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Abstracts of the ASHS Northeast Region Annual Meeting

Baltimore, Maryland **3–5 January 2011**

Poster Session

Application of Coragen® (Rynaxypyr®) for Reduction of Sunflower Moth Larvae Damage in New Jersey

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The sunflower head moth (SHM), *Homeosoma electellum*, is a serious threat to the fresh-cut sunflower (*Helianthus annuus*) market in New Jersey and other areas of the US. Larvae of this moth are considered by USDA-ARS researchers as the most widespread and damaging sunflower insect pest in North America (Chirumamilla et al., 2010). Damage from SHM is most devastating at the end of the growing season just before harvest, when moths migrate from the southern US and Mexico. Previous research indicates that if SHM were effectively controlled, the fresh-cut, retail sunflower market could be expanded later into the season to include the Labor Day holiday as travelers drive to shore points in southern New Jersey (Carleo and Polanin, 2008). Coragen® (Rynaxypyr®) is a highly effective chemical control on lepidopteron pests in vegetables and other crops. One significant advantage of Coragen® is its systemic capability, targeting only those pests feeding on treated plant material. Currently, recommended controls for the SHM are bloom-time sprays of organophosphates or pyrethroids (Michaud, 2010), both of which are toxic to honey bees (*Apis mellifera*) and other pollinators. The objectives of this study were to determine the effects of three different rates of Coragen® applied either through drip irrigation or by foliar application for the control of SHM. Foliar application of Coragen® significantly reduced SHM larval damage as compared to untreated sunflowers. However, applications of Coragen® through a drip irrigation system did not significantly reduce larval numbers or damage caused by SHM.

Abstracts are listed in presentation order; †student presentation; *presenting author.

Implementation of Reduced Phosphorus Management by Massachusetts Cranberry Growers: Effect on Crop Production and Water Quality

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Phosphorus (P) plot and demonstration research on Massachusetts cranberry beds during the past 10 years has shown that sustainable yields can be achieved with P rates of no more than 22 kg·ha^{-1}. As a result of extensive outreach, including grower-to-grower efforts, Massachusetts cranberry growers are modifying their nutrient management to reduce P inputs. In a 2010 survey, 65% of respondents indicated that they were reducing P use. Several sites are being monitored as the growers reduce P inputs. Data collection at these sites includes crop yield and P concentration in waters exiting the bogs. At a site monitored since 2003, the grower has reduced P use to an annual average of ~11 kg·ha^{-1}. Through 2009, crop yield at that site increased while P concentration in discharged harvest flood water decreased from 0.60 to 0.099 mg·L^{-1} and P concentration in discharged winter flood water decreased from 0.29 to 0.017 mg·L^{-1}. Six other sites have been monitored for various periods (3–5 years). All sites have reduced P use and have sustained or increased yield. P in winter flood discharges was less than that in harvest flood discharge (warmer water). In-season water discharge, at sites with upwelling groundwater, was an additional source of P leaving some bogs.

Evaluation of Ethnic Eggplant Germplasm

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Rutgers NJAES retired plant breeder Dr. Bernie Pollack developed two open-pollinated ethnic eggplant varieties he named ‘Rayada’ and ‘Rosita’. These new lines had not been compared for yield and quality against commercially available varieties. In 2009, these eggplant varieties were compared to two commercially available varieties, ‘Calliope’ and ‘Santana’. A study at the Rutgers Agricultural Research and Extension Center in Bridgeton, NJ was conducted. The four eggplant varieties were transplanted into the field on 21 May 2009 and grown using standard practices. Harvests began on 27 July and were done

