Abstracts of the ASHS Northeast Region Annual Meeting

Baltimore, Md. 5–6 Jan. 2000

Paper Session I

Performance Evaluation of Fine Fescue Turfgrass Cultivars in Maine

Annamarie Pennucci[1] and *Alan R. Langille**[2]; [1]Northeast Turf and Ornamental Research, Milford, N.H.; [2]Horticulture Program, Dept. of Biosystems Science and Engineering, Univ. of Maine, Orono, ME 04469

The N.T.E.P. fine fescue test was established in Sept. 1994 in the Turfgrass Experimental Plot Area of the Littlefield Ornamental Trial Garden on the Univ. of Maine campus. The test consisted of 59 cultivars seeded in a randomized complete-block design with three replications. Following soil preparation, the Marlowe fine sandy soil was amended with lime and starter fertilizer according to soil test recommendations. Seeding was facilitated using a 5 × 3-ft plywood box to eliminate wind drift, and seed was raked in by hand. The study was conducted in a shade-free location with a maintenance fertility program of N at 0.6 lb/1000 ft^2 per month of growing season using a slow-release commercial 20–5–15 fertilizer. Supplemental moisture was supplied as needed using an in-ground irrigation system. Mowing was initiated in May 1995 at a height of 2.5 inches and reduced to maintenance height of 2 inches for the duration of the 3-year test. Visual turf quality, turf density, color, weediness, and disease ratings were made monthly during each growing season and were statistically analyzed. Cultivars Darwin, NJ F-93, Columbra, Florentine, and the Banner II and III series were ranked as the best performers in the early- and late-season evaluations. BARFRR4ZBD, Jasper, Defiant, Silverlawn, Treazure, SR 5100, and Spartan were cultivars that performed well in early summer; however, during August, all cultivars showed depressed quality scores and no differences were observed. With the onset of true autumn conditions in October, the number of excellent performing cultivars approximated the same number observed in the spring. These results confirm that a number of fineleaf fescue cultivars are now available whose performance begins to rival Kentucky bluegrass under Maine conditions and will certainly provide better long-term turf than will perennial ryegrass.

Relationship between Nitrate Leaching under Turf and Nitrate Uptake by Turfgrasses

John W. Pote, Chhandak Basu, Zhongchun Jiang, and W. Michael Sullivan,* Dept. of Plant Sciences, Univ. of Rhode Island, Kingston, RI 02881-0804

Leaching-induced N losses have been shown to be minimal under turfgrasses. This is likely due to superior ability of turfgrasses to absorb nitrate. No direct evidence for this theory has been reported. The present study quantified nitrate leaching under miniature turf and nitrate uptake by individual turfgrass plants, and established the relationship between nitrate leaching loss and nitrate uptake rate. Seedlings of six Kentucky bluegrass (*Poa pratensis* L.) cultivars, 'Blacksburg', 'Barzan', 'Connie', 'Dawn', 'Eclipse', and 'Gnome', were planted individually in polystyrene containers filled with silica sand. The plants were irrigated with tap water or a nutrient solution containing 1 mM nitrate on alternate days and mowed to a 5-cm height once each week for 25 weeks. Nitrate leaching potential was then determined by applying 15 to 52 mL of nutrient solutions containing 7 to 70 $mg \cdot L^{-1}$ nitrate-N into the containers and collecting leachate. After the leaching experiment, plants were excavated, roots were washed to remove sand, and the plants were grown individually in containers filled with 125 mL of a nutrient solution containing 8.4 $mg \cdot L^{-1}$ nitrate-N. Nitrate uptake rate was determined by monitoring nitrate depletion at 24-hour intervals. Leachate nitrate-N concentration ranged from 0.5 to 6 $mg \cdot L^{-1}$ depending on cultivar, initial nitrate-N concentration, irrigation volume, and timing of nitrate-N application. Significant intraspecific difference in nitrate uptake rate on a root length basis was observed. Nitrate uptake rate on a per plant basis was significantly ($P \leq 0.05$) and negatively correlated ($r = -0.65$) with nitrate leaching loss. The results provide strong evidence that superior nitrate uptake ability of turfgrass roots could reduce leaching-induced nitrate-N losses.

Host Range of a Select Isolate of the Beneficial Ericoid Mycorrhizal Fungus *Hymenoscyphus ericae*

Nicole R. Gorman and Mark C. Starrett,* Dept. of Plant and Soil Science, Univ. of Vermont, Burlington, VT 05405-0082

Studies were conducted to examine the host range of a select isolate of the ericoid mycorrhizal fungus, *Hymenoscyphus ericae* (Read) Korf and Kernan [American Type Culture Collection (ATCC) #32985]. Host status was tested for 15 ericaceous species, including *Calluna vulgaris, Enkianthus campanulatus, Gaultheria procumbens, Kalmia latifolia, Leucothoe fontanesiana, Oxydendrum arboreum, Pieris floribunda, Rhododendron calendulaceum, Rhododendron carolinianum, Rhododendron catawbiense, Rhododendron maximum, Rhododendron mucronulatum*, *Vaccinium corymbosum*, and *Vaccinium macrocarpon*. *Arbutus unedo*, an ericaceous species that forms arbutoid, not ericoid, mycorrhizae was used as a negative control. All of the species were colonized by the ericoid isolate with the exception of *Enkianthus campanulatus* and the negative control. The benefits of the association and possible commercial applications are discussed.

