HortScience 21(3):463–464. 1986.

Comparative Effects of Ancymidol and Paclobutrazol on Easter Lily

T.J. Gianfagna[1] and G.J. Wulster[1]
Department of Horticulture and Forestry, Rutgers University, P.O. Box 231, New Brunswick, NJ 08903

Additional index words. PP333, Bonzi, A-Rest, *Lilium longiflorum*

Abstract. **'Nellie White' Easter lilies were treated with either ancymidol or paclobutrazol as a soil drench (1, 2.5, or 5 mg·pot^{-1}) or as a foliar spray (5 mg·plant^{-1}). Ancymidol significantly retarded plant height at all concentrations and for both methods of application. In addition, ancymidol, at 5 mg·pot^{-1} soil drench, increased days to anthesis. Paclobutrazol did not retard height in this cultivar; in fact, the 2 lower rates increased height slightly and decreased days to anthesis. Plant height of 'Ace' Easter lilies was reduced by paclobutrazol treatments (5, 10, or 20 mg·pot^{-1} soil drench). This cultivar, however, was also more sensitive to ancymidol treatment than 'Nellie White'. Rates >1 mg ancymidol excessively retarded plant height. Paclobutrazol appears to have limited potential as a growth retardant for Easter lily. Although it must be used in higher amounts than ancymidol to control stem growth, it provides commercially acceptable height retardation over a wider range of treatment rates. Chemical names used: α-cyclopropyl-α-[4-methoxyphenyl]-5-pyrimidinemethanol (ancymidol); and β-[(4-chlorophenyl)methyl]-α-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol (paclobutrazol).**

Ancymidol has been effective in reducing plant height of Easter lily when applied as either a foliar spray or soil drench (9), or by immersion of bulbs in concentrated solutions (5) before planting. Ancymidol is, however, expensive and so biologically active that excessive height reduction can result, especially when applied as a soil drench. The purpose of this investigation was to compare the effectiveness of ancymidol with paclobutrazol, a growth retardant that has shown exceptional potential for controlling plant growth in a wide range of fruit and nut crops (2, 4, 10, 13), chrysanthemum (6), and poinsettia (12).

Easter lily bulbs (*Lilium longiflorum* Thumb. 'Nellie White' and 'Ace') were received well-rooted in 15-cm plastic pots from a commercial grower. The medium consisted of 50% sphagnum peat, 40% styrofoam, and 10% coarse sand (by volume) and was amended with 5.2 kg of dolomitic lime, 0.039 kg of Fe, and 0.07 kg of granular Aqua-Grow·m^{-3}.

Plants were grown on a single greenhouse bench at 15°C night and 20° day temperatures during the course of the experiment. Plants were irrigated and fertilized with 200 mg·liter^{-1} N (15N–6.6P–12.5K) on a constant basis as required, with clear water irrigation provided once each week. 'Nellie White' plants were treated with 1, 2.5, or 5 mg of either ancymidol or paclobutrazol in 250 ml as a soil drench, or with 5 mg a.i. as a foliar spray (25 ml·plant^{-1}) when shoots were 10–14 cm in height. 'Ace' plants were treated with 1, 2.5, or 5 mg of ancymidol or 5, 10, or 20 mg of paclobutrazol in 100-ml aliquots as a soil drench. There were 10 replicates/treatment in a completely randomized design.

Height control. Applied as equal amounts of active ingredient per pot, ancymidol was a much more potent inhibitor of stem growth in 'Nellie White' than paclobutrazol (Table 1). Paclobutrazol applied at 1–2.5 mg·pot^{-1} was not effective. The 5 mg·pot^{-1} rate of paclobutrazol, however, produced significantly shorter plants in comparison to the 2 lowest paclobutrazol rates but not shorter than control plants of 'Nellie White'.

Increased growth with low concentrations of growth retardants has been reported. Pool found that low concentrations of 1,1-dimethylpiperidinium chloride (mepiquat chloride) increased internode elongation in grape, whereas higher concentrations reduced growth (7). Adepipe et al. (1) found an increase in growth and Reid and Crozier (11) found significantly higher amounts of gibberellin-like activity in peas with 2-chloro-*N,N,N*-trimethylethanaminium chloride (chlormequat chloride).

All ancymidol drench rates significantly reduced plant height but produced excessively short plants of no commercial value. The ancymidol spray reduced height to the same extent as the highest paclobutrazol drench rate. Plants receiving paclobutrazol as a spray were significantly taller than the ancymidol spray treatment, but not taller than controls (Table 1).

Plant height of 'Ace' was reduced by both paclobutrazol and ancymidol (Table 2). Paclobutrazol was effective at the 5 mg·pot^{-1} rate on 'Ace', whereas this treatment did not reduce plant height of 'Nellie White'. The high rates of paclobutrazol produced somewhat smaller plants, but height reduction was not excessive at any level, although some stem lodging was observed at the 20 mg·pot^{-1} paclobutrazol rate. Weakened stems also have been reported for ancymidol treatments (8, 9) and may be due to reduced wall thickening of cortical sclerenchyma cells (9).