twice weekly for a 4-week period. Yield was taken and quality attributes were also noted. 'Rayada' fruit are plump, oval, deep lavender-purple and white streaked eggplant that are suitable for baby or mature harvest. The fruit of 'Rayada' are glossy when small and become duller when large and the calyxes are spined. 'Rayada' plants have large leaves and good fruit cover for sunscald protection and plants are tall and erect. 'Rosita' has glossy bright deep lavender fruit that fade as fruit get larger. The fruit of 'Rosita' have a traditional teardrop-shaped fruit with calyxes that are spiny. The leaves of 'Rosita' are large and provide good fruit cover and the plants are tall and erect. 'Calliope' has glossy, small variegated fruits that are oval, white and purple streaked Indian-style eggplant. 'Calliope' is suitable for baby (2 inches) or mature (3–4 inches) harvest and have calyxes that are spineless. The leaves of 'Calliope' are smaller than other varieties, but are numerous and provide good fruit cover. The plant structure of 'Calliope' is more spreading and not erect as other varieties. 'Santana' has glossy black-purple fruit with bright green calyx with few spines. 'Santana' plants are tall and upright. 'Santana' is a standard variety for New Jersey. 'Rayada' and 'Rosita' have a longer days-to-harvest period than 'Calliope' and 'Santana', and yields of 'Rayada' and 'Rosita' were much lower than 'Calliope' and 'Santana'. 'Rayada' and 'Rosita' have similar characteristics of other ethnic eggplants and may be a fit for specialty markets.

Fresh Market Tomato Cultivar Evaluations for New Jersey

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New Jersey fresh market tomato growers rely on high quality, early maturing tomato cultivars for vine ripe production and marketing. Unfortunately, several currently recommended early tomato varieties are being removed from the market by seed companies. A field trial was initiated at the Snyder Research and Extension Farm in Pittstown, NJ to evaluate the performance of seven early tomato cultivars and one breeding selection. Tomatoes were grown utilizing a stake and weave system and recommended commercial practices. Tomato fruit was harvested vine-ripe from the plots, sorted, counted, and weighed. Fruit samples were completely ripened at room temperature and ripe fruit samples were evaluated for quality attributes and made available for flavor evaluations at public tasting events. Early yields were highest for NJ 23, 'Primo Red', 'Applause', and 'Royal Mountie'. Only 'Primo Red' had internal and external fruit characteristics similar to 'Applause', a currently recommended cultivar. 'Royal Mountie' and 'Primo Red' compared favorably to 'Applause' in consumer flavor evaluations.

†Media Affect Seedling Growth of *Laurocerasus hypotricha* (Rehd.) T.T. Yu & L.T. Lu

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Container growing media are hard to find in China and the potential for marketing growing media for nursery crops is tremendous. Traditionally, container plants were produced using local soil (loess) in Hunan and its bulk density (at dry), pH, and water holding capacity were 1.31 g·cm^{-3}, 6.28, and 35%. To evaluate the effect of media on plant growth, *Laurocerasus hypotricha* seedlings had been grown with loess (control) and loess with amendment of peatmoss, cotton shells, and compost manure at 1:1 ratio (by volume). Although amended loess had supplied with fertilizer, seedling growth showed height differences at 70 days and diameter differences at 110 days after transplanting. Both height and diameter under compost manure and cotton shells amended media grew faster than that of peatmoss + loess and straight loess. At the end of the first growing season (2009), the seedling heights were 22.64 (peatmoss), 26.97 (compost manure), 26.58 (cotton shells), and 22.12 cm (loess) and the seedling diameters at the medium level were 0.41 (peatmoss), 0.52 (compost manure), 0.50 (cotton shells), and 0.39 cm (loess). No significant different was found among the amended media. At the beginning of the second growing season, amended media showed 7% (peatmoss) and 4% (compost manure and cotton shells) increase of water holding capacity and 1.0 (peatmoss), 0.5 (compost manure), and 0.6 (cotton shells) pH reduction.

†Breeding Ornamental Hazelnuts (*Corylus*)

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Ornamental hazelnuts (*Corylus* sp.) have been used in the landscape in Europe for centuries, exemplified by the popular cultivar Harry Lauder's Walking Stick (*C. avellana* 'Contorta'), planted since the mid-19th century. Others include those with purple leaves, like 'Rote Zellernuss', 'Fusca-rubra', and 'Purple Fortin'. Ornamental hazelnuts are less common in North America, partly because almost all cultivars lack resistance to the destructive fungal disease eastern filbert blight (EFB), caused by *Anisogramma anomala. Anisogramma anomala* is native to the eastern US and causes cankers that girdle stems, reducing value until death occurs, which is typically 3 to 5 years from infection. A hazelnut genetic improvement program has been ongoing at Rutgers University since 1996. One of our breeding objectives is the development of new, highly attractive, EFB-resistant cultivars of ornamental hazelnuts. In the US, Harry Lauder's Walking Stick is widely propagated and sold in its