Correcting Lowbush Blueberry Boron Deficiency with Soil or Foliar Application

J.M. Smagula, W. Litten, and S. Dunham,* Horticulture Program, Univ. of Maine, Orono, ME 04469

In the acid podzol soils of Maine where most lowbush blueberries are grown, low availability of boron tends to keep foliar B concentration below the 24 ppm standard. To compare efficacy of soil and foliar boron application methods, 1.5 × 7.6-m treatment plots in a commer-

cial lowbush blueberry field received soil-applied borate at 0, 1.1, 2.2, or 3.3 kg·ha^{-1} B with or without additional DAP (89 kg·ha^{-1} P) and $ZnSO_4$ (3.3 kg·ha^{-1} Zn) or foliar-applied Solubor at 0, 0.24, 0.49, or 0.74 kg·ha^{-1} B with or without the additional DAP and Zn. These 16 treatments were replicated eight times in a randomized complete-block design. Leaf B concentrations were raised by all soil-applied borate treatments and by the 0.49 and 0.74 kg·ha^{-1} B foliar Solubor treatments, compared to the controls. When borate at 2.2 or 3.3 kg·ha^{-1} B was combined with DAP plus Zn a lower leaf B concentration was observed compared to B alone, possibly due to a dilution effect caused by an increase in DAP-induced growth. Leaf P deficiency (<0.125% P) was corrected when DAP and Zn were included in the fertilizer treatment. The greatest potential yield (flower buds/stem and flower bud density) was measured in treatment plots receiving a combination of DAP plus Zn and either borate at 2.2 kg·ha^{-1} B or Solubor at 0.74 kg·ha^{-1} B. With no additional treatments applied in 1999, leaf B concentrations were slightly higher in soil-treated and foliar-treated plots than in controls suggesting a small carryover from 1997-applied boron. Carryover may vary with rainfall.

Carbon Dioxide Effects on Metabolism of Two Apple Fruit Cultivars

Chris B. Watkins, Juan-Pablo Fernández-Trujillo, and Jacqueline F. Nock*, Dept. of Fruit and Vegetable Science, Cornell Univ., Ithaca, NY 14853

Susceptibility of apple fruit to CO_2 can be affected by cultivar and postharvest treatment with diphenylamine (DPA). To study possible metabolic reasons for CO_2 injury development, 'Cortland' and 'Law Rome' apple fruit were either untreated or treated with DPA at harvest, and then exposed to air or 45 kPa CO_2 for up to 12 days. Fruit were sampled at 3-day intervals during treatment, and peel and flesh samples were taken for organic acid and fermentation product analysis. Additional fruit were removed to air and stored for 25 weeks for evaluation of injury. 'Cortland' apple fruit had more external CO_2 injury, but less internal CO_2 injury than 'Law Rome'. DPA treatment markedly reduced incidence of both external and internal injury. Fermentation products increased in peel and flesh of both cultivars with increasing exposure to CO_2. However, acetaldehyde concentrations were ≈10 times higher in peel and flesh of 'Law Rome' than 'Cortland' apples. Ethanol concentrations in the flesh were similar in both cultivars, but were about twice as high in 'Cortland' than 'Law Rome' peel. Neither acetaldehyde nor ethanol concentrations were affected consistently by DPA treatment. Cultivar or DPA treatment did not affect accumulation of succinate, often regarded as the compound responsible for CO_2 injury. These results do not indicate that acetaldehyde, ethanol, or succinate accumulation is responsible for CO_2 injury in apple fruit.

Bat Predation of Insects on the N.A.P.I. Farm

J.M. Dangler and L.D. Nakai*, Navajo Agr. Products Industry, Farmington, NM

Abstract not available

Usefulness of Apogee® for the PA Apple Industry

*George M. Greene II**, Penn State Univ., Dept. of Horticulture, Fruit Res. and Ext. Center, Biglerville, PA 17307

