

COHORT

A NEWSLETTER FOR TURFGRASS, LANDSCAPE, AND NURSERY ISSUES.

NURSERY NEWS

by Ursula K. Schuch

CULTURAL PRACTICES AND POINSETTIAS -

How fertilizer and irrigation regimes affect plant growth and silverleaf whiteflies

U.K. Schuch, R.A. Redak, and J. Bethke

In recent years fertilizer recommendations have been re-evaluated because nitrate leaching from intensive greenhouse production has become a major environmental concern. According to The Poinsettia Manual, approximately 250 mg N/liter constant fertigation are recommended for poinsettias (*Euphorbia pulcherrima* Willd.). However, a previous study reported that acceptable poinsettias were grown with 125 mg N/liter and subirrigated, indicating that this crop can be produced with as little fertilizer as 50% of the current recommended level. Our objectives were to evaluate six poinsettia cultivars for their vegetative growth and physiological characteristics in response to three fertilizer and two irrigation regimes, as well as using cultural treatments and host-plant resistance to control populations of the silverleaf whitefly (*Bemisia argentifolii* Bellows and Perring).

Six cultivars of poinsettia 'Angelika White', 'Celebrate 2', 'Freedom Red', 'Lilo Red', 'Red Sails', and 'Supjibi Red' were grown for nine weeks during vegetative development under three constant fertilizer treatments, 80, 160, or 240 mg N/liter and two irrigation treatments, well watered or water deficient.

Growth of all cultivars was similarly affected by fertilizer and irrigation treatments. The lowest fertilizer treatment (80 mg/liter) produced unacceptable plants with smaller leaf

area, proportionally bigger stems, and chlorotic foliage. Doubling the fertilizer concentration to 160 mg N/liter eliminated chlorosis and resulted in an attractive green foliage, the intensity of which varied by cultivar. Deficit irrigation reduced plant height, leaf area, and leaf and stem growth, and resulted in a relatively sparse canopy. Stomatal conductance and transpiration were also reduced under low irrigation and with increasing fertilizer application.

Chlorophyll content (measured *in situ* and with a SPAD-502) was approximately 40% or 50% higher for the medium and high fertilizer treatment compared to the low treatment. Average leaf N concentrations for the low, medium, and high fertilizer treatments were 3.66%, 4.49%,

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and 4.59%, respectively. Increasing N from 80 to 160 mg/liter increased both leaf N and leaf chlorophyll content, but the response to further increase of fertilizer to 240 mg N/liter was cultivar specific. Under the conditions of this study, acceptable poinsettias could be grown with 160 mg N/liter continuous fertilizer application and irrigation volumes of 240 ml every other day. A further increase in fertilizer concentration is unwarranted because it showed no benefit for shoot biomass production or plant quality as expressed in foliage color.

Plant characteristics of six poinsettia cultivars grown under three fertilizer and two irrigation regimes.

	Leaf area (cm ²)	Leaf dry wt. (g)	Stem dry wt. (g)	Chlorophyll SPAD **
Fertilizer (mg N/liter)				
80	2708 c*	12.0 c	8.2 a	26.5 b
160	3394 b	13.6 b	5.7 c	37.8 a
240	3947 a	15.1 a	6.8 b	38.4 a
Irrigation (ml/pot)				
120	2592 b	10.5 b	5.1 b	34.9 a
240	4107 a	16.8 a	8.7 a	33.6 a
Cultivar				
Angelika White	4477 a	15.2 a	8.3 a	34.1 bc
Celebrate 2	2991 bc	12.0 c	6.6 b	32.0 c
Freedom Red	2765 c	12.6 bc	5.9 b	35.0 b
Lilo Red	3518 b	15.0 a	7.3 ab	39.2 a
Red Sails	3435 b	14.6 ab	7.1 ab	31.9 c
Supjibi Red	2912 bc	12.3 bc	6.2 b	33.0 bc
* Means within a column for a treatment are significantly different at $p < 0.05$, Duncan's multiple range test.				
** Measured six weeks after treatments begun.				