pristine form. As demonstrated by field trials at Rutgers, this plant is extremely susceptible to EFB, as is the new purple-leaf release 'Red Majestic'. Through breeding work, we have developed a diversity of EFB-resistant contorted hazels, the best of which will soon be put under test in replicated trials to identify superior genotypes. Sources of EFB-resistance used include that from select *C. avellana* as well as wild species including *C. americana*, *C. heterophylla*, and *C. colurna*. In addition, we are also working with ornamental traits derived from 'Pendula' (weeping habit), 'Cutleaf' (dissected leaves), and 'Aurea' (golden leaves), as well as several tree hazel forms (*C. chinensis, C. colurna*, and *C. fargesii*). In advanced progeny, we are introducing fall color through *C. americana*, which shows up as striking pink and orange leaf colors in the weeks leading up to senescence.

†Screening New Hazelnut Germplasm for Resistance to Eastern Filbert Blight

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Eastern filbert blight (EFB) is a destructive canker disease, endemic to North America, caused by the fungus *Anisogramma anomala* (Peck) E. Müller. It is harbored by the native hazel, *Corylus americana*, which is disease-tolerant and cold-hardy, but produces small, thick-shelled nuts. Most hazelnuts (filberts) used as food and ornamentals are the European species *Corylus avellana* that, in general, are highly susceptible to this disease. However, a small number of EFB-resistant *C. avellana* genotypes have been identified in the past, with a large germplasm pool yet to be tested. Searching for resistance in *C. avellana* for use in breeding is promising, as this species has the best nut production traits within the genus. To evaluate new germplasm and identify resistant individuals, susceptible plants are infected at an early stage, using comprehensive disease-screening methods we have developed to expedite the natural 22-month life cycle of *A. anomala*. Seedling infection is achieved through greenhouse inoculations, in which applications of spore suspension are sprayed onto the growing tips of plants inside a humidity chamber. As well, disease pressure is increased and maintained for field plants by tying pieces of infected wood into the canopy yearly. Since initiating the project, extensive germplasm collection efforts have been made in Europe, the Middle East, and North America. In 2009, we obtained a diverse collection of *C. avellana* seeds from the Republic of Georgia and have begun to apply the protocol we have developed for rapid assessment of this and future collections. In addition to assessing the amount of infection and resistance, we plan to characterize the Georgian population using microsatellite (SSR) markers to explore its genetic diversity, population structure and, if identified, relatedness of genes for resistance to EFB.

†Youth Enhanced Service to Society: Encouraging Home Gardening and Community Service

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"Y.E.S.S." is a 5-day gardening program for youth entering grades 7 through 10. The program focuses on environmentally friendly gardening and community leadership and volunteer action. Throughout the week youth participate in leadership games, educational activities, group discussions, hands-on workshops, tours, and basic gardening skills. The activities include gardening jeopardy, building a mini-greenhouse, designing a garden, and a garden tour. At the end of the week the youth develop a plan of action with their future gardening goals. Pre- and post-tests revealed a significant increase in knowledge by program participants. The youth also sign up to volunteer in the local Garden for the Hungry where they help with garden maintenance and harvesting produce that is donated to a local soup kitchen. More than 4000 lb of produce was donated to the needy from the YESS vegetable garden at the EARTH Center.

Oral Session

Two-Year Study to Evaluate Bacterial Leaf Spot and Phytophthora Resistant Bell Peppers for Yield

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Bacterial leaf spot (*Xanthomonas* sp.) and phytophthora blight (*Phytophthora capsici*) are the two major diseases in New Jersey bell pepper (*Capsicum annuum* L.) production. Bacterial leaf spot has been controlled using resistant cultivars for the races 1–3 until race 4 was identified in 2008. Phytophthora blight has been managed using resistant/tolerant cultivars and chemical controls, but few commercial cultivars have been available until recently. Eighteen cultivars and breeding lines in 2009 and 15 in 2010 were transplanted on raised plastic-covered beds. One drip line was placed between double rows 12 inches apart with 18 inches between plants and 5 ft between

