

Research Highlights

Tomato Growth in Spring-sown Cover Crops

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Additional index words. *Lycopersicon esculentum*, legume/monocot mixtures, winter rye, field peas, undercutting, allelochemicals, tropical climates

Abstract. Pure and biculture stands of rye 'Wheeler' (*Secale cereale* L.) and field pea (*Pisum sativum* L.) were established and killed for mulch in Spring 1996, 1997, and 1998, in Columbus, Ohio. Treatments were five rye to pea proportions, each with a high, medium, and low seeding rate. Their effects on tomato (*Lycopersicon esculentum* Mill.) growth and yield were compared with those of a weedy check; a tilled, nonweeded check; and a tilled, hand-weeded check. Tomato tissue and soil were sampled for nutrient analysis. Number of leaves, branching, height, leaf area, dry weight, rate of flowering and fruit set, and fruit yield of tomato plants varied directly with the proportion of pea in the cover crop and decreased with reduced cover crop seeding rates. In 1997, yields of tomato were as high as 50 MT·ha⁻¹ in the 1 rye : 3 pea cover crop; yield was poorest in the weedy check (0.02 MT·ha⁻¹ in 1996). Most of the cover-cropped plots produced better yields than did the conventionally weeded check. No consistent relationship between levels of macronutrients in tomato leaf and soil samples and the cover crop treatments was established. Spring-sown rye + pea bicultures (with a higher ratio of pea) have a potential for use in tomato production. *HORTSCIENCE* 35(5):843.

Performance of Satsuma Mandarin Mandarin Protected from Freezing Temperatures by Microsprinkler Irrigation

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Additional index words. *Citrus unshiu*, cold hardiness

Abstract. Several microsprinkler treatments were tested on 5-year-old satsuma mandarin orange (*Citrus unshiu* Marc.) trees to compare survivability of trunks and scaffold limbs in severe freezes. Three damaging freeze events occurred during winter, with two in 1995–96 and one in 1996–97. Air temperature dropped to -9.4, -5.6, and -6.7 °C, respectively. Almost 90% of the foliage was dead on the control plants after the first freezing event and 98% after the second. A single microsprinkler 1.6 m high in the canopy delivering 90.8 L·h⁻¹ reduced injury; only 54% of the canopy was dead after the first freeze and 71% after the second. There was slightly more

shoot-tip dieback on the plants in the microsprinkler treatments than on the control plants after the first two freezes. The amount of limb breakage by ice was minor. The third freeze killed 34% of the canopy in the control plants, but only 26% in the plants in the microsprinkler treatments. Use of microsprinklers increased yield in 1996, but yield for all treatments was very low. Yield for all treatments fully recovered in 1997, averaging 153 kg/tree. Although no death of scaffold limbs or trunks occurred, these results demonstrate that microsprinkler irrigation reduces damage to foliage and increases yield somewhat in severe freezes. *HORTSCIENCE* 35(5):856.

Management of Diamondback Moth (Lepidoptera: Plutellidae) in Cabbage Using Collard as a Trap Crop

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Additional index words. cultural control, *Diadegma insulare*, integrated pest management, IPM, natural enemy conservation, cabbage looper, *Brassica oleracea*, *Plutella xylostella*, *Trichoplusia ni*

Abstract. Collard greens (*Brassica oleracea* var. *acephala* L.) were planted in the peripheries of cabbage (*Brassica oleracea* var. *capitata* L.) fields in the spring growing seasons of 1997 and 1998 to evaluate their effectiveness as a trap crop to manage the diamondback moth (DBM) [*Plutella xylostella* (L.)]. The numbers of DBM never exceeded the action threshold for application of insecticides in any of the

fields that were completely surrounded by collards, but did exceed the action threshold in three of the fields without collards on four sampling dates in 1998. In both years, the numbers of DBM larvae in the collards exceeded the action threshold of 0.3 total larvae/plant in eight of nine fields. Larval counts in cabbage surrounded with collards were not significantly higher than in the conventionally planted cabbage, even though the number of pesticide applications was reduced in the former. The few pesticide applications in fields surrounded by collards probably targeted the cabbage looper [*Trichoplusia ni* (Hübner)], which was not impeded by the collards from infesting the interior cabbage. There was no significant reduction in marketability, and damage to cabbage was similar to that in fields where collards were planted and in fields where only conventional pesticides were used. The reduced number of pesticide sprays, as well as the high concentration of host larvae in the collards, may help maintain populations of natural enemies of DBM in the agroecosystem. Planting collards in field peripheries is a potentially effective tactic to manage DBM in cabbage. *HORTSCIENCE* 35(5):875.

