James B. Beard

PROCEEDINGS OF THE 22ND ANNUAL NORTH CAROLINA TURFGRASS CONFERENCE

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PREFACE

Proceedings of the 22nd Annual North Carolina Turfgrass Conference are being provided to those who attended as a permanent reference of the conference. The 1984 conference was held at the Pinehurst Hotel in Pinehurst, N. C., on January 3, 4 and 5. Sessions with general turf topics and concurrent sessions for golf course, lawn care and general turf topics were scheduled. The first trade show with 37 exhibitors was held in association with the conference. The attendance at the conference was 776 people.

Special thanks are extended to everyone who helped make this conference successful. Each speaker is to be commended for his excellent presentation and for providing a written summary for the proceedings. The Annual Turfgrass Conference was sponsored by the Turfgrass Council of North Carolina, Inc., North Carolina State University and the North Carolina Agricultural Extension Service in cooperation with the Turfgrass Associations. The following committee members contributed to the success of the conference.

CONFERENCE CHAIRMAN - Dr. W. B. Gilbert

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Ed Ancherico	Galen Decker	Chuck Dolge
Bill Riggan	George Thompson	

The 1985 North Carolina Turfgrass Conference will be held in Charlotte, N. C., on January 2, 3 and 4.

PROCEEDINGS EDITORS: L. T. Lucas and J. M. DiPaola, Extension Plant Pathology Specialist - Turf and Assistant Professor of Crop Science, respectively, N. C. State University, Raleigh, N. C. 27695-7616.

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Additional copies of the proceedings are available at $5.00 each from Dr. L. T. Lucas, Department of Plant Pathology, NCSU, Box 7616, Raleigh, N. C. 27695-7616. Make checks payable to The Turfgrass Council of North Carolina.

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Characterization and Identification of Hybrid Bermudagrasses

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Turf-type bermudagrasses are used throughout the South for all types of turf. All of these except common burmudagrass lack seed for propagation and require vegetative establishment. Increased demand for these grasses by consumers has led to increased acreage and growth in the sod industry. Because these grasses are propagated solely from vegetative cutting, sod farmers control the quality and purity of each cultivar.

Presently, there are over 20 different cultivars of turf-type bermudagrasses which have been made available for commercial release. Of that list, only 5 or 6 make up the majority of sod sales. Many of the turf-type cultivars of bermudagrass when grown under similar conditions are difficult or impossible to separate. Because of these similarities and the persistent growth habit of all bermudagrasses, maintaining pure stands of each cultivar is a major concern. Sod farmers, golf course superintendents and other turf professionals who deal with these bermudagrasses are constantly battling with the question of cultivar purity.

In 1980, research was initiated at Mississippi State University to characterize and identify turf-type bermudagrass cultivars. Methods used for characterization and identification involved the measurement of plant features including leaf angle, node diameter, internode diameter, leaf width, leaf length, sheath length and internode length. Measurements were initially made on turf-type bermudagrasses growing side-by-side in field plots. Although these plots were pure and from a distance uniform, quantitative measurements varied due to difference in microclimate and sampling procedures. Because of this problem, each cultivar was sampled and grown under controlled conditions (plant growth chambers) in hydroponic culture (nutrient solution without soil). This new approach provided uniform growth expression; however, it also made it difficult for others to use this procedure because of the specialized growing conditions. The data presented in table 1 provides a unique comparison of each cultivar, yet these numbers will not duplicate those that one may find if measured on a lawn or golf green. Rather, these figures are to be used for making relative comparisions between cultivars. These comparisons are very informative because they are similar in order of magnitude for field grown cultivars. This comparison of cultivars allows one the opportunity to gain a better insight into the characteristics and growth habit of each cultivar. In addition to characterization, the findings of this study supply a means of identification given an opportunity to grow the plant samples under controlled environmental and nutrient conditions. Careful review of table 1 will provide one with insight and information previously unavailable until now.

Table 1. Quantitative measurements of plant features which allow for the relative comparison and identification of each turf-type bermudagrass cultivar listed.