beds in a randomized complete-block design with 4 replications. Peppers were grown utilizing a stake and weave system with nutrient and pesticides applied based on recommended commercial practices. Thirteen cultivars were the same in both years. Peppers were hand-harvested 5 times each year. Fruits were graded into silvered (skin separation) and non-silvered fruit and into sizes by weight. Fruit sizes were extra large (0.5 lb/fruit), large (0.33–0.49 lb/fruit), medium (0.25–0.32 lb/fruit), and culls. Yields are reported in 28-lb boxes/acre (b/a). In 2009, 'Paladin' (372 b/a) and 'Colossal' (374 b/a) had significantly higher marketable yields than five other cultivars. 'Snapper' and '0992-8032' had significantly lower yields for the first harvest than six other cultivars. For all harvests, 'Excursion II' (1866 b/a) had significantly higher marketable yields than 'Snapper', 'Camelot', '0992-8302', 'Intruder', or 'Hunter'. '0992-8302' had the lowest yield and was statistically lower than all other cultivars except 'Camelot', 'Intruder', 'Hunter', or 'Snapper'. '0991-5776' had the most silvering for early harvest (44%) and total harvests (46%), followed by 'Colossal'. In 2010, there were no statistical differences among cultivars for the first harvest. For all harvests, 'Alliance' (2062 b/a) and 'Colossal' (2018 b/a) had significantly higher yields than 'Hunter' or 'Intruder'. 'Colossal' produced more silvered fruit for early and total harvest (51%). Of the highest yielders, 'Paladin' is resistant to phytophthora and 'Alliance' has resistance to bacterial leaf spot 1-3 and 5, but not race 4.

Yellow Vine Syndrome of Cranberries in Massachusetts: Mechanism and Regulation

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We have previously reported the shading effect on yellow vine syndrome of cranberry by using spectrometric, HPLC, and chlorophyll fluorescence methods to explore the molecular mechanisms of yellow vine formation and proposed a possible role of photoinhibition associated with the yellow vine syndrome in cranberry plants [Z. Wei, P. Jeranyama, F. Zhang, C. DeMoranville, and H.J.M. Hou (2010) HortScience 45:1345–1348]. To explore the similarity and difference in photosynthetic performance of yellow vine syndrome and normal cranberry leaves, we examined the behaviors and properties of yellow vine and normal cranberry leaves by chlorophyll fluorescence analysis over the period of one day and of one month, respectively. Both experimental data sets indicated that the accessible parameters including the maximum quantum efficiency of PS II, the size of quinone pool, the numbers of reaction center per chlorophyll, and the photosynthesis performance index, of the yellow vine samples are substantially lower than those of the normal cranberry leaves. These results are in line with the data of yellow vine leaves, having about 26% to 28% less in chlorophyll than the normal leaves by spectrometric and HPLC analysis. We concluded that the yellow vine syndrome is associated with a poor photosynthesis activity and problematic for the long-term growth and crop production of cranberries. In addition, the responses of yellow vine cranberry leaves to the environmental stress, such as temperature, pH values, and nutritious ions, were examined by chlorophyll fluorescence kinetics. The data strongly suggested that the yellow vine cranberry is significantly vulnerable to the stress conditions and lacks the capability to defend against the adverse environmental factors.

†Cranberry Bud Damage as Affected by Spring Frost Control Method

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Cranberry growers have traditionally used the heat of fusion principle to protect cranberry vines from frost damage by turning on their irrigation sprinkler system on a frost night. They often vary two approaches of using irrigation systems by either 1) running a system throughout the night beginning once the bog reaches a critical temperature, starting and stopping manually or by an automated sensor system, and/or 2) intermittent sprinkling, mostly used by growers with automation equipment. Yet some growers use late water spring floods (used for other purposes) as a frost protection method. An experiment was conducted in southeastern Massachusetts in spring on cranberry beds planted with cultivars Howes and Stevens. The objective of the experiment was to determine the effectiveness of automated intermittent sprinkling (AI) and late water spring floods (LW) in reducing cranberry spring bud damage. At least 500 cranberry buds were collected from both 'Howes' and 'Stevens'. Buds were dissected under a microscope and assessed for damage. Upright density, flowering and fruiting characteristics were also measured. Using general linear regression models, we observed an association between cultivar and method indicating an interaction between method and cultivar across all the variables ($P \leq 0.005$). We compared the proportion of bud damage in each cultivar within method and there was significantly higher bud damage for 'Howes' in LW than in the AI method ($\chi^2 = 20$; $P \leq 0.0001$), and significantly higher damage for 'Stevens' in the (AI) than in (LW) ($\chi^2 = 38$; $P \leq 0.0001$). 'Howes' under AI was associated with high flowering and fruiting compared with LW (556 vs.400 flowers/m^2). Although 'Stevens' had greater proportions of flowers and fruits under LW, no significant differences were noted against AI. We also observed negative correlations between damage, flowering, and fruiting. The associations were stronger and even more pronounced by site ($P = 0.0023$).