Soluble foliar protein has been suggested as an indicator for host plant preference to phytophagous insects. Previous studies suggested higher concentrations of foliar protein to be associated with increased preference of such plants to insects. In our study, soluble foliar protein content was unaffected by irrigation and fertilizer treatments, but was cultivar specific. Leaves of 'Supjibi Red' and 'Angelika White' contained 0.26 and 0.24 mg/g dry weight, while leaves of the other four cultivars contained less soluble proteins, ranging from 0.21 to 0.19 mg/g dry weight.

Although cultural treatments did not alter soluble foliar protein content, they affected survivorship and development time of the silverleaf whitefly. Low irrigation significantly reduced insect survivorship and low fertilizer treatment decreased insect development time. Cultivars influenced whitefly populations significantly; a higher percentage of eggs survived to the pupa stage and from the pupa to the

adult stage on 'Supjibi' (about 50%) versus 'Celebrate 2' (about 20%) or 'Angelika White' (about 27%). In a preference trial, 'Celebrate 2' and 'Angelika White' were least preferred by whiteflies, whereas 'Freedom Red' plants were most preferred as indicated by the number of nymphs on poinsettia leaves. Whiteflies developed slowest from egg to adult on 'Angelika White' (26 days) and three days faster on 'Freedom Red' and 'Celebrate 2'. Combining cultivar selection and fertilizer and irrigation treatments, whiteflies could be reduced by more than 50%.

Ranking of poinsettia cultivars from best to worst as they are suggested for growers based on this study. Best preference, survivorship, and development refer to lowest number of nymphs per unit leaf, lowest percent survival from egg to adult, and slowest development time of whiteflies.

Ranking	Preference	Survivorship	Development
Best	Angelika	Celebrate 2	Angelika
	Celebrate 2	Angelika	Supjibi
	Lilo Red	Freedom	Red Sails
	Red Sails	Lilo Red	Lilo Red
	Supjibi	Red Sails	Freedom
Worst	Freedom	Supjibi	Celebrate 2

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SOUTHERN CALIFORNIA BEDDING PLANT PACK TRIALS

Seed companies have always offered an open house for customers to admire their new and existing varieties of bedding plants. This April, rather than trekking to several individual seed companies in Northern California, we had the opportunity to visit Sunrise Growers bedding plant pack trials in Carson, California. Open to the public for the first time, this trial featured 1,100 varieties of bedding plants from all the prominent seed companies. Just to give an example, there were 234 petunia varieties from 10 seed suppliers. The other species displayed were pansy, impatiens, geranium, marigold, dianthus, alyssum, lobelia, phlox, stock, celosia, zinnia, vinca, salvia, begonia, gazania, snapdragon, and verbena. The trial represented plant material that was grown using the same cultural techniques, including media, fertilizer, watering, plant growth regulators, or other pesticides that Sunrise Growers normally uses in their operation.

Seeds of each cultivar were sown at three dates and scheduled to be finished (100% bloom) on March 30, April 12, and April 26, 1995. When I visited the nursery on April 13, a wide range of developmental stages could be observed, with the last sowing just about ready to bloom, the second sowing at the peak of bloom, and the first sowing past their prime. Differences in shelf life between cultivars were obvious when comparing plants from the first sowing. I also took the opportunity to pick some likely candidates for the next growth regulator studies. If you are interested in bedding plants, don't miss this unique opportunity next year. Mark your calendar for March 1996 to contact Sunrise Growers (phone 310/425-6453) and find out about their pack trial dates. - *Ursula Schuch* -

NEW CE SPECIALISTS FOR ORNAMENTALS AT UC RIVERSIDE

Two new CE Specialists have started their positions on the Riverside campus on July 1, 1995.