Cultivar	Leaf Angle	Cultivar	Node diameter	Cultivar	Internode diameter	Cultivar	Leaf width	Cultivar	Leaf length	Cultivar	Sheath length	Cultivar	Internode length
	--deg--		--mm--		--mm--		--mm--		--mm--		--mm--		--mm--
Tidwarf	67.2	Common	1.30	Common	.89	Common	1.91	Common	52.7	Common	19.0	Common	39.3
Tiflawn	56.4	Tifway	1.19	Tifway	.79	Tifway	1.91	Tifway	36.7	Tifway	17.0	Midiron	26.2
Pee Dee	54.5	U-3	1.19	U-3	.77	U-3	1.68	Midiron	36.6	Midiron	13.8	U-3	21.2
Tifgreen	54.0	Tiflawn	1.07	Midiron	.70	Tiflawn	1.58	Tifway 2	32.5	Tifway 2	32.5	Tifway	17.7
Midiron	51.8	Midiron	1.05	Tiflawn	.68	Tidwarf	1.57	U-3	29.8	U-3	12.1	Tiflawn	17.0
Tifway	51.5	Tifway 2	.98	Tifway 2	.66	Midiron	1.45	Tiflawn	21.7	Tiflawn	9.8	Pee Dee	14.5
U-3	50.1	Tidwarf	.90	Tidwarf	.57	Tifway 2	1.40	Tifgreen	19.6	Tifgreen	8.4	Tifgreen	12.8
Common	45.4	Tifgreen	.87	Tifgreen	.54	Tifgreen	1.26	Pee Dee	15.9	Pee Dee	6.6	Tifway 2	12.4
Tifway 2	42.3	Pee Dee	.83	Pee Dee	.49	Pee Dee	1.24	Tidwarf	9.1	Tidwarf	5.4	Tidwarf	6.5

+values based on 60-72 replications per cultivar combined from four independent experiments.

TURFGRASS ASSOCIATIONS

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INTRODUCTION:

It's a pleasure to be here at Pinehurst to address this group. In a way, I envy the fact that you're dealing with both warm and cool season grasses. The challenge, from an Association standpoint, must be enormous. I'm not familiar with your soil types, but they have to have more substance to them than our sandy Florida soils. In Florida, we just assume that we have nothing to work with, and start from scratch. I am familiar with much of your state as a tourist, and I'd like to compliment all of you who play such an important part in making it look so beautiful. I've traveled the piedmont, outer banks, and mountains, and have often commented to my wife how well-groomed it always looks.

PRESENTATION:

My feelings about Turfgrass Associations are that they should provide a myriad of services to their respective memberships. Primary among these services are education, research, and scholarship.

I'll elaborate on these a little later. But, first, allow me to give you an outline of the history of the Florida Turf Grass Association.

On December 16, 1952, a group of dedicated turf people met with Dr. Gene C. Nutter in Miami to form the Florida Turf Association. Joe Konwinski, still active in our organization, was elected the first president. In May of the following year, twenty-four men met in Orlando to appoint committees and plan the first annual University of Florida Turf Management Conference, co-sponsored by the Florida Turf Association, the Florida Agricultural Experimental Station and the Florida Agricultural Extension Service. This two-day conference was held at the University of Florida, Gainesville, in August 1953.

1955 was an interesting year for F.T.G.A. A survey showed approximately 200 million dollars per year were spent on lawn care alone. Another study showed there were 125 golf courses in the state and a few of these had sand greens. (Today's estimates are that 1 billion dollars annually are involved in turf maintenance, and some 700 courses exist -- none, to my knowledge, with sand greens.)

Officers and directors of F.T.G.A. paid their dues in advance to have money to operate for the rest of the year. The Association began to recognize a need for and to promote the establishment of an extension turf position at the University of Florida. This position was established in 1957. And in 1957, the Vegetative Certification program was finalized and became administered under the State Department of Agriculture. Two years later, Floratine St. Augustine was the first grass released in Florida under the Certification program.

In the early 1960's, the F.T.G.A. Scholarship-Research Foundation was chartered and the first Florida Turf-Grass Trade Show was held. In 1962, the first Executive Secretary was hired.

An Executive Committee was formed in 1965 to handle affairs between full Board Meetings, and a long range Master Planning Committee was instituted. The first Golf Tournament for Scholarship and Research was held at the Diplomat Country Club in Hollywood, Florida in 1967.

In 1969, the first grant-in-aid to the University of Florida Department of Horticulture was provided. And, in the same year, student membership classification was established.