†Estimation of Leaf N, P, and K Standards for Lowbush Blueberry Using the Boundary Line Approach

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Fertilizer recommendations for Maine wild lowbush blueberries (*Vaccinium angustifolium* Ait.) are based on leaf nutrient standards reported as a second approximation by Trevett in 1972. It is unclear what the values were based upon, except that tissue samples were a composite of all leaves on a stem and were taken at 90% to 100% tip dieback. The objective of this study was to confirm the validity or update the current leaf nutrient standards for lowbush blueberry using a boundary line approach. Leaf nutrient concentrations and yield data from 33 lowbush blueberry nutrient studies conducted between 1991 and 2009 were subjected to the boundary line analysis. Data were reduced using a series of criteria that produced data points that were used to fit a quadratic regression curve. A range and optimum concentration of leaf nutrients associated with maximum yield were calculated by solving for the first derivative of the quadratic regression equation. Current fertilizer recommendations are based on the minimum value of Trevett's satisfactory range and not on optimum nutrient concentration. Using the boundary line approach, the optimum nutrient concentrations of leaf N, P, and K for maximum blueberry yield were: N (1.655%), P (0.136%), and K (0.437%); and these were higher than the current leaf standards for N (1.600%), P (0.125%), and K (0.400%).

†Prohexadione Calcium Increases Rhizome Production of Lowbush Blueberry (*Vaccinium angustifolium* Ait.)

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The spread of lowbush blueberry, *Vaccinium angustifolium* Ait., is accomplished by relatively slow lateral rhizome growth. Improving rhizome initiation and growth into adjacent bare areas in commercial fields would result in greater plant cover and therefore greater crop yield. Ten sod strips 30 cm wide and 12.8 m long were created in a commercial wild blueberry field by removing 30-cm-wide and 5-cm-thick strips on either side. The adjacent void created by removing sod was filled with 10-cm-thick softwood bark mulch. Seven treatment plots 30 cm wide and 91 cm long were established with sod buffers of similar size between plots within the 12.8-m-long sod strip. Commercial formulations of three growth regulators at two rates each (20 and 100 ppm ethephon, 5 and 20 ppm naphthaleneacetic acid, and 125 and 250 ppm prohexadione calcium) were applied 17 June 2009, during the vegetative year of the blueberry production cycle, when stems were about 4 cm tall. A control plot received no treatment. Each sod strip constituted a block in a RCB design, with 7 treatments and 10 blocks. On 5 May 2010, mulch was gently pulled away from each side of the sod strip and rhizomes that had entered the mulch were collected for number, length, and dry weight measurements. Only prohexadione calcium at 125 ppm had a significantly greater number of rhizomes per treatment plot (9.9) than the control (3.6), with almost 3 times as many rhizomes. Treatments had no effect on mean rhizome length, which ranged from 5.9 to 8.5 cm or on mean rhizome dry weight, which ranged from 49 to 89 mg. These data suggest that prohexadione calcium, a gibberellin synthesis inhibitor, may promote rhizome production of lowbush blueberry.

