are the regulatory issues that will be important?

There are many regulatory issues to consider when starting a new vineyard. The link, *Resources for New and Aspiring Farmers*, provided in the first section contains very useful information regarding regulatory issues as well as lists of agricultural contacts that can provide assistance and answers to grower's questions.

Regulatory issues are also covered by in many factsheets and bulletins on the Rutgers NJAES website. http://njaes.rutgers.edu/pubs/category.asp?cat=4

Pesticide Control Program website – Provides information regarding pesticide regulations and obtaining the proper licensing.
http://www.state.nj.us/dep/enforcement/pcp/

Your local agricultural agent or other officials of agricultural and non-agricultural offices in municipal, county, state and the federal government may be able to assist you in finding or answering questions on regulatory issues.

Where will you plant?

Site selection is crucial to grape growing success. There are climatic, soil, land use, and proximity factors to consider in evaluating a potential grape growing site.

New Jersey Wine Grape Resource Center – This website has links to facts regarding New Jersey winegrape production and interactive grape site suitability maps for the state of New Jersey. http://njvines.rutgers.edu/njvines-map.htm

The Basics of Vineyard Site Evaluation and Selection - This Cornell and Cayuga Community College website presents a "concise overview of vineyard site selection." http://arcserver2.iagt.org/vll/learnmore.aspx

Virginia Cooperative Extension Vineyard Site Selection – This website discusses the many factors that need to be evaluated regarding site selection for a new vineyard. http://www.pubs.ext.vt.edu/463/463-020/463-020.html

Web Soil Survey – This national web soil survey allows access to interactive maps that provide information about the soil for a selected area of interest. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Most productive vineyards in New Jersey benefit from supplemental moisture via irrigation during establishment years and periods of drought stress. Depending upon the acreage and water use, irrigating grapes may require approval and certification from the state of New Jersey. A vineyard may not be established in wetlands and must be approved in other protected areas (e.g. the Pinelands). Your District Conservationist with the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Conservation District, and your local agricultural agent may be helpful is assisting you with soil surveys, water, soil, irrigation, wetland delineations, and Pineland and Highland issues.

What will you plant?

Based on the vineyard site that has been selected, the grower needs to decide which varieties are most suitable for that site based on varietal and rootstock strengths, weaknesses and marketability. The following sources provide information on some of the varieties best suited for the Mid-Atlantic region.

Commercial Grape Varieties of Virginia – This publication provides a thorough description of many of the commercial grape varieties suitable for Virginia and other Mid-Atlantic states. http://www.pubs.ext.vt.edu/463/463-019/463-019_pdf.pdf

Wine and Juice Grape Varieties for Cool Climates – This Cornell website describes in detail the many American, hybrid, and European grapes varieties that are suitable for cool climate growing regions. http://www.hort.cornell.edu/reisch/grapegenetics/bulletin/wine/

The market will also determine what varieties you plant. Visit grape marketing operations and wineries to see what they are growing and selling. The Garden State Wine Growers at www.newjerseywines.com/wineries.html has many New Jersey wineries as members. Talking to local growers and those marketing may give you valuable insight on market trends. The Outer Coastal Plain Vineyard Association lists the vineyards in the Association all in New Jersey and provides statistics on varieties and acreage www.outercoastalplain.com

How will you plant?

Trellis selection and canopy management – This publication is a brief overview of the different trellising styles and the factors that influence the vineyard trellis design. http://ucanr.org/sites/intvit/files/24348.pdf

Vineyard Establishment - In this well organized publication, Dr. Bruce Bordelon of Purdue University provides instructions on how to plan, plant and manage a new vineyard site for the first three years.
http://viticulture.hort.iastate.edu/wsfeb01/establ.html#layout
Organic Production Guide – Organic production is much more challenging than conventional grape production in New Jersey and has not been successful. The following web site gives potential organic growers all the information needed to certify their farm or vineyard as organic in NJ.
www.state.nj.us/agriculture/divisions/md/prog/jerseyorganic.html.
This production guide gives an outline for growers that want to produce organic grapes.
http://nysipm.cornell.edu/organic_guide/grapes.pdf

How will you continue to learn?

After thinking about these questions and considering your goals your next step may be to contact your local Rutgers Cooperative Extension office. They can put you on mail/e-mail lists for educational meetings, events, and newsletters that relate to grape production. Cooperative Extension has developed a national extension web site called E-viticulture, www.extension.org/pages/60308/growing-grapes-starting-a-vineyard that aggregates education information on viticulture from across the United States in one easy to use location.
You can also visit the Rutgers/NJAES Wine Grape Resource Center website for more links and Rutgers publications. http://njvines.rutgers.edu/njvines.htm. One of the most important publications on this site is the Plant and Pest Advisory - Fruit newsletter to which you can subscribe.
The Garden State Wine Growers Association (http://newjerseywines.com) and the Outer Coastal Plain Vineyard Association (http://www.outercoastalplain.com) previously mentioned are active in developing the industry and attending their meetings can be very informative.
Subscribe to industry, trade, and Cooperative Extension newsletters.

The following selection of websites contains other relevant information for vineyard beginners in New Jersey:

Wine Grape Information for Pennsylvania and the Region - This newsletter by Mark Chien, Penn State University Viticulture Extension Educator, is an excellent source of current information for grape growers in the Mid-Atlantic - highly recommended.
http://www.pawinegrape.com/index.php?page=penn-state-viticulture-email-newsletter

Nebraska Vineyard Establishment – The University of Nebraska gives an overview of what to consider when establishing a new vineyard in Nebraska. http://agronomy.unl.edu/web/agronomy/getstarted

Maryland Grapes and Fruit Page – Starting a Vineyard by Dr. Joe Fiola. This webpage developed by The University of Maryland provides presentations that outline important information that will assist growers with starting a new vineyard. http://www.grapesandfruit.umd.edu/Grapes/Starting.htm

Starting A Commercial Wine Grape Vineyard - This fact sheet by Dr. Bruce Bordelon of Purdue University provides a summary of what it takes to start a vineyard from an Indiana viewpoint.
http://www.hort.purdue.edu/fruitveg/fruit/grapes/StartCommercialVineyard.pdf

Starting a Vineyard in Oregon http://extension.oregonstate.edu/catalog/pdf/em/em8973-e.pdf

Food Safety Audit Training Workshop

NJF2S Twitter Workshop