Innovation marked the decade of the 70's for F.T.G.A. A new F.T.G.A. logo emerged and the Board voted to have one or more advisory members from all educational institutions in Florida with turfgrass programs as members of the Board of F.T.G.A.

Work began on a Turf Survey for Florida and the first combined Conference and Trade Show was held at Curtis Hixon Convention Center in Tampa. In 1976, the turf survey was published by the State Department of Agriculture revealing that the turfgrass industry was worth 523 million dollars and that there were more than 600 golf courses in the state.

The 1980's have brought a rededication to fund-raising for Scholarship and Research, along with an effort to expand the membership base. The organization has grown from a group of golf course superintendents and sod growers to include every facet of turf and turf-related personnel. A lobbyist has been retained on an annual basis. Membership has grown to 600, educational slide sets have been developed, a fund-raising slide set is now in circulation and we are now in the process of interviewing for the position of Director of Membership Services. Our ad for this position has drawn responses from Oregon to Maine. We recently concluded our most successful Conference and Show in terms of total attendance and possible revenue.

Our Conference is quite similar in structure to the one we are now attending.

I feel the success of any Association lies with the maintenance of a strong Board of Directors. In a Turf Associaion, it is mandatory for that Board to have representation from all facets of industry - golf courses, landscape, suppliers, pest control, parks and recreation, etc. A fully representative Board establishes contact with each industry segment and is able to both serve as an educational instrument and a clearing house for problem solving. Over the years the F.T.G.A. has funded research projects dealing with problems that have been brought to our attention by these segments. The editors of our magazine strive to deliver a diversified educational package with special attention to current industry-wide problems. Our Board members serve 3-year terms. This provides for a steady influs of new, enthusiastic members and provides enough time for them to get a feel for how the organization runs. Officers are elected from the existing Board. An Executive Committee composed of the Secretary-Treasurer, Vice-President, President, and immediate past President provide leadership for the Board, and handle daily affairs between quarterly Board meetings.

One very large problem we have addressed this year is the ability to follow through. It became obvious during my tenure on the Board, that the Board consisted of some of the most creative people I had ever met. The problem occurs when 100% of the people involved spend 98% of their time making a living. I guess that's the long way around saying we're all working folks - no retirees, no independently wealthy folks with time on their hands to implement some of the creativity coming out of committee meetings. The recognition of this problem prompted our decision to hire a Director of Member Services. We'd been down the road of having someone do everything for us, and it was not successful. The Board of Directors must give the organization direction to insure that the most good is accomplished for the greatest number. The new Director of Member Services will be responsible for implementing and carrying through Board decisions on such metters as funding for Scholarship and Research, and the dissemination of educational information as well as expanding membership. I've always felt that the essence of our Turf Association was both Scholarship and Research, along with providing eduational information for our membership. We have rededicated ourselves to this mission in the last four years.

Mole crickets have long been an extremely destructive pest throughout Florida. We were approached by Dr. James A. Reinert of the Ft. Lauderdale Research and Education Center about helping to fund a research project to find and answer to this problem. We committed funds in excess of $30,000. to help. The project is for 3 years and the work is going on now. Those of you who have seen Jim's fine slide presentation on control of mole crickets by a host-specific parasite can realize how proud we are of the work he is doing and how satisfied we are with this expenditure of funds.

Another major funding effort was recently undertaken. Bermudagrass decline has become a serious problem for golf course superintendents in southern Florida. F.T.G.A. made a committment of funds in excess of $20,000. to help Dr. Ed. Freeman and Dr. Bruce Augustin solve the problem. The Florida Golf Course Superintendents' Association helped with generous funding, and work has begun.

Other projects funded by F.T.G.A. directly to IFAS in 1982-83 include an "Evaluation of Postemergence Herbicides for Annual Grassy Weed Control in Warm-Season Trufgrasses; Warm Season Turfgrass Response to Saline Irrigation; Salinity Tolerance of St. Augustinegrass; and Soil-Related Causes of South Florida Slash Pine Decline."