†Effect of Temperature on Seed Germination of Invasive *Berberis thunbergii* DC

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Berberis thunbergii DC (Japanese barberry) has been widely planted in landscapes of the United States for its colorful foliage and abundant bright red fruits. Because of its high rate of seed dispersal by birds and its adaptability to many growing conditions, this plant has become one of the most invasive understory shrubs in many regions of the US. To investigate its invasiveness, Japanese barberry seeds were collected and cleaned in Nov. 2009 and subjected to several germination tests. Assessment by dissection indicated that seed viability was 100%. Seeds were soaked overnight and randomly sown in germination trays on 11 Dec. 2009. The trays were placed outside without covering (–9~3 °C), under overwintering fabric (–9~15 °C), under microfoam (–2~10 °C), in a cooler (4 °C), under bark mulch (–5~2 °C), in a poly greenhouse (–7~20 °C), or in a heated greenhouse (18~45 °C). Seeds were also incubated at 20, 30, 40, 50, 60, 70, 80, and 90 °C for 24 hours, respectively, and sown in the heated greenhouse (18~45 °C). In late Mar. 2010, all treatments were moved into the heated greenhouse and seed germination was recorded every 2 days. The germination percentages ranged from 0% (24 hours at 50 °C or higher) to 94.4% (bark mulch). Cold period significantly affected Japanese barberry seed germination. Seeds that received cold temperatures below 4 °C for 3 months had germination percentages above 81.3%, while in warm temperatures (18 °C or above), the germination percentages only reached 42.0% (24 hours at 20 °C). Germination time was significantly shorter with a cold period (3–9 days) compared to only warm temperature treatments (23–41 days). Germination potential was also much lower under warm temperatures. The germination index, an indication of overall germination ability, showed a similar trend. In the New England area, Japanese barberry seeds could be vernalized in winter and germinate at highest percentages in spring, especially under forest litter layers (similar to mulch treatment). In the southern US, temperatures above 18 °C could significantly reduce germination rates. In

temperatures above 40 °C, Japanese barberry seeds completely lost their viability. Composting could be an effective method to prevent seed germination and dispersal of Japanese barberry.

Challenges and Opportunities for Field Production and Use of Switchgrass and Miscanthus as Bioenergy Crops in the Northeast

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New Jersey farmers have expressed a genuine interest in producing their own on-farm bioenergy crops through surveys conducted at alternative energy educational meetings conducted by NJAES Cooperative Extension and the NJ Farm Bureau over the past two years. Growers are genuinely interested in alternative energy as a means to decrease their energy costs and increase profits. Field research conducted over the past two years has revealed practical challenges in the production, storage, and use of bioenergy crops such as switchgrass and *Miscanthus* species. Environmental groups are concerned that non-native *Miscanthus* species will become an invasive threat and contribute little to the environment when compared to native switchgrass. The current cost of establishing *Miscanthus* rhizomes is high and harvest can be a greater challenge with conventional farm equipment. The US Department of Energy has focused on native switchgrass as a viable bioenergy crop for select parts of the nation. Switchgrass can be seeded and harvested with conventional farm equipment commonly found on farms in the Northeast. Seed cost and establishment of switchgrass on select sites has been a challenge. Weed control options are limited for both switchgrass and *Miscanthus* species. Current research is under way to increase germination rates for switchgrass and select the best cultivars and inputs to match site-specific requirements. Our research is focused on the most practical and economical methods for establishment, harvest, and use of switchgrass on marginal lands on or near small farms in the Northeast.

Evaluation of Biofungicides for Downy Mildew of Basil

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Downy mildew (caused by *Peronospora belbahrii*) is a new disease of basil in the US. It was first detected in Florida in Oct. 2007. Downy mildew was reported in 2008–10 on basil grown in greenhouses and outdoors, in both commercial crops and gardens throughout the eastern United States. Entire crops have been lost because of this disease. Downy mildew is now recognized to be established in the US and is expected to continue occurring. The need to apply fungicides for control has forced a change in the production of a crop that rarely needed pesticide applications previously. Biopesticides were evaluated in a replicated experiment with field-grown plants of basil at the Long Island Horticultural Research and Extension Center in Riverhead, NY. The primary source of initial inoculum in this area is considered to be wind-dispersed spores from affected plants in another area. Each plot had 26 plants in two 10-ft rows on black plastic mulch with 9-inch plant spacing and 9-inch row spacing. A randomized complete-block design with four replications was used. The following biofungicides plus a conventional fungicide (Revus) and a copper fungicide (NuCop) were applied using a CO_2-pressurized backpack sprayer and a hand-held boom for 7 weeks: Actinovate, Companion, ProPhyt, Organocide, Oxidate, Regalia, Sporatec, Sonata, and Timorex Gold. The number of plants affected and percentage of leaves affected on up to 10 plants was determined at each assessment. Incidence and average severity on affected plants was used to calculate overall severity for the canopy of each plot. Symptoms were not found in plots until 20 Sept., which was after the fourth application. Few significant differences were detected among treatments. The conventional fungicide Revus was not significantly better than most of the biopesticide treatments. Results may have been affected by the fact disease onset was late in the season and occurrence remained low. While there were few significant differences among treatments, the biopesticide that appears to be the least effective (Oxidate) is one of the two products currently labeled for managing downy mildew in organically produced crops.