Ancymidol was more effective than pa-

Table 1. Effect of rate and method of application of paclobutrazol and ancymidol on number of flowers per plant, number of days to anthesis, and plant height of 'Nellie White' Easter lilies.

Chemical treatment	Rate (mg·pot^{-1})	Final height (cm)	Number flowers per plant	Number days to anthesis
Control	---	30.9 ab[z]	4.9 a	60.2 b
Paclobutrazol (drench)	1.0	34.9 a	3.9 a	56.3 c
Paclobutrazol (drench)	2.5	34.9 a	4.1 a	54.2 c
Paclobutrazol (drench)	5.0	27.4 b	4.6 a	61.5 b
Paclobutrazol (spray)	5.0	35.0 a	4.6 a	59.6 b
Ancymidol (drench)	1.0	16.4 c	3.5 a	60.7 b
Ancymidol (drench)	2.5	14.0 c	4.2 a	66.5 ab
Ancymidol (drench)	5.0	12.2 c	3.8 a	69.7 a
Ancymidol (spray)	5.0	27.5 b	4.5 a	63.4 b

[z]Mean separation by HSD, $P = 0.05$ (n = 10).

Table 2. Effect of rate of soil drench application of paclobutrazol and ancymidol on number of flowers per plant, number of days to anthesis, and plant height of 'Ace' Easter lilies.

Chemical treatment	Rate (mg·pot^{-1})	Final height (cm)	Number flowers per plant	Number days to anthesis
Control	---	50.0 a[z]	7.1 a	63.5 a
Paclobutrazol	5.0	35.5 b	7.4 a	66.0 a
Paclobutrazol	10.0	31.9 bc	7.9 a	66.0 a
Paclobutrazol	20.0	28.1 c	7.1 a	65.2 a
Ancymidol	1.0	37.0 b	7.4 a	63.8 a
Ancymidol	2.5	17.5 d	6.6 a	71.5 b
Ancymidol	5.0	13.6 d	6.1 a	75.1 b

[z]Mean separation by HSD, $P = 0.05$ (n = 10).

Received for publication 21 June 1985. New Jersey Agricultural Experiment Station Publication No. 12145-13-85, supported by state and Hatch Act funds. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

[1]Assistant Professor.

clobutrazol in controlling plant height of 'Ace'. Rates of 1 mg·pot^{-1} reduced plant height to the same extent as the 5 mg·pot^{-1} paclobutrazol treatment. Despite the requirement for increased rates, paclobutrazol was effective over a wider range of treatment rates than ancymidol. All treatments (5–20 mg·pot^{-1}) produced plants of suitable commercial size, whereas only the 1 mg·pot^{-1} ancymidol treatment resulted in acceptable height control. Even the 2.5 mg·pot^{-1} rate produced excessively small plants.

Paclobutrazol at the 1 and 2.5 mg·pot^{-1} rates significantly reduced the number of days to anthesis (Table 1), an effect usually found after treating lilies with gibberellin (3). Ancymidol at the 2.5 and 5 mg·pot^{-1} rates increased days to anthesis in 'Nellie White' (Table 1) and 'Ace' (Table 2). In addition, neither ancymidol nor paclobutrazol affected the total number of flower buds produced by 'Nellie White' (Table 1) and 'Ace' (Table 2).

In conclusion, paclobutrazol effectively controlled height of 'Ace' lily, although the rates required for height retardation are greater than that for ancymidol. Paclobutrazol can be used to provide modest height control at the 5 mg·pot^{-1} rate without danger of drastic reductions in growth that may more easily occur with ancymidol treatment. Surprisingly, low rates of paclobutrazol (<2.5 mg·pot^{-1}) on 'Nellie White' resulted in a decrease in days to anthesis and a tendency toward increased plant height.

Literature Cited

1. Adepipe, N.O., Omrod, D.P., and Maurer, A.R. 1968. Response of peas to soil and foliar application of Cycocel ([2-chloroethyl]-trimethylammonium chloride). Can. J. Plant Sci. 48:323–325.
2. Aron, Y., S.P. Monselise, R. Goren, and J. Costo. 1985. Chemical control of vegetative growth in citrus trees by paclobutrazol. HortScience 20:96–98.
3. DeHertogh, A.A. and N. Blakely. 1972. Influence of gibberellins A_3 and A_{4+7} on development of forced *Lilium longiflorum* Thunb. cv. Ace. J. Amer. Soc. Hort. Sci. 97:320–323.
4. Greene, D.W. 1982. Effect of PP333 and its analogs on vegetative growth and fruit quality of 'Delicious' apples. HortScience 17:474. (Abstr.)
5. Lewis, A.J. and J.S. Lewis. 1981. Improving ancymidol efficiency for height control of Easter lily. HortScience 16:89–90.
6. McDaniel, G.L. 1983. Growth retardation activity of paclobutrazol on chrysanthemum. HortScience 18:199–200.
7. Pool, R.M. 1982. Effect of mepiquat chloride on the growth and yield of 'Concord' grapevines. J. Amer. Soc. Hort. Sci. 107:376–380.
8. Roh, S.M. and H.F. Wilkins. 1977. The influence and interaction of ancymidol and photoperiod on growth of *Lilium longiflorum* Thunb. J. Amer. Soc. Hort. Sci. 102:255–257.
9. Sanderson, K.C., W.C. Martin, Jr., K.A. Marcus, and W.E. Goslin. 1975. Effects of plant growth regulators on *Lilium longiflorum* Thunb. cv. Georgia. HortScience 10:611–612.
10. Stang, E.J. and G.G. Weis. 1984. Influence of paclobutrazol plant growth regulator on strawberry plant growth, fruiting, and runner supression. HortScience 19:643–645.
11. Reid, D.M. and A. Crozier. 1970. CCC-induced increase of gibberellin levels in pea seedlings. Planta 94:95–106.
12. Wilfret, G.J. 1981. Height retardation of poinsettia with ICI-PP-333. HortScience 16:443. (Abstr.)
13. Wood, B.W. 1984. Influence of paclobutrazol on selected growth and chemical characteristics of young pecan seedlings. HortScience 19:837–839.