Marcella Grebus joined the Department of Plant Pathology to work on turf, nursery and floriculture. You can reach her at phone: (909) 787-5508, FAX: (909)787-4294, and e-mail: mgrebus@ucr.ac1.ucr.edu. Marci received her MS and recently her Ph.D. from the Department of Plant Pathology at The Ohio State University. Composts are definitely her strong side since the objectives of her re-

search were to 1) develop a commercial-scale process for the production of biocontrol agent-fortified compost-amended potting mixes consistently suppressive to several soilborne plant pathogens; 2) assess biocontrol agent-fortified compost topdressings for efficacy in control of dollar spot (*Sclerotinia homoeocarpa*) on creeping bentgrass cv. 'Penncross'; and 3) generate a random amplified polymorphic DNA (RAPD) system for detection and identification of the introduced but indigenous biocontrol agent *Trichoderma hamatum* 382.

Antoon Ploeg joined the Department of Nematology to work on ornamentals after leaving his position as a research scientist at the Research Institute for Plant Protection in Wageningen, the Netherlands. You can reach him at phone: (909) 787-3192, FAX: (909)787-3719 or e-mail: atploeg@mail.ucr.edu. Toon graduated with a BS from the Agricultural University Wageningen, the Netherlands, and received a Ph.D. in 1992 from St. Andrews University in Scotland. A virologist by training, his research has focused on studying interactions between trichodorid nematode vectors, tobacco rattle virus and crop species of bulbous ornamentals and potato.

LANDSCAPE LEXICON

by *Dennis R. Pittenger*

PREVENTING GRAFFITI BY DESIGN

Graffiti is simply defined as crude drawings, inscriptions or scrawlings written or drawn on walls or other surfaces so as to be seen by the public. Once only an inner-city problem, graffiti has spread to virtually every area of the country. Many municipalities have adopted aggressive anti-graffiti programs that include both prevention and removal components.

Preventing graffiti by design is a process that centers on reviewing new and existing developments to identify design elements that can be integrated into a project to discourage potential graffiti problems. Detailed reviews of the site plans, landscaping, building elevations, walls, and fencing, usually indicate that *well-planned landscaping* is the key design element for discouraging or preventing graffiti

within the project because it integrates strongly with the other elements. Careful selection and placement of plant materials denies access to graffiti artists and discourages their interest in a site because the plants screen the public view of their "art."

Following are check lists to review a development's design elements for graffiti prevention. The plant list represents a brief enumeration of species that can be especially effective in preventing graffiti. I am presently working to develop a more complete list for this purpose.

■ Site Planning Elements:

- ☛ Provide good lighting in all areas.
 - Locate structures close to street or existing activity areas.
- ☛ Provide enough visual access to police all major areas and sides of the site or structure.
- ☛ Provide physical barriers (slopes, plant material, drainage ditches, etc.) to walls or structures.
- ☛ Provide activity on the site, as much and as long as possible.
 - Avoid creating areas that cannot be observed or supervised (alleys, narrow spaces between walls and buildings, access to building roofs from adjacent walls, etc.).
 - Where applicable, use forms other than a 6-foot concrete block screening wall. Consider the use of tubular steel or wrought iron (with or without pilasters), vines, or other forms of landscaping, landscape hedges, or combinations of the above.
 - Provide elements in the site design which facilitate good property management practices. These would include the ability to provide litter pick-up, landscape maintenance, and periodic touch-up and repainting—all of which give an impression of power and control on the part of the property owner or manager.

■ Architectural Elements:

- ☛ Darker and highly-textured surfaces are not as likely to be vandalized.
- ☛ Use materials which resist paint and ink or paint materials with polyurethane-based products or products which seal porous surfaces.
- Large flat surfaces, including windows, should be divided into smaller components.
- Include decorative elements such as trellises, pillars, pop-outs, recessed areas on structures and walls to reduce large, unbroken surface areas.
- Add more windows to structure to increase views.
- Provide internal roof access with hatches instead of external roof ladders.
- Assess structural aspects of signage to reduce the amount of flat surface areas on wall and freestanding signs.