Use of Tissue Culture Plants for Reestablishing Lowbush Blueberry Cover

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Many commercial wild blueberry (*Vaccinium angustifolium* Ait.) fields in Maine are being land leveled to accommodate mechanical pruning and harvesting equipment. Removal of large boulders leaves disturbed bare areas. Introduction of new plant material would hasten the recovery and fill in bare spots. To determine the best way to introduce clonally propagated plant material, tissue culture plants of a selected clone (cv. Burgundy) were planted into a disturbed area that had blueberry sod removed for sale to landscapers for a groundcover. Treatment plots were 0.61 m × 3.67 m with 0.30-m alleyways. A RCB design with four blocks and six treatments was used. Treatments included: 1) control (allowing rhizomes left behind to regenerate the blueberry cover); 2) yearly fertilization to encourage growth from existing rhizomes left behind; 3) planting of six 2-year-old tissue culture propagated 'Burgundy' plants into tilled ground without fertilization; 4) planting of six 2-year-old tissue culture propagated 'Burgundy' plants into untilled ground without fertilization; 5) planting of six 2-year-old tissue culture propagated 'Burgundy' plants to tilled ground with fertilization; 6)

planting of six 2-year-old tissue culture propagated 'Burgundy' plants into untilled ground with fertilization. In the first year after planting, a soil drench of liquid fertilizer (11 kg N/ha from Peters Azalea Special 21N–3.1P–5.8K) was applied weekly for 3 weeks. In subsequent years, a slow-release fertilizer (Osmocote 19N–2.2P–6.6K, 3-month formulation) was hand-spread at the rate of 112 kg N/ha to those plots designated to receive fertilizer. Supplemental irrigation through a soaker hose was occasionally provided to all plots. The whole area was mulched after planting with 10 cm of softwood bark mulch. Plant cover measurements, determined yearly using photography and Assess 2.0 (Image Analysis Software for Plant Disease Quantification), indicated that after a period of 6 years, blueberry cover was17.5% for the control and increased to 40% when fertilized. Without fertilizer, planting tissue culture plants in tilled or untilled soil had similar groundcover of 34% and 29%, respectively. The greatest plant cover occurred within plots that had plants and fertilizer; and cover was greater (60%) when soil was untilled compared to tilled (47.4%).

The Effects of Compost Applications on Yield and Overall Health of Vegetables Grown under Plasticulture

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As part of an extension program on soil health as a component of an overall integrated pest management program for vegetable crops, experiments were conducted in 2009 and 2010 comparing different compost types and compost rates on yield and health of vegetables grown under plasticulture. Trials were conducted at two locations: the University of Delaware Research and Education Center near Georgetown, DE in a field with a history of vegetable production and the Delaware State University Research and Outreach Center near Smyrna, DE that had no history of vegetable production. In 2009 treatments consisted of yard waste (YW), agricultural grade (AG), or spent mushroom (SM) composts applied at 15 or 60 MT/ha. Fumigated and untreated control plots were also included. Test crops included mini, canary, and honeydew melons with snap beans planted as root health indicators at plot ends. In 2010, the residual effect of composts at these sites was evaluated on watermelon and lima bean crops. In 2010 extensive trials were also done with the AG compost at lower application rates: 0, 2.2, 4.4, 6.6, 8.8, 11.0, and 13.2 MT/ha. Test crops included zucchini, cantaloupe, watermelon, pepper, and tomato. In all trials, yield (weight and number), grade, plant vigor and health ratings, root health ratings, and chlorophyll meter readings were taken. In 2009, at the Georgetown site, highest yields were obtained on the lower rate AG compost. Poor yields were obtained on the high rate YW compost treatments. High rate MS compost treatments had high chlorophyll meter readings but low yield. At the Smyrna site, yield and vigor were highest in the low rate AG compost. Poor yields were also obtained on the high rate YW compost treatments. Root disease ratings and lesion counts on indicator bean plants and melon plants showed no significant differences between treatments at either site. In 2010, there were no differences in yield, grade, vigor, or health of watermelons or cantaloupes at any level of AG compost addition. Zucchini numbers were significantly increased at the 11.0 and 13.2 MT/ha compost rates and vigor and late season yields were improved. There was a higher number of small grade peppers with higher rate AG compost additions but no other differences. Residual effects of high rate compost additions in 2009 were evident in 2010.