Excessive tree vigor is a significant production problem for the PA apple industry. A series of experiments were conducted from 1994 to 1999, which indicated that Apogee® could effectively reduce vegetative shoot growth. Results from 1994 to 1996 have previously been reported (*HortScience* 31:598, 32:558). In 1997, 16 treatments composed of four rates (0, 63, 125, and 250 ppm) and four timings (22 May; 4, 11, and 24 June) in various combinations, were applied as dilute handgun sprays. These treatments were applied to sixth leaf 'York Imperial' apple trees. Ten peripheral shoots, at a height of 2 m, were tagged and measured on 21 May, 9 and 30 June, 16 July, 12 Aug., and on 10 Oct. Shoots treated with 63, 125, or 250 ppm on 22 May followed by 0, 63, or 125 ppm on 4, 11, or 24 June were from 65% to 76% of the length of the controls (25.5 cm). Treated shoots were from 69% to 78% of the length of the controls following sprays with 63 ppm on 22 May followed by 0, 63, or 125 ppm on 4, 11, or 24 June. Shoots treated with 125 ppm on 22 May followed by 0 or 63 ppm on 4, 11, or 24 June were from 69% to 73% of the length of the controls. The later applications (11 and 24 June) of 250 ppm gave no growth control but the 22 May treatment gave a 30% reduction in growth. In 1999, dilute handgun sprays of 125, 125, 83, and 83 ppm were made on 22 May and on 4, 11, and 24 June, respectively. Cultivars treated were 'Spartan', 'Delicious', 'York Imperial', 'Gala', and 'Mutsu'. The length of 10 peripheral shoots at 2 and 3 m were measured on 28 July and on 12 Aug. All cultivars responded and on 12 Aug. treated terminal shoot lengths ranged from 33% to 55% of the controls. With reduced vegetative tree vigor many horticultural factors will be improved. In addition, the severity of shoot fire blight can be reduced and the control of all pests that prosper on young succulent leaves will be easier, especially apple aphids and obliquebanded leafrollers. Major factors to be considered in developing an efficacious Apogee® program appear to be initial tree vigor, length of growing season, and crop load. An initial application at 1 to 3 inches of terminal growth is probably the most critical factor.

Residents' Opinions on the Value of Street Trees

James Gorman and James E. Swasey*, Univ. of Delaware, Newark, DE

This research sought to determine if there was a difference of opinions regarding street trees depending on whether or not residents had a street tree planted directly in front of their house. Six hundred seventy-six residents of State College, Pa., responded to a structured questionnaire regarding their opinions of benefits and annoyances of street trees. Results of this research show that there were statistically significant differences of residents' opinions depending on whether or not there was a street tree planted in front of their residence.

Determination of the Optimal Fertilizer Concentration Range for Plant Growth in a Peat-based Medium

Gretchen E. Mills and Allen V. Barker*, Dept. of Plant and Soil Sciences, Univ. of Massachusetts, Amherst, MA 01003

For optimum plant growth in containers, adequate plant nutrition is essential. Objectives of this research were to determine the optimum fertilization of tomatoes (*Lycopersicon esculentum* Mill.) in a peat-based medium and to assess plant nutrition by plant and media analysis. Tomato seedlings ('Heinz 1437') were transplanted (one plant per pot) into 2-L pots filled with a peat-based medium. The medium was fertilized with a progressive array of soluble fertilizers to supply N at 0, 50, 100, 150, or 200 mg·L^{-1} of solution with concomitant proportional increases of other macronutrients with each increase in N (P at 0, 10, 20, 30, or 40; K at 0, 40, 80, 120, or 160; Ca at 0, 50, 100, 150, or 200; and Mg at 0, 12, 24, 36, or 48 mg·L^{-1}). The plants were irrigated starting with 100 mL fertilizer solution per day and increasing to 200 mL per day as plant growth progressed. The tomatoes were harvested at three stages of growth (five-leaf stage, flower initiation, and fruit initiation) for analysis of growth and composition. Samples of media for nutrient analysis were taken at each growth stage. Plant biomass increased linearly as fertilizer level increased or as time progressed. Generally, concentrations of nutrients in the medium increased linearly with increases in nutrients in the solutions. With time, N concentrations in media rose, but P, K, Ca, and Mg in the media fell. Concentrations of N, P, or K in leaves increased as nutrition increased, but Mg or Ca in leaves had no significant changes with increased nutrient supply. The N, P, Ca, and Mg in tissues fell, but K rose with time. Assessment of plant nutrition was best at flower initiation, with assessments at the other stages of development being judged as untimely or excessively variable. For optimum growth, critical concentrations of nutrients in the media (mg·kg^{-1}) at flower initiation were judged to be 30 NO_3-N, 30 P, 300 K, 2600 Ca, and 800 Mg and in leaves (g·kg^{-1}) to be 35 N, 10 P, 70 K, 35 Ca, and 20 Mg. Optimum fertilization to reach these critical concentrations was reached with the third level (the regime with 100 mg N/L) or higher levels of nutrition.