■ Landscape Elements:

- Landscape with shrubs and groundcover to provide a barrier to structures and walls and to replace walls used for visual screening (where applicable).
- ☛ Landscape with trees to provide a partial visual barrier to large, flat surface areas.
- ☛ Provide vines on walls.
 - Use larger plant material to transplant in areas of greater potential graffiti impact.
 - The following list provides a brief enumeration of plant materials which are useful as an aesthetic means of deterring graffiti by covering, screening or restricting access to walls and structures.

V I N E S

BOTANICAL NAME	COMMON NAME	COMMENTS*
<i>Antigonon leptopus</i> 'Baja Red'	queen's wreath	D, C (may freeze to ground)
<i>Clytostoma callistegioides</i>	violet trumpet vine	E, S
<i>Ficus pumila</i>	creeping fig	E, C
<i>Gelsemium sempervirens</i>	Carolina jessamine	E, Tw/S
<i>Hedera helix</i>	English ivy	E, C
<i>Jasminum grandiflorum</i>	Spanish jasmine	D/E, Tw/S
<i>Jasminum officinale</i>	white jasmine	D/E, Tw
<i>Jasminum polyanthum</i>	pink jasmine	E, Tw
<i>Lonicera japonica</i>	Japanese honeysuckle	E, S
<i>Parthenocissus tricuspidata</i> 'Veitchii'	Boston ivy	D, C
<i>Wisteria sinensis</i>	Chinese wisteria	D, S

SHRUBS/SMALL TREES

BOTANICAL NAME	COMMON NAME	COMMENTS*
<i>Acacia armata</i>	kangaroo thorn	E, T (large screen)
<i>Acacia decora</i>	graceful wattle	E (large hedge)
<i>Carissa macrocarpa</i>	natal plum	E, T
<i>Crataegus phaenopyrum</i>	Washington hawthorne	D, T (small tree)
<i>Escallonia exoniensis</i>	none	E, Es
'Frades'		
<i>Ilex cornuta</i> (except 'Burford')	Chinese holly	E, F, Es
<i>Juniperus chinensis</i> 'Armstrong', 'Blaauw', 'Fruittland'	juniper	E
<i>Leptospermum scorparium</i>	New Zealand tea tree	E (shrub)
<i>Mahonia aquifolium</i>	Oregon grape	E, F
<i>Mahonia lomariifolia</i>	none	E, F (very upright)
<i>Mahonia pinnata</i>	California holly grape	E, S, F
<i>Olmediella betscherana</i>	Costa Rican holly	E, F (shrub or small tree)
<i>Podocarpus gracilior</i>	fem pine	E, Es (small tree)
<i>Pyracantha coccinea</i>	firethorn	E, T, Es
<i>Pyracantha fortuneana</i>	firethorn	E, T, Es
<i>Pyracantha 'Santa Cruz'</i>	firethorn	E, T (shrub)
<i>Pyrus kawakamii</i>	evergreen pear	D/E, T, Es
<i>Viburnum burkwoodii</i>	viburnum	D/E, Es
'Dawn'		
<i>Viburnum macrocephalum</i>	Chinese snowball	D/E, Es

*KEY TO COMMENTS:

C=	Vines that cling to surface	F=	Spiny foliage
D=	Deciduous	S=	Vine that needs substantial support
E=	Evergreen	T=	Thorns on stems
Es=	Best use as espalier	Tw=	Vine that twines and needs minimal support

AUTUMN COLOR OF TREES

Brilliant coloration of foliage in the autumn is a desirable characteristic of deciduous tree species. With declining temperatures and shorter days of autumn, the growth of deciduous trees slows and their leaves stop producing chlorophyll, while existing chlorophyll begins to disintegrate. In some species other pigments (anthocyanin, carotene, and xanthophyll) are present and unmasked as the chlorophyll is lost resulting in leaves that are various shades of red, yellow, or orange. Many species show little color change in autumn, while brilliant displays of color are common in many maple species, sumac, eastern white oak, scarlet oak, hickory, sweetgum, sourwood, and sassafras. Variation among species may reflect genetic variability in pigment production and rate or amount of chlorophyll breakdown in autumn.