Funds for the projects just mentioned are generated by the work of the whole organization under the leadership of the Scholarship and Research Funding Committee. Monies are raised by the direct contributions of members, solicitations designed to appeal to the 700+ golf courses in the state, an annual Scholarhip and Research Golf Tournament, sale of promtional materials at our Conference and Show (usually handled by personnel from Lake City Community College) and donations from local chapters and the State chapter of Golf Course Superintendents.

The revenue raised at our Conference and Show by selling of booth space goes solely to the running of the organization. It has been our goal to

have one year's operating revenue in reserve. By investing a portion of our income and careful management by a succession of "hard-nosed" treasurers, this has been accomplished. Nothing prevents us from using those funds for research, but we have felt strongly about having this "disaster fund" as a reserve.

Scholarships are awarded annually at the Conference and Show. Recipients are selected by our Scholarship and Research Committee from recommendations given to us by the staff at Lake City Community College and the University of Florida. This year, 3 - $1000 awards were made along with 4 - $500 awards. Nine years ago, one award for $500 was all that was given. It looks like we're making progress.

No mention of Turf Association funding can be made without including the marvelous cooperation we receive from the turf products suppliers in our state. Their participation each year guarantees a financially sound show. We in Florida go to great lenths to insure that they have adequate facilities and plenty of time to merchandise their products. For the last several years, we have insured that there is no Conference conflict with Show hours.

I feel another good innovation we've made is an "Exhibitor's Critique Breakfast". We invite each exhibitor to share his comments, both favorable and unfavorable, with the Show Committee and Board members at breakfast immediately after the final day of the Show. Some of the major changes in our Show have resulted from these discussions.

I'd like to mention the working relations we've developed with the University of Florida Research personnel in the last few years. We've pretty well decided that the best way to get research accomplished was to work through the existing facilities with the University system. As the economic situation at the University grows tighter, we've found the system more receptive to our problems.

Not being a graduate of the Florida university system, has not helped my ability to understand how it works. It seems to me that at times, it is fragmented to the extent that it is difficult to establish which part to deal with. By including members of the University staff as advisory members on our Board, we have gone a long way towards maintaining an open line of communication with the system, as well as a means of understanding procedures and univesity structure.

I owe a special debt to the personnel from IFAS. I got into the turf business with a BA degree from Northwestern University with a major in history and minors in political science and English. I also had 20 years experience in a family owned service business. As you can see, I had a great deal to learn about all facets of turf growing and maintenance. The IFAS staff and University personnel were always available for questions and continually provided educational sessions and material. I owe them a great deal and like to acknowledge their help and expertise at every opportunity.

BEDDING PLANTS IN THE LANDSCAPE

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Never before have landscape architects, contractors, and ground managers had such an opportunity to incorporate bedding plants and flowers into commercial landscapes as they do in 1984. Consumers of landscape services, visitors to parks, golf courses, malls and shopping centers readily accept the efforts of landscapers and appear more aware than ever before of the aesthetic qualities offered by a mass of flowering plants. Competition is keen for maintenance contracts, and the contractor now has to offer more than just mowing and pruning services. The 'California' style of landscaping is slowly but surely evolving in North Carolina.

The use of bedding plants is one solution to the problem of having seasonal interest. Traditionally, North Carolina landscapes accentuate the spring with dogwoods and azaleas, summer with crape myrtles and hydrangeas, and fall with foliage color from red and sugar maples. (The winter is typically spent waiting for spring to arrive!) Landscape design depends upon unity. Unity is accomplished by the application of the principles of Repetition, Variety, Balance, Sequence, Scale and Emphasis. The principles are then applied to the design qualities of form, line, texture and color. Designers use these principles and qualities to achieve unity, but most passersby are simply color conscious. Bedding plants can offer all of the design characteristics with special regard to color.

When designing areas for bedding plants, a site analysis is critical for a favorable result. The most important consideration would be light intensity and exposure. Other factors can be amended and controlled, such as soil preparation, pH, nutrients, water and pest control.

The following table is a quick reference guide for the use of bedding plants. (High priorities to consider when using bedding plants would be seasonal interest, landscape uses, color and exposure.)