HortScience 21(3):464–466. 1986.

Zoysiagrass Competition in Two Cool-season Turfgrasses Treated with Plant Growth Regulators

J.D. Fry[1] and P.H. Dernoeden[2]

Department of Agronomy, University of Maryland, College Park, MD 20742

Additional index words. *Lolium perenne, Poa pratensis, Zoysia japonica*, 'Meyer', amidochlor, ethephon, flurprimidol, mefluidide

Abstract. **This study was conducted to determine if the rate of 'Meyer' zoysiagrass (*Zoysia japonica* Steud.) establishment and spread could be enhanced when plugs were introduced into plant growth regulator- (PGR) treated Kentucky bluegrass (*Poa pratensis* L.) and perennial ryegrass (*Lolium perenne* L.) turfs. During the first growing season, PGR treatment made little difference in zoysiagrass spread. Zoysiagrass coverage in perennial ryegrass treated with mefluidide (57%) or amidochlor (63%) was significantly greater than in ryegrass treated with ethephon (47%) or the untreated control (48%) by the end of the 2nd year. Enhanced zoysiagrass spread in perennial ryegrass treated with mefluidide and amidochlor was attributed to stand thinning resulting from PGR phytotoxicity and environmental stress in the first year. Zoysiagrass coverage in Kentucky bluegrass was greatest in mefluidide-treated plots, but the increase over the control was only 6%. Flurprimidol slowed the establishment of zoysiagrass in both cool season turfs. Chemical names used: [(*N*-[(acetylamino)methyl]-2-chloro-*N*-(2,6-diethyl phenyl)acetamide (amidochlor); (2-chloroethyl)phosphonic acid (ethephon); α-(1-methylethyl)-α-[4-(trifluoromethoxy)phenyl]-5-pyrimidinemethanol (flurprimidol); and *N*-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino]phenyl]acetamide (mefluidide).**

Poor summer performance of cool-season turfgrasses in the transition zone has created a need to use warm-season grasses whenever possible. 'Meyer' zoysiagrass is a warm-season grass possessing excellent winterhardiness and summer performance and is frequently used as a transition zone turfgrass species (2). One factor limiting zoysiagrass use is its slow establishment rate (2). When planting plugs into bare soil, 2 or 3 years may be required for complete zoysiagrass coverage (2). Bare ground and subsequent weed encroachment can reduce the aesthetic quality and increase the establishment period of zoysiagrass. It may be desirable to plug zoysiagrass into an existing, cool-season turf to maintain turfgrass quality. Time required for establishment, however, is prolonged by competition from a cool-season species (3). Hubbel and Dunn (1) reported that PGRs could be used to reduce cool-season turfgrass competition and increase zoysiagrass establishment rate. Additional research is needed to determine PGR effectiveness in reducing competition from cool-season turfgrasses during zoysiagrass establishment. This study was initiated to determine PGR effects on turfgrass quality and competition of mature Kentucky bluegrass and perennial ryegrass turfs that had been plugged with 'Meyer' zoysiagrass.

These studies were conducted at the Univ. of Maryland Turfgrass Research Facility, Silver Spring. Separate studies were conducted on 3-year-old stands of 'Yorktown II' perennial ryegrass and a blend of 'Merion', 'Sydsport', and 'Vantage' Kentucky bluegrass. Soil at both sites was a Chillum silt loam (fine-silty, mixed, mesic Typic Hapludult) with a pH of 6.8 and 1.7% organic matter. The growth regulators evaluated were flurprimidol, mefluidide, amidochlor, and ethephon. Rates and formulation of the PGRs evaluated are shown in Tables 1–4. The

Received for publication 25 Feb. 1985. Contribution from the Agronomy Dept., Univ. of Maryland as Scientific Paper No. A-4078 and Contribution No. 7063 of the Maryland Agriculture Experiment Station, College Park, MD 20742. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

[1]Former Graduate Research Assistant.

[2]Associate Professor of Agronomy.