Anthocyanins are the pigments that produce red and related colors in leaves. They are water soluble glycosides and their formation is favored by carbohydrate accumulation. Trees of the same species may vary in autumn color because of genetic potential for anthocyanin production or variation in the amounts of soluble carbohydrates present in the plant. Any environmental factor that influences carbohydrate production by the plant or the conversion of insoluble carbohydrates to soluble carbohydrates will improve anthocyanin formation and bright foliage colors. Temperature, light and available water are the primary factors. Low, non-freezing temperatures, bright light and dry autumn weather conditions will favor anthocyanin production. Early frosts actually reduce the brilliance of red autumn colors. Thus, clear, dry, cool non-freezing weather will optimize foliage coloration.

Typical Autumn Color of Selected Tree Species

YELLOW

Striped maple	American beech
Norway maple	European beech
Ohio buckeye	White ash
Apple serviceberry	Modesto ash
Allegheny serviceberry	Maidenhair tree
Common pawpaw	Star magnolia
Birch spp.	Black gum
Hickory spp.	Poplar spp.
Japanese chestnut	Golden larch
Chinese chestnut	White oak
Redbud spp.	Shingle oak
Fringetree	Korean mountainash
American yellowwood	

RED

Amur maple	Blackgum
Fullmoon maple	Sourwood
Japanese maple	Persian Parrotia (red to yellow)
Norway maple	Chinese pistache (red to orange)
Red maple	Miyama cherry
Silver maple	Nippon cherry
Tatarian maple (red to yellow)	Wild red cherry
Shadblow serviceberry (yellow to red)	Bradford Callery pear
Allegheny serviceberry (yellow to red)	Ussurian pear
American hornbeam	Red oak
Katsuratree (yellow to scarlet)	Scarlet oak
Flowering dogwood	Pink oak
Corneliancherry dogwood	Shumard oak
Pacific dogwood (red to yellow)	Black oak
American smoketree	Sassafras
Lavalle hawthorn (bronze to red)	Korean mountainash
Glossy hawthorn (orange to red)	European mountainash
Washington hawthorn	Korean stewartia
Franklin tree	Zelkova
American sweetgum	

NO AUTUMN COLOR

Hedge maple	Hardy rubber tree
Boxelder	European ash
Sycamore maple	Walnut spp.
Baumann horsechestnut	Laburnum spp.
Tree of heaven	Magnolia spp.
Silk tree	Crabapple spp.
European alder	English oak
European hornbeam	Locust spp.
Chinese tohn	Japanese pagodatree
Turkish filbert	Japanese tree lilac
Single seed hawthorn	Littleleaf linden
English hawthorn	Crimean linden
Russian olive	Common or European linden

References:

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NEWS AND REVIEWS

TOP 10 HERBS

Herbs have always been favorites with gardeners, but there has been a large increase in herb purchases in the past 5 years. The 10 most popular herbs today, according to the International Herb Association, are: chives, basil, rosemary, lemon verbena, sage, oregano, sweet marjoram, parsley, French tarragon, and thyme. (Source: National Garden Bureau.)

CAL POLY SLO NEWS

The ornamental horticulture department at Cal Poly, San Luis Obispo has a new name: the environmental horticulture science department. The change has been in the works for several years; the university approved it early last fall. The degree will remain a bachelor of science in ornamental horticulture. The name change was supported by the O.H. department's Advisory Council; individual members cited the fact that many horticulture departments across the county have already made the name change to environmental horticulture. (Source: CLCS *The Cutting Edge* newsletter.)