Optimum Height at Which to Kill Barley Used as a Living Mulch in Onions

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Additional index words. cover crop, fluzifop-P, planting configuration, crop competition, soil erosion, wind damage, *Hordeum vulgare*, *Allium cepa*

Abstract. Planting barley (*Hordeum vulgare* L.) as a living mulch with onions (*Allium cepa* L.) reduces soil erosion and protects the onions from wind damage. It can also reduce yield and size of onion bulbs if not managed correctly. In a 4-year study at the Oakes Irrigation Research Site in North Dakota, barley was planted in the spring at the same time that onions were direct-seeded. Barley rows were planted either parallel with or perpendicular to the onion rows. Barley was killed with fluzifop-P herbicide when ≈13, 18, 23, or 30 cm tall. Onion size and yields

were reduced when barley was allowed to grow taller than 18 cm before killing it. Total onion yield was usually greater when barley was planted parallel with, rather than perpendicular to, onion rows. Chemical name used: (R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid (fluzifop-P). *HORTSCIENCE* 35(5):853.

The Use of Vinegar Vapor to Reduce Postharvest Decay of Harvested Fruit

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Additional index words. acetic acid, *Penicillium expansum*, *Monilinia fruticola*, *Botrytis cinerea*, apple, strawberry, cherry, apricot, peach

Abstract. Vapors of several common vinegars containing 4.2% to 6.0% (= 2.5 to 3.6 mol·L⁻¹) acetic acid effectively prevented conidia of brown rot [*Monilinia fruticola* (G. Wint.) Honey], gray mold (*Botrytis cinerea* Pers.:Fr.), and blue mold (*Penicillium expansum* Link) from germinating and causing decay of stone fruit (*Prunus* sp.), strawberries (*Fragaria xananassa* Duchesne), and apples (*Malus xdomestica* Borkh.), respectively. Fruit were fumigated in 12.7-L sealed containers in which vinegar was dripped on to filter paper wicks or vaporized by heating from an aluminum receptacle. Vapor from 1.0 mL of red wine vinegar (6.0% acetic acid) reduced decay by *M. fruticola* on 'Sundrop' apricots (*Prunus armeniaca* L.) from 100% to 0%. Similarly, vapor from 1.0 mL of white vinegar (5.0% acetic acid) reduced decay in strawberries by *B. cinerea* from 50% to 1.4%. Eight different vinegars, ranging from 4.2% to 6.0% acetic acid, of which 0.5 mL of each vinegar was heat-vaporized, reduced decay by *P. expansum* to 1% or less in 'Jonagold' apples. The volume of heat-vaporized white vinegar (5.0% acetic acid) necessary to reduce decay by *P. expansum* on 'Jonagold' apples to zero was 36.6 μL·L⁻¹ of air. Increasing the number of conidia on the apple surface reduced the effectiveness of vinegar va-

por. The number of lesions caused by *P. expansum* on 'McIntosh' apple decreased exponentially with increasing time of fumigation, approaching zero after about 6 hours. These results suggest that vinegar vapor could be an effective alternative to liquid biocides such as sodium hypochlorite for sterilization of surfaces contaminated by conidia of fungal pathogens. *HORTSCIENCE* 35(5):898.