Plant Density and Inter-row Polyethylene Mulch Treatment Affect Growth and Yield of Tomato

Amy Ouellette and J. Brent Loy*, Dept. of Plant Biology, Univ. of New Hampshire, Durham, NH 03824

A field study was conducted to compare the effect of different planting densities and polyethylene mulch treatments on growth and yield of 'Mountain Fresh' trellised tomato grown on raised beds on 1.8-m centers. The experiment design was a split plot with four replications and four mulch treatments as main effects: 1) standard black mulch (B), 2) Sonoco red mulch (R), 3) black mulch with inter-row (between beds) reflective white on black mulch (B/W), and 4) red mulch with inter-row R/W. Subtreatments were three within-row spacings: 1) 0.60 m (8966 plants/ha); 2) 0.45 m (11955 plants/ha; standard spacing), and 3) 0.30 m (17932 plants/ha). Yield was determined from eight-plant plots and adjacent plants were harvested at regular intervals to determine plant biomass accumulation and partitioning of biomass among roots, stems, leaves, and reproductive organs. There was a linear increase in yield among mulch treatments with increasing plant density. The B/W mulch treatment increased midseason and total yields ≈20% over that of the other mulch treatments. Fruit yield of plants with the B/W mulch treatment at the 0.3-m spacing was 54% higher (151 MT/ha) than that of plants grown on black mulch with the standard plant spacing of 0.45 m (97.9 MT/ha). There was a linear decrease in fruit size with increasing plant density; however, plants grown at the 0.30-m spacing on the B/W mulched plots exhibited only a 2.7% decrease in fruit size as compared to plants grown at the standard 0.45-m spacing on black mulch.

Chilling Injury of Chile Peppers (*Capsicum annuum* L.)

Kathleen M. Sullivan and William J. Bramlage*, Dept. of Plant and Soil Sciences, Univ. of Massachusetts, Amherst, MA 01003

Seven types of chile peppers were tested for differences in susceptibility to postharvest chilling injury (CI). Cherry, cubanelle, Hungarian wax (HW), poblano, serrano, and both mature-green and full-color (red) jalapeño fruit were stored at 2.5, 7, and 15 °C for 0 to 30 days. External C_2H_4 production at 12 and 24 hours after removal from storage and internal C_2H_4 concentration at 24 hours were measured. There was no significant difference in C_2H_4 production after the first 12 hours, but serrano produced significantly less C_2H_4 than the other types during the second 12 hours. Among the cultivars there were differences in the amounts of internal C_2H_4 measured: HW had the highest levels measured, and serrano had undetectable levels. CI has been observed on bell and some chile pepper cultivars as small black pits, and the recommended nonchilling storage temperature is 7 °C for all peppers. In this study, scald (a surface browning) was observed on HW and cubanelle fruit in addition to pitting, which occurred on all the cultivars. Susceptibility to chilling varied among pepper types in this study. HW peppers were the most susceptible, manifesting scald after 4 days at 2.5 °C and scald and pits after 16 days at 7 °C. Serrano fruit were the most resistant to CI, only pitting after 23 days at 2.5 °C, and having no symptoms after storage at 7 °C for 30 days. Cherry and poblano peppers developed pits after 8 days at 2.5 °C. Both green and red jalapeños pitted after 12 days at 2.5 °C, and cubanelles had scald after 16 days at 2.5 °C. Poblano fruit had large, deep pits after 8 days at 7 °C, cherry peppers pitted after 12 days, and both green and red jalapeño fruit pitted after 16 days at 7 °C. Both pits and scald were observed on cubanelle fruit after 23 days at 7 °C. Recommendations for storage of peppers should be expanded to accommodate differences among cultivars.

Poster Session

Biomass Partitioning and Seed Yield in Hybrid Snackseed Pumpkins

Robert L. Chretien and J. Brent Loy*, Dept. of Plant Biology, Univ. of New Hampshire, Durham, NH 03824

A field study was conducted to compare seed yield and fruit biomass partitioning among 11 F_1 hybrid snackseed (hull-less seeded) pumpkins. Experimental plots were seeded on 3 June 1999, using a randomized complete-block design with four replications and 20 plants per plot. Rows were spaced 1.8 m apart; within-row spacing was 0.3 m. The plots were divided in half with 10 plants for fruit and seed yield determinations and 10 plants for fruit biomass partitioning studies. Seed yields among hybrids ranged from 818 kg·ha^{-1} for NH1003 to 1575 kg·ha^{-1} for NH1041. The three highest-yielding hybrids (NH1030, NH1040, and NH1041) were derived from sister lines crossed to a common parent and were characterized by small fruit size (0.8 to 1.4 kg) and high seed biomass per kilogram of fruit fresh weight. The next highest-yielding group of hybrids (NH1024, NH1043, NH1044, and NH1045) also had small fruit, and two pairs of hybrids, NH1024/NH1043 and NH1044/NH1045, each shared a common parent. The four lowest-yielding hybrids (NH1003, NH1025, NH1027, and NH1029) were characterized by larger fruit (2 to 3 kg) and low seed yield per kilogram fruit fresh weight, but had larger seeds (average between 175 to 183 mg) than the other hybrids (130 to 165 mg). Peak percent dry matter of mesocarp tissue at 35 days postanthesis (PA) was lowest in large-fruited hybrids and highest in the highest-yielding hybrids. In most hybrids, percent dry matter decreased between 35 days PA and fruit maturity (65 days PA), indicating a shortage of photosythates needed for maintaining mesocarp biomass and maximizing seed fill. The highest-yielding varieties partitioned a greater portion of fruit biomass into seeds rather than flesh. Seed yield per plot was highly correlated with seed yield per kilogram of fruit fresh weight.