TURFGRASS TALK

by Victor A. Gibeault

NITROGEN FATE IN TURFGRASS SYSTEMS

Nitrogen is the nutrient supplied by fertilization that is used the most by turfgrasses, and it is the nutrient that is supplied most frequently and in the largest amount by turfgrass managers. It is needed for many plant processes and components and is basic to the growth and development of all turfgrasses and to the appearance and recuperative ability of those grasses. Nitrogen is supplied to turf sites at various rates and frequencies and from various sources. The fate of the nitrogen applied is important because nitrogen can be a mobile nutrient, that is, it can move from the site where applied to ground and surface waters or to the atmosphere by leaching and runoff or by volatilization and thereby

create a possible environmental concern. Understanding the fate of nitrogen used in turfgrass systems is, therefore, important as is understanding optimum cultural practices to ensure the efficient use of nitrogen by the turfgrass sward.

Nitrogen fertilizer is applied as fast-release sources, such as ammonium sulfate, or as slow-releases sources, such as synthetic organic or natural organic nitrogen carriers. When the nitrogen from these sources, or from residual soil organic sources, is in the nitrate ion form (either from nitrate fertilizers directly or from the mineralization/nitrification of organic nitrogen carriers), it is not bound to soil or organic colloids. Being in the soil-water, it is mobile and can be taken up by turfgrass and other plant roots, or it can move from the immediate turfgrass system by leaching or runoff. In contrast, when a nitrogen source experiences rapid mineralization, ammonia is produced. If the ammonia is not quickly dissolved in water, it can be lost to the atmosphere. Gaseous nitrogen loss can also be caused by the chemical reduction of nitrate in a saturated soil by microorganisms, producing elemental nitrogen and nitrous oxides which are subject to loss. Therefore, losses of nitrogen from the "system" can occur in the nitrate, ammonia, elemental nitrogen and nitrous oxide forms.

Recently, numerous studies have been conducted at various turfgrass research institutions on the fate of nitrogen applied to turfgrasses under differing conditions. Several of the studies were coordinated by a project supported by the United States Golf Association while other studies were based on needs of local turfgrass interests or water agencies. As an example, at UC Riverside Dr. Marylynn Yates headed a study that was designed to evaluate the fate of nitrogen and pesticides applied to simulated golf course "fairway" and "green" turfgrasses. The in-field study examined two soil types for the fairway and a sand-based medium for the green, two irrigation regimes (at 100% and 130% of calculated water need) and two fertilizers at two levels (at 1-lb N/1000 sq ft per month and 0.5 lb N/1000 sq ft per month). Lysimeters with drainpipes were used under field conditions to capture any nitrogen that went through the system. It was found that between 0.30 and 1.71% of the nitrogen applied leached out of the profile on the fairway treatments. There was no difference in the amount of nitrogen leached caused by soil type, fertilizer type or irrigation amount. In the simulated putting green, the nitrogen leached was between 0.56 and 1.69% of the total applied with no differences noted from the other treatments.

Other studies found similar, very low levels of nitrogen leaching. A Michigan State University researcher

(Branham) reported that less than 0.2% of the nitrogen applied was recovered below the turfgrass root system and that the nitrogen detected was at least 10 times below the drinking water standard. A Nevada study (Bowman) reported a total leachate loss at 1% or less for tall fescue and bermudagrass turf. Nitrogen leaching in a Cornell study was found to be minimal, with practically all samples being considerably below the drinking water standard.

In contrast, a project conducted by Drs. Brauen and Stahnke at the Washington State University Puyallup Research and Extension Center found that nitrates could leach from newly constructed sand putting greens. It was the objective of their work to quantify the effect of rooting medium, fertilization interval and annual nitrogen rate on nitrate movement from creeping bentgrass putting greens. They found that nitrogen leaching was greater during the first year of the study than the second; that the leaching in the first year was related to nitrogen application rate and was strongly modified by rooting medium and frequency of nitrogen application; and that nitrogen concentration leached from pure sand was greater than nitrogen leached from a sand-peat medium. They found that the combination of modified sand rooting medium, moderate levels of total annual nitrogen applications and frequent nitrogen applications gave the lowest nitrogen leaching loss (3-5% of nitrogen applied on an annual basis) in the first year of a newly constructed sand based green. In the second year, nitrate concentration in the leachates was greatly reduced from those observed in the first year of the study. As an example, nearly zero concentration was found in the summer and early fall time periods of the second year, irrespective of treatments. The researchers suggested that the results observed in the second season was due to more extensive rooting, increased thatch and increased organic matter in the root zone.