Nitrogen Increases Fresh Weight and Retail Value of Fraser Fir Christmas Trees

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Additional index words. *Abies fraseri*, budset, biomass, foliage area, needle traits, shearing, leader number, retail value

Abstract. *Abies fraseri* (Pursh) Poir. Christmas trees were fertilized for 5 years with four levels of N (0, 56, 113, or 170 kg·ha⁻¹ per year) in spring, fall, or equally split between spring and fall. Nitrogen did not affect leader length, number of leaders, or bud frequency on the upper (distal) portion of the leader. Nitrogen increased bud frequency on the lower (proximal) 20 cm of the leader in only 1 of 3 years of measurement. All application schedules increased the number of apical buds on branches, whereas the number of lateral buds was increased only by spring applications. Nitrogen increased tree fresh weight and retail value as well as weight, length, and surface area of needles. Foliar N concentrations in the fall varied with fertilization schedule, and were higher in November than in October. *HORTSCIENCE* 35(5):860.

Germination and Emergence of Parsley in Response to Osmotic or Matric Seed Priming and Treatment with Gibberellin

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Additional index words. *Petroselinum crispum*, stand establishment, gibberellic acid

Abstract. 'Moss Curled' seeds of parsley (*Petroselinum crispum* L.) were primed osmotically in polyethylene glycol or matrically in fine, exfoliated vermiculite at -0.5 MPa for 4 or 7 days at 20 or 30 °C with 0 or 1 mM GA₃. All priming treatments stimulated and hastened germination. Matric priming resulted in greater germination (89%) than osmotic priming (83%) when seeds were primed for 7 days at 30 °C, but priming agent had no effect on germination percentage following priming at 20 °C or for 4 days. In seeds primed for 4 days at 20 or 30 °C, matric priming hastened germination more than did osmotic priming. Germination was generally less synchronous with matric than with osmotic priming. Increasing priming time from 4 to 7 days increased the rate of germination, but increased germination synchrony only when seeds were primed at 20 °C. Inclusion of 1 mM GA₃ during priming had little or no effect on germination. All matric priming treatments (other than 4-day priming) were repeated to assess seedling emergence in a greenhouse (25 °C day/22 °C night). Priming increased the percentage, rate and synchrony of emergence, and increased hypocotyl length at 3 weeks after planting. Priming at 30 °C with 1 mM GA₃ resulted in the greatest emergence percentage, hypocotyl length, and shoot dry weight. We conclude that matric priming is a satisfactory alternative to osmotic priming of parsley seeds. Chemical name used: gibberellic acid (GA₃). HORTSCIENCE 35(5):907.

Date of Seeding Affects Establishment of Cool-season Turfgrasses

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Additional index words. Kentucky bluegrass, *Poa pratensis*, perennial ryegrass, *Lolium perenne*, tall fescue, *Festuca arundinacea*, crabgrass, *Digitaria* sp., dormant-seeding, nitrogen, phosphorus

Abstract. Little documentation exists on the success of seeding cool-season turfgrasses in the late fall, winter and spring. The objectives of these two studies were to document the success of seeding Kentucky bluegrass (*Poa pratensis* L.), perennial ryegrass (*Lolium perenne* L.), and tall fescue (*Festuca arundinacea* Schreb.) at less-than-optimum times of the year, and to determine if N and P fertilizer requirements vary with seeding date of Kentucky bluegrass. 'Ram 1' Kentucky bluegrass, 'Fiesta' perennial ryegrass, and 'Mustang' tall fescue were seeded on 1 Sept., 1 Oct., 1 Nov., 1 Dec., 1 Mar., 1 Apr., and 1 May \pm 2 days beginning in 1989 and 1990. As expected, the September seeding date produced the best establishment, regardless of species. Dormant-seeding Kentucky bluegrass and tall fescue in November, December, or March reduced the establishment time compared with seeding in April or May. Seeding perennial ryegrass in November, December, or March may not be justified because of winterkill potential. To determine the effect of starter fertilizer on seedlings made at different times of the year, 'Ram 1' Kentucky bluegrass was seeded 1 Sept., 1 Nov., 1 Mar., and 1 May \pm 2 days in 1989 and 1990, and the seedbed was fertilized with all combinations of rates of N (0, 24, and 48 kg·ha⁻¹) and P (0, 21, and 42 kg·ha⁻¹). Fertilizer rate had no effect on establishment regardless of seeding date, possibly because of the fertile soil on the experimental site. HORTSCIENCE 35(6):1166.