Flower Species	Flowering Period	Exposure	Color	Size/Habit	Landscape Remarks
Pansy	fall/winter	sun/light shade	full spectrum + mixed	8"	Borders/containers
Petunia	summer	sun	full spectrum	12-24" spreading	Beds, borders, cut flowers
Alyssum (Sweet)	spring/summer	sun/light shade	white, pink, violet	spreading	Rock gardens, ground covers
Ageratum	summer	sun	blue, pink, off-white	3-12" mounded	Rock gardens, containers
Marigold	summer	sun	yellow-orange, bronze	6-18"	Dwarf sizes available, very versatile
Impatiens	summer	shade/part. shade	white, pink, red & purple	8-24"	Borders, containers
Salvia (Scarlet Sage)	summer	sun - non-red varieties in pt. shade	brilliant red, white, pink, purple	8-36"	Flower spikes
Snapdragon	summer	sun	white, cream, pink, red, yellow, lavender	6-36"	Accent plants, dwarf varieties as borders
Portulaca	summer	sun	white, pink, red, yellow	6-8"	Ground cover - spreading
Verbena	mid-spring/fall	sun	white, pink, red, salmon, blue, purple	6-12"	Ground covers, rock gardens, containers
Begonia	summer	shade	white, pink, red	4-15" rounded	Excellent for mass planting in shaded areas
Zinnia	summer	sun	all colors except blue	6-36" upright	Dwarf varieties available
Geranium	summer	sun	red	12-18"	Containers - a real favorite
Coleus	summer	pt. shade	red, maroon, pink, green, yellow	12-36"	Brilliant foliage
Vinca	summer	sun	white, pink - with or w/out pink centers	8-18"	Excellent ground cover, good in containers, planters
Dusty Miller	summer	sun	silver, gray	8-18"	Edging, rock gardens, excellent when combined with other bright colors
Rudbeckia	summer	sun	yellow-orange	12-18"	Excellent for ground cover in hot, dry location

DIVERSITY OF TURFGRASS DISEASES IN NORTH CAROLINA

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North Carolina is called variety vacation land because of the variations from the coast to the mountains. The same can be said for the different types of plants including turfgrasses that grow in the state. The cool-season turfgrasses — bluegrass, perennial ryegrass, fescue, and bentgrass — are well adapted to the western and mountain regions, whereas the warm-season turfgrasses -- bermudagrass, centipedegrass, St. Augustinegrass, bahiagrass and zoysiagrass — are well adapted to eastern North Carolina. All of the cool- and warm-season grasses grow in the transition zone in the central part of the state. The summers are often too hot for the cool-season grasses to grow well and the winters are often too cold for the warm season grasses to survive in this region. Tall fescue is the best adapted grass in the transition zone for lawns and low maintenance turf. Bermudagrasses are usually used on golf course fairways and are preferred on athletic fields in this region, whereas, bentgrass is used on golf greens in most cases. More problems with diseases are usually associated with these higher maintained turfgrasses in this region to which they are not best adapted.

Another way of visualizing the diversity of the environments in the state is to realize that regions in the mountains may be similar to regions in western New York or Michigan. Regions in the southeastern part of the state are similar in climate to northern Florida.

Similar diversity in pest problems can occur throughout the state. Diseases that occur on turfgrasses in the mountains of North Carolina are similar to diseases in the northern states. Disease and nematode problems in the southeastern part of the state are similar to states further south. Many of the diseases overlap in the transition zone in central North Carolina. The northern type diseases often occur in this region in the winter on cool-season grasses. Also, some diseases unique to this region occur in North Carolina such as spring dead spot on bermudagrass.

Snow mold, particularly pink snow, is a problem during the winter on cool-season grasses in western North Carolina. Red thread is a serious problem in the mountains during the spring, summer and fall. These diseases occur occasionally in central North Carolina but not often in eastern North Carolina. Dollar spot is a serious problem on the cool-season grasses in the western and central part of the state and occasionally in the east on bentgrass golf greens. Cool-weather brown patch, or yellow patch, has become a problem on bentgrass in western and central regions in recent years. Brown patch and pythium blight can be a problem during the summer in the west. Helminthosporium diseases are often seen on cool-season turfgrasses in these regions. Ophiobolus patch on bentgrass that used to be considered a problem limited to the northwestern United States is often a problem on new bentgrass golf greens in the mountains of North Carolina.

Nematodes are a major problem on warm- and cool-season grasses in southeastern North Carolina but not in other regions. Warm-weather diseases such as brown patch and Pythium blight are more of a problem on cool-season grasses such as bentgrass and tall fescue in the warmer areas in central and eastern parts of the state.