Characterization of Nitrate Uptake by Kentucky Bluegrass at the Whole-plant and Organ Levels

Yuexia Wang, Chhandak Basu, Zhongchun Jiang, and W. Michael Sullivan*, Dept. of Plant Sciences, Univ. of Rhode Island, Kingston, RI 02881-0804

It has been suggested that shoot demand for nitrogen controls nitrate uptake in plant roots. In turfgrasses, shoots are partly removed by regular mowing, which may severely alter nitrate uptake ability. However, reported groundwater nitrate concentrations under intensively managed turf are well below the USEPA maximum contaminant limit of 10 mg·L^{-1} nitrate-N in potable water. We hypothesize that the turfgrass root can also exert significant control over its nitrate uptake ability. The present study was to test this hypothesis by comparing nitrate uptake rates of excised roots and intact, whole plants of six Kentucky bluegrass (*Poa pratensis* L.) cultivars. Three replications or cultures of each cultivar were grown in sand for 15 months. For whole-plant nitrate uptake, the roots were placed in a flask filled with 200 mL of a nutrient solution containing 0.125 mM nitrate. Nitrate depletion was monitored at 20-minute intervals over an 8-hour period under ≈600 µmol·m^{-2}·s^{-1} photosynthetic photon flux density. After the whole-plant experiment, the plants were placed in an N-free nutrient solution for 15 hours, and the roots were then excised. The excised roots were placed in a beaker containing 60 mL of the 0.125-mm nitrate nutrient solution and nitrate depletion was monitored at 20-minute intervals over a 6-hour period. Whole-plant nitrate uptake rate differed significantly ($P \leq 0.05$) among cultivars and was twice that of excised roots. Excised root nitrate uptake rate exhibited no cultivar difference but was positively and significantly ($P \leq 0.05$) correlated with whole-plant nitrate uptake rate. Our results indicate that turfgrass roots exert substantial control over nitrate uptake.

Cytokinin Expression in *Campanula* Transformed with Isopentenyl Transferase Gene

Young Hee Joung[1], Mark S. Roh[1], Kathryn Kamo[1], and Jeoung Seob Song[2]*, [1]USDA, Agricultural Research Service, National Arboretum, Floral and Nursery Plants Research Unit, Beltsville, MD 20705; [2]Rural Development Administration, National Horticultural Research Institute, Floriculture Division II, Suweon, Korea

The main goal of this research was to develop *Campanula glaumerata* 'Acaulis' plants transformed with the isopentenyl transferase (*ipt*) gene for increased growth of the axillary buds and en-

hanced insect resistance. Isopentenyl transferase is a first enzyme in the cytokinin biosynthetic pathway. For *Campanula* transformation, leaf discs were co-cultivated with *Agrobacterium tumefacience* LBA4404, which harbored the binary vector pBC34 (A. Smigocki, Beltsville, Md.) that codes for the *nos-npt*II gene and the *ipt* gene controlled by the CaMV35S promoter. The transformation frequency was about three times higher when leaf blade explants were infected with LBA4404 containing pBC34 as compared to infection with pGUSINT, which contains the *gusint* gene instead of the *ipt* gene. This difference in transformation frequency was attributed to expression of cytokinin from the *ipt* gene. Transgenic plant lines containing the *ipt* gene were verified by southern hybridization and divided into three groups by phenotype following culture in vitro on MS medium: 1) yellow/large leaves, no rooting; 2) green/large leaves, no rooting; 3) green/normal leaf size, rooting. These different phenotypes could be due to different levels of cytokinin expression in the transgenic plants.

Changes in Essential Elements Levels during Flower Development

*Sven Verlinden**, Divison of Plant and Soil Sciences, P.O. Box 6108, West Virginia Univ., Morgantown, WV 26506

Flower senescence in many plants is associated with a significant increase in ethylene production. This ethylene has been shown to play a regulatory role in the demise of the petals. The regulation of petal senescence by ethylene is thought to facilitate the ordered breakdown and remobilization of cellular constituents to other plant and flower organs. In order to gain insight in the remobilization of cellular constituents, we investigated changes in P, Ca, Mg, Mn, Cu, Fe, and Co concentrations in petunia corollas from flowers at anthesis through senescence. Our results showed that all elements in our study were present in lower concentrations in corollas than mature leaves. Phosphorus concentration decreased from ≈2000 $mg \cdot kg^{-1}$ in presenescent corollas to 1500 $mg \cdot kg^{-1}$ in senescing tissue, a change correlated to increases in ethylene production by the corollas. Increases in Ca, Mg, and Mn concentrations were noted during development of corollas from anthesis to senescence. However, no clear correlation exists between these changes and the ethylene climacteric since increases were gradual and continuous from anthesis to senescence. Calcium concentrations increased 3- to 4-fold from anthesis to senescence. Changes in Mg and Mn concentrations were less pronounced and were limited to 2- to 3-fold increases for Mn and a 2-fold increase for Mg. Concentrations of Cu, Fe, and Co fluctuated throughout development and ranged from 2 to 14, 88 to 544, and 0 to 4 $mg \cdot kg^{-1}$, respectively.