Control of Height and Flowering of *Ixia* Hybrids as Container Plants

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Additional index words. growth regulator, growth retardant, triazole, paclobutrazol, preplant treatment

Abstract. Growth and flowering of *Ixia* hybrids as potted plants can be controlled environmentally by cool preplant storage of corms, regulation of greenhouse forcing temperatures, and application of a growth retardant. Paclobutrazol applied as a preplant corm soak, a postemergent drench, or a postemergent spray in combination with a 2- to 4-week preplant storage of corms at 7 °C, and an 18 °C day/10 °C night forcing temperature produced attractive and marketable plants. Chemical name used: β -[(4-chlorophenyl)methyl]- α -(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol (paclobutrazol, Bonzi®). HORTSCIENCE 35(6):1087.

Flowering and Fruit Set of Pumpkin Cultivars under Field Conditions

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Additional index words. *Cucurbita pepo*, pistillate flower, fruit production, pollination

Abstract. Field experiments with six pumpkin cultivars (*Cucurbita pepo* L.) were conducted in Ithaca, N.Y., in 1992 and 1993 to characterize the patterns of flowering and fruit set. Plants of all cultivars produced the greatest number of female flowers and exhibited the highest rate of fruit set 35–45 days after transplanting, during the first 2 weeks of greatest flower production (“peak bloom”). During the 3 weeks of peak bloom, each plant produced an average of 3.4 pistillate flowers in 1992 and 5.4 in 1993, and fruit set was 50.9% in 1992 and 74.6% in 1993, yielding 1.7 and 4.0 fruit per plant, respectively. In 1994, flower production was further studied with the cultivar Wizard. Flowers were produced in a ratio of 33 staminate to 1 pistillate flower over the entire season. Climatic conditions appeared to be secondary to physiological factors in affecting flowering and fruit set during all three seasons. Characterization of fruit set patterns in pumpkin may aid producers in scheduling pollination services and predicting yields. *HORTSCIENCE* 35(6):1074.

Weed Control in Carrots: The Efficacy and Economic Value of Linuron

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Additional index words. *Daucus carota*, hand-weeding, cost-benefit analysis, *Chenopodium murale*, *Malva parviflora*, *Phalaris minor*, herbicide

Abstract. Application of linuron was compared with hand-weeding and a nontreated control (= control) for weed control in carrots. Linuron, applied pre- or postemergent, was slightly less effective than the 100% weed control obtained by

hand-weeding. Carrot yields were similar for all treatments, and were at least six times as great as in the control. In 1996, linuron treatments returned net profits ranging from \$980 to \$1887 per ha, compared to \$740 for hand-weeding and –\$2975 for the control. In 1997, return on linuron treatments was greater, ranging from \$5326 to \$6426, compared with \$2852 for hand-weeding. Marginal rates of return ranged from 21% to 86% in 1996. In 1997, rates of return for every dollar invested in linuron were over 59%. Chemical name used: *N*-(3,4-dichlorophenyl)-*N*-methoxy-*N*-methylurea (linuron). *HORTSCIENCE* 35(6):1089.

Trehalose Delays Senescence in Cut Gladiolus Spikes

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Additional index words. cut flower, cycloheximide, *Gladiolus ×grandiflora*, iodoacetic acid, sugars, tetranitro blue tetrazolium (TNBT), vase-life, water content, wilting

Abstract. Florets of cut gladiolus (*Gladiolus ×grandiflora* hort. cv. Fujinoyuki) spikes kept at 25 °C under 14 h light/10 h dark condition showed severe wilting 4 days after flower opening. Treatment with 0.1 M trehalose prolonged vase-life 2 days, whereas inhibitors and other sugars had no effect. The upper florets also opened properly in trehalose-treated spikes, but not in cycloheximide-treated ones. After 4 days, the first florets of trehalose-treated spikes maintained water content more effectively than did controls or spikes treated with other sugars. The parenchyma adjacent to vascular bundles in the petals of trehalose-treated spikes maintained viability for 4 days. These results suggest that trehalose preserves cell viability in gladiolus spikes, thereby enhancing water uptake into petal tissues. *HORTSCIENCE* 35(6):1107.