Delta ^{13}C Predicts Water Deficit Sensitivity in *Malus sieversii* (Ledeb.) M. Roem. from a Xerophytic Site in Kazakhstan

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Modern apples [*Malus* ×*domestica* (Borkh.)] are thought to have originated in western China from the progenitor species *Malus sieversii* (Ledeb.) M. Roem. Due to many generations of selection for traits associated with high fruit quality, our current breeding germplasm has become dangerously narrow. Genes for other useful traits such as disease and insect resistance, cold hardiness, and drought tolerance are quite limited within our breeding populations. To expand our repertoire of stress responsive genes that can be used to improve drought tolerance and/or water use efficiency (WUE) in our current apple varieties, we have screened a population of *M. sieversii* isolated from a xerophytic site in Kazakhstan. Using $\Delta^{13}C$ as a surrogate measurement of WUE to select *M. sieversii* individuals with extreme WUE values, we clonally propagated GMAL4002.e and GMAL3685.e (both low WUE values), along with a commercially important cultivar ('Royal Gala') to serve as a standard for comparison. In a preliminary experiment the lowest WUE line (GMAL4002.e) showed signs of early wilting after water was withheld from the pots for 6 days. 'Royal Gala', GMAL3685.e, and well-watered controls from each line showed no signs of wilting during this time.

Breeding for Eastern Filbert Blight Resistance in Hazelnuts

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The fungal disease eastern filbert blight (EFB), caused by *Anisogramma anomala*, has been recognized as the primary limiting factor of European hazelnut (*Corylus* spp.) culture in eastern North America. The disease is also now widespread throughout the Willamette Valley of Oregon, where it was previously absent, which is the region where 99% of the current US crop of hazelnuts is produced. Fortunately, a number of sources of resistance to EFB have recently been identified within *C. avellana*, the European hazelnut species of commerce, as well as

in wild species such as *C. americana, C. heterophylla,* and *C. colurna*. However, most of these sources are lacking in important production traits such as adequate nut size and/or kernel quality, cold hardiness, and nuts that fall free from the husk at maturity. At Rutgers we are using both intra- and interspecific hybridization to utilize a wide diversity of sources of resistance to EFB to develop improved, EFB-resistant plants that are adapted to the Northeast, which also produce medium to large size, thin-shelled round nuts with high quality kernels. An overview of the breeding program, including EFB resistance breeding approaches and objectives, will be discussed.

Ploidy Analysis of Cultivated *Corylopsis* Siebold & Zucc. (Hamamelidaceae)

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Winterhazels (*Corylopsis* Siebold & Zucc.) are flowering shrubs and trees in the witchhazel family (Hamamelidaceae) grown primarily for their showy yellow flowers in late winter. The taxonomy of the genus is complex, confounded by poor species representation in botanical collections, confusion in those species commonly cultivated, and possible hybridization. A long-term study was initiated at the US National Arboretum to address identification and taxonomic difficulties in the genus and facilitate future breeding efforts, beginning with a ploidy analysis of cultivated taxa. Ninety-eight accessions from 31 sources, representing 16 species, were sampled for relative ploidy level using nuclei extracted from leaf tissue, stained with 4′,6-diamidino-2-phenylindole (DAPI) and analyzed on a flow cytometer. An internal standard was used to calculate relative genome size and ploidy levels of sampled taxa. Results were compared to expected ploidy levels from published literature when available and superimposed on the most complete taxonomic treatment of the genus. Results confirmed the existence of a ploidy series within *Corylopsis*, encompassing diploids, tetraploids, and hexaploids; however, some discrepancies were noted and new levels established for several taxa. Diploid species were found in three of the five sections examined (sect. Multiflorae, Pauciflorae, and Spicatae); tetraploids and hexaploids were identified in only sect. Spicatae. Section Spicatae was the largest section examined and includes several species complexes where ploidy screening will aid in elucidating subgeneric relationships. Future studies will combine molecular and morphological data to further elucidate taxonomic relationships and guide efforts at curation and breeding in the genus.

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