Use of a Food-processing Residual Compost for Salad Green Production on Organic Farms: Soil Response and Crop Yields

Christopher Worden, George Elliott, Bernard Bible, Karl Guillard, and Thomas Morris*, Dept. of Plant Science, Univ. of Connecticut, U-Box 67, Storrs, CT 06269

A composting facility in New Milford, Conn. (NMF), utilizes food-processing residuals, including spent tea leaves, coffee grounds, cocoa shell and cleanings, wastewater treatment sludge from a food ingredients manufacturing plant, and past-expiration processed vegetable products. Materials are composted in aerated, frequently turned windrows under cover. The range of inputs, combined with time constraints on the composting process, has resulted in a variable, immature compost product with a high rate of microbial activity. Users have expressed concern about potential phytotoxicity or nutrient immobilization from using NMF compost. Therefore, research was conducted to determine the influence of cured and uncured NMF compost amendments on potentially sensitive crops with high nutrient requirements. Arugula (*Eruca vesicaria*) and green bibb lettuce (*Lactuca sativa*) were grown on two Connecticut organic farm research sites in 1998 and 1999. Both sites have soils classified as coarse loamy over sandy or sandy-skeletal, mixed, mesic, typic, Dystraudepts. Farms differed in the length of time under organic farm management. One farm has been an organic farm since 1988 and consequently has high soil fertility, while the other was a first-year organic farm in 1998, and had relatively low soil fertility. Three amendment types were applied: cured compost, uncured compost, and organic fertilizer ($5N–3P_2O_5–4K_2O$). Amendment application rates were estimated to provide a comparable range of plant-available nutrients for the amendments and a control without fertilizer. Compost application rates were 3.4, 6.8, 20.2, 35.8, and 71.7 $Mg \cdot ha^{-1}$ (dry-weight basis) in 1998 and 11.2, 22.4, 44.8, and 89.6 $Mg \cdot ha^{-1}$ (dry-weight basis) in 1999. Organic fertilizer application rates were 1.34, 2.68, 5.36, 10.72, and 21.44 $Mg \cdot ha^{-1}$ in 1998 and 1.34, 2.68, 5.38, and 10.72 $Mg \cdot ha^{-1}$ in 1999. Soil organic matter and nutrients increased with amendment application rate at both locations. Crop yields increased with amendment rate at the new, lower-fertility farm, but yields did not respond to amendments at the older, higher-fertility farm. Yield differences were minor between the uncured and cured compost treatments at both locations. This indicates that either cured or uncured NMF food-processing residual compost can be successfully used as an organic soil amendment for salad green production.

Postharvest Development of Leaf Yellowing in Cut Asiatic and Oriental Lilies

*Susan S. Han**, Dept. of Plant and Soil Sciences, Univ. of Massachusetts, Amherst, MA 01003

The development of postharvest leaf yellowing affects the quality of cut Oriental and Asiatic lilies. Without cold storage, lower leaves began to turn yellow ≈1 week after placing them in an interior environment. The development of leaf yellowing continued to progress upward until the vase life was over with >25% of the leaves chlorotic. Cold storage of cut lilies worsened this leaf disorder. The longer the duration of cold storage, the sooner the development of leaf yellowing and the higher the percentage of leaves that were chlorotic. Spraying leaves with a solution containing 25 $mg \cdot L^{-1}$ each of BA and GA_{4+7} significantly reduced cold-stored induced leaf yellowing in both Oriental and Asiatic lily. While the growth regulator treatment completely prevented leaf yellowing of cold-stored Asiatic lilies, its effectiveness in Oriental lilies diminished with the duration of cold storage. Timing of the growth regulator application was not critical, as there were no differences in leaf yellowing when the growth regulator solution was sprayed before or after the cold storage. The concentration of the growth regulators was inversely related to the development of leaf yellowing and concentrations <5 $mg \cdot L^{-1}$ each of BA and GA_{4+7} were not effective. Alternative means of applying the growth regulators were evaluated, including the addition of the growth regulators to the preservative solution or as a pulsed treatment. Both methods completely prevented leaf yellowing but also induced bud abortion. For practical application, spraying the growth regulator solution on the leaves prior to or after cold storage would significantly improve postharvest quality of the cut lilies.