Gaseous loss of nitrogen can occur if rapid mineralization of a recently applied nitrogen source, such as urea, results in the release of ammonia, and the ammonia is not dissolved in water to produce the ammonium ion. It has been clearly shown, however, that gaseous loss of nitrogen can be minimized by applying water immediately after the application of fertilizer; Dr. R. Hull reported that only about 1% of the nitrogen volatilized in his studies when "watering-in" was practiced. Gaseous nitrogen loss can also be caused by the chemical reduction of nitrate in a saturated soil by microorganisms, producing elemental nitrogen and nitrous oxides which are gases and subject to loss. Interestingly, the above mentioned Michigan State University project estimated that a considerable amount of the applied ni-

trogen may have volatilized and this avenue of nitrogen loss should be considered further from a research perspective.

In summary, it has been found that most nitrogen applied to turfgrass usually stays in the "turfgrass system." Analysis of nitrogen in turfgrass clippings, verdure, thatch and soil show that the "system" is dynamic, because the high level of surface organic matter associated with turfgrass swards supports a high level of microbial activity. Microorganisms in turn use nutrients for their growth and return those organic bound nutrients to the "system" upon death. Fertilizer nitrogen applied to a dense, mature and well-maintained turf is normally rapidly used by the turfgrass plant and by soil microorganisms. There appears to be little chance of downward movement of nitrogen, other than on pure sand with immature turf present, however cultural practices should be followed to minimize such a possibility. Those practices would include, but not be limited to, the following: **water-in fertilizer immediately following application; apply nitrogen when turfgrass roots can use the nutrient and when nitrate levels are expected to be low; use low nitrogen rates or slow release sources on sands or very leachable soils; and avoid overirrigation closely following fertilization and avoid runoff at that same time.**

References:

- From: *USGA Green Section Record*, January/February, 1995**
 D. Bowman, D. Devitt and W. Miller. The Effect of Salinity on Nitrate Leaching from Turfgrass. 45-49 pp.
- B. Branham, E. Miltner and P. Rieke. Potential Groundwater Contamination from Pesticides and Fertilizers Used on Golf Courses. 33-37 pp.
- S. Brauen and G. Stahnke. Leaching of Nitrate from Sand Putting Greens. 29-32 pp.
- M. Petrovic. The Impact of Soil Type and Precipitation on Pesticide and Nutrient Leaching from Fairway Turfs. 38-41 pp.
- M. Yates. The Fate of Pesticides and Fertilizers in a Turfgrass Environment. 10-12 pp.
- From: *TurfGrass Trends*, Vol 4, Issue 9. Sept. 1994**
 Hull. Nitrogen Fate: What Happens to it and Where Does it Go? 1-10 pp.


C A L E N D A R

MONTH	EVENT AND LOCATION	CONTACT
Aug. 30-31	CAN Ornamental Horticulture Research Conferences, San Diego, California	Carol Hutchings (916) 567-0505
Sept. 12-13	Turfgrass and Landscape Research Conferences, Riverside, California	Susana Denney (909) 787-4430
Sept. 14-16	International Plant Propagators Society - Western Region 36th Annual Meeting, Portland, Oregon	Allan Elliott (503) 868-7971
Sept. 30 - Oct. 4	International Professional Plant Growers Assn. Conference and Trade Show. San Jose, California	Kathy Kochendorfer, PPGA 1-800-674-PPGA
	F & N Workgroup meeting in conjunction with the PPGA meeting.	Richard Evans (916) 752-6617
Oct. 4-5	Southern California Turfgrass Council EXPO, Costa Mesa Fairgrounds.	Pam Pavela (909) 734-5251



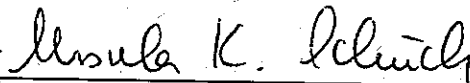
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