Paper Session II

Seedless Watermelon Production: Extension's Role in Supporting a New Crop Enterprise

Tracy Wootten and Ed Kee*, Univ. of Delaware, Research and Education Center, R.D. 6, Box 48, Georgetown, DE 19947

In response to a national increase in the consumption of triploid (seedless) watermelons, seedless watermelon production in Delaware has increased to 43% of the total watermelon acreage. Cultural practices for triploid watermelon production are similar to seeded (diploid) types. However, poor seed germination, high seed costs, erratic performance, and inadequate varieties limited their adoption until the early 1990s in Delaware. Univ. of Delaware Cooperative Extension has worked with Delaware growers to develop a "recipe" for successful triploid production. Extension programs, such as on-farm demonstrations, research trials, educational seminars, and one-on-one consultations, have enabled producers to provide high-quality fruit and yields. Intensive management and marketing are the keys to

success as Delaware producers have become leaders of triploid production in the Northeast region. As demand for triploid watermelon continues to increase, extension will remain a vital part of the $4.5 million industry. Growers continually deal with marketing issues in a supply and demand–driven market. As more seedless are on the market and profits lessen, growers will have to be diligent in their marketing and management practices.

Improving Mechanical Harvest Pickle Production

Ed Kee[*1], *Tracy Wootten*[1], *James Adkins*[1], *and James Glancey*[2], [1]Univ. of Delaware, Research and Education Center, R.D. 6, Box 48, Georgetown, DE 19947; [2]Univ. of Delaware, Dept. of Bio-Resources Engineering, 71 Townsend Hall, Newark, DE 19717

Proper variety selection and production practices are critical to obtaining profitable yields of mechanically harvested pickling cucumbers (*Cucumis sativus* L.). On the Delmarva peninsula, the tractor-mounted harvester, which utilizes the pinch-roller system for separating the pickles from the vine, was used exclusively for harvest until 1998. The pull-type forced-balance shaker machines have been introduced as an alternative harvest system. Replicated commercial-size variety trials have been conducted for four consecutive years. The trials are planted twice during the growing season, reflecting the climactic differences associated with early-season and late-season plantings. 'Vlaspic' and 'Lafayette' are standard varieties. Promising new varieties include 'EX 1914' and 'SQRP 1882'. Investigations to determine optimum plant populations and row spacing have determined that three-row beds with 60,000 plants per acre provide the highest yields and best quality fruit. Optimal operating speeds and picking reel speeds of 1.4 mph and 45 rpm, respectively, have been determined for the tractor-mounted machine. Additional design improvements have been implemented and evaluated to reduce damage. Fifty-nine replicated commercial tests evaluating the tractor-mounted harvester and the forced-balance shaker type indicate much greater harvest and throughput efficiencies are associated with the forced-balance shaker harvester, resulting in improvements between $65 and $100 per acre.

Identifying and Improving Factors That Limit Yield and Profitability in Lima Bean Production

Ed Kee[*1], *Tracy Wootten*[1], *and James Glancey*[2], [1]Univ. of Delaware, Research and Education Center, R.D. 6, Box 48, Georgetown, DE 19947; [2]Univ. of Delaware, Bio-Resources Engineering, 71 Townsend Hall, Newark, DE 19717

Average yields of baby lima beans (*Phaseolus lunatus* L.) are consistently lower in Delaware than California and the Pacific Northwest. Comparison of production practices revealed differences in plant populations, soil type, irrigation, relative humidity, temperature, and plant size for the two areas. Research plots conducted simultaneously in Delaware and California were consistent with commercial experience in that plant mass and shelled bean yield were greater in California. Documentation of lima bean ontogeny revealed more than one flower cluster at a single node in an inflorescence can be produced. Multiple flower clusters contributed to the higher yields in California, but tended to abort under Delaware conditions. Pod-stripper combines are the predominant method of harvesting lima beans for processing in the Mid-Atlantic region. Eighty-four field tests in 1994 and 1995 showed total crop loss during harvest averaged 23.6% of the commercial yield. The predominant losses occurred at the combine header. Variety, lack of field levelness, and improper operation parameters were identified as major contributors to loss.

Interaction of Potassium Form and Nitrogen Rate: High K Is Not a Cure for Excessive N

Carolyn J. DeMoranville[*1] *and Joan R. Davenport*[2], [1]Univ. of Massachusetts Cranberry Experiment Station, P.O. Box 569, E. Wareham, MA 02538; [2]Washington State Univ. IAREC, Route 2, Bunn Road, Prosser, WA 99350

It has been speculated that cranberries are susceptible to chloride injury. If this is the case, it is possible that applications of high rates of 0–0–60 (KCl) fertilizer as a K source could be detrimental to cranberry productivity. Grower anecdotes of using 0–0–60 to "shut down the plants" persist. Supposedly, using 225+ $kg \cdot ha^{-1}$ of this material slows or arrests vegetative growth. In fact, growers have claimed it can overcome the production of rank vegetation that results when too much N fertilizer has been applied. Field plots were initiated to determine the suitability of KCl and to determine if high K rates could overcome the deleterious effects of excess applied N. Plots were set up in a split-block plot design with N doses [three each "normal" (28–34 $kg \cdot ha^{-1}$ N) vs. "high" (56–67 lb N/A)] in one direction and potassium/chloride treatments in the other direction (KCl or K_2SO_4 at 115 or 225 kg K_2O; $CaCl_2$ to give the equivalent Cl as in the high-rate KCl treatment, and a nontreated control) for a total of 36 2×2-m plots per each of three cultivar locations. Plots were treated and evaluated for three consecutive years. There were no significant differences in yield among the K_2SO_4 and KCl treatments, indicating that at rates as high as 225 $kg \cdot ha^{-1}$ K_2O, 0–0–60 and 0–0–50 perform similarly. Further, treatment with $CaCl_2$ had no significant effect on yield. In the third year, plots receiving no K treatment had significantly lower yield than those receiving either rate or form of K (single degree of freedom comparison, significant at 0.03). These results indicate that at the rates used in this study, KCl is an adequate K source. The effect of N rate was more pronounced than that of the K treatments. In years two and three, the low N rate strips had significantly greater yield compared to that in the high N rate strips. By year two, the high N strips were visually different, with rank overgrowth. There was no significant interaction of N rate and the K treatments. While there was a trend for greater difference between the 0 K and 115 kg K rates in the high N plots compared to the moderate N plots, the addition of K never entirely overcame the negative yield effects of high N rate.

Cranberry Establishment and Growth at Varying Water Tables

*Bruce D. Lampinen**, Univ. of Massachusetts, Cranberry Experiment Station, P.O. Box 569, E. Wareham, MA 02538

Although capillary rise plays an important role in providing water to cranberry plants, the relation between water level and plant establishment and growth has not been adequately studied. The aim of this study was to maintain constant water levels and to monitor the effects on establishment, root growth, and aboveground growth in greenhouse-grown cranberries. Cuttings from cranberry (*Vaccinium macrocarpon* Ait.) cultivar Stevens were rooted in sand-filled pots in the greenhouse for ≈2 weeks and then transplanted to sand-filled PVC tubes. The water level in the tubes was set 7.5, 15, 22.5, 30, or 37.5 cm below the top of the sand surface. Pan evaporation was estimated using PVC tubes filled with water to the same level as the sand in the planted tubes. Extension growth of uprights and runners was measured every 3 days. After growing in the PVC tubes for 90 days, all plants were harvested and upright length, runner length, leaf dry weight, stem dry weight, root length, and root dry weight were measured. There was a similar mortality rate among plants in all of the treatments. Water use varied among the treatments, with the 7.5-cm water level treatment using the least water. The 15-cm water level used the most water, with water use then decreasing in a linear fashion for the 22.5-, 30-, and 37.5-cm treatments. At the conclusion of the study, aboveground dry weight was significantly less for plants in the 7.5-cm treatment compared to any of the other treatments, while it was highest in the 15-cm water level treatment and decreased with lower water levels in a linear fashion as did the average daily water use. The patterns of root dry-weight accumulation were different among the treatments with the highest accumulation in the 22.5-cm water level treatment and decreasing root dry weight with both higher and lower water level treatments. This study points out the detrimental effects of a too high water table, but it also shows that there are costs associated with establishing a deeper rooting system. The benefit of the deeper root system probably outweighs the cost of production however, since shallow root systems lead to increased susceptibility to drought stress and decreased access to nutrients.

A Comparative Study of Onion Maggot "Delia Antiqua" Monitoring Techniques

Wesley Kline, Scott Haag, and Gerald Ghidiu,* Rutgers Cooperative Extension, 291 Morton Ave., Millville, NJ 08332

Onion maggots have reduced green onion and leek production in southern New Jersey for at least the last 80 years. Growers routinely apply soil insecticides at planting and spray for larvae and adult flies during the season. Two monitoring methods are available for determining adult fly activity. New York researchers have demonstrated that cone traps can be used. Two traps are placed near onion fields and checked for adult flies twice per week to determine peak fly emergence. Ontario researchers use yellow sticky cards for monitoring onion maggot flies in the onion fields. Three 10 × 15-cm cards are placed on each side of the field and are checked twice per week. An experiment was conducted in New Jersey to determine which system is more reliable and easier for consultants and growers to use. Two cone traps were placed at the edge of one onion field and yellow cards were placed in another field on four farms. The traps were checked twice per week from 29 Mar. to 22 Oct. Both monitoring methods tracked the adult flights, but the average number of flies captured was higher on the sticky cards. Ease of use is important if either system will be used as a monitoring tool. Sticky cards are more difficult to maintain since they must be replaced at least every 2 weeks. Since fields are irrigated or cultivated every week in southern New Jersey, the cards become covered with soil, reducing effectiveness. Also, it is more difficult to determine male and female flies on sticky cards.