All of the diseases except nematodes can be a problem during different times of the year in the central part of the state. Problems with winter kill of warm season grasses and drought and heat stress on cool-season grasses are often observed in the transition zone. Spring dead spot is sometimes a problem in this area. This disease apparently develops in the more northern range of adaptation of bermudagrass where winter temperatures are lower and not in warmer areas near Wilmington.

As indicated, the climates and the types of turfgrasses grown in North Carolina vary from the southeast to the northwest. This large range in climatic conditions in the state has environmental conditions that are conducive to nearly all turfgrass diseases that occur in the United States. The importance of this information to a turf manager in North Carolina is that he must know the adaptation of the different grasses and the many different diseases that can occur in the state. Literature that is available from garden centers, newspapers and the extension service must be evaluated carefully to determine if it applies to a particular area of the state. Information for turfgrasses in New York may be useful for western North Carolina but not eastern North Carolina. Information from Florida may apply to southeastern North Carolina but not western North CArolina. An appreciation for this diversity in North Carolina will help turf managers and home owners better understand turfgrass management practices and disease problems and select appropriate control methods.

NEW INSECTICIDES FOR TURF

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Several promising insecticides were evaluated for control of fall armyworm, sod webworm and green June beetle grubs on turf in 1983. A brief summary of results follows:

Fall Armyworm

Tifton 419 hybrid bermudagrass fairways were sprayed with a Cushman mounted PTO powered Broyhill boom-type sprayer on August 26, 1983, for control of fall armyworm. Plots were 40 feet wide and 50 feet long and replicated four times. The sprayer was operated at approximately 4 miles per hour with 40 psi. The boom was equipped with 8008 Spraying System nozzles spaced 20 inches apart on the boom. The application rate was 1.38 gallons per 1,000 square feet.

At the time of application windspeed was less than 5 mph, temperature was approximately 90°F with a relative humidity of 60%. Approximately one-half inch rain fell on August 29.

The number of live fall armyworms was counted in two 12-inch by 12-inch areas in each plot. Prior to counts, worms were flushed from thatch with a synergized pyrethrum water solution.

The number of live fall armyworms is given for post-treatment dates in Table 1.

Table 1. Number of live fall armyworms per square foot 3 and 5 days after treatment

Treatment and rate of formulation/1,000 sq. ft.	Average number of live fall armyworms 3 days	5 days
Oftanol 2F @ 1.5 oz	1.5	0
Oftanol 2F @ 3 oz	0	0.5
CGA 12223 @ 0.75 oz	0	0.25
CGA 12223 @ 1.5 oz	0	0
Dyfonate 5S @ 1.2 oz	0.5	0
Dyfonate 5S @ 1.78 oz	0	0
Ficam 75WP & syn. pyrethrum 0.5 oz & 2.5 oz	1.25	0.5
Ficam 75WP & syn. pyrethrum 1 oz & 5 oz	1.25	1.25
Deltic 2.4EC & 6.4 oz	1.0	1.5
Deltic 2.4EC @ 12.8 oz	0.5	1.25
Dursban 4E @ 0.75 oz	2.5	5.75
Proxol 80S @ 4 oz	2.5	5.75
Untreated check	20.0	10.75

Sod Webworm

Sprays were applied to Tifton 318 hybrid bermudagrass on August 8, 1983, for control of a sod webworm (Crambidae). Plots were 12 feet by 20 feet and replicated three times. A carbon dioxide compressed backpack sprayer with Spraying System 8003 flat fan nozzles 20 inches apart on the boom was used for the spray application. The sprayer was operated at 30 psi at 2 mph. Spray rate was 1 gallon per 1,000 square feet.

Wind velocity was less than 5 mph with temperatures about 95°F. There was no rain for three days following application, but the area was irrigated with 1/2 to 1/3 inch of water within 24 hours of application. No phytotoxic effects resulted from any treatments. Slight burn resulted from the synergized pyrethrum drench that was used for flushing worms prior to counts. These areas were 12 inches by 12 inches.

Live sod webworms in the 12-inch by 12-inch flushed area were counted 1 day, 3 days and 7 days after treatment. Results are given in Table 2.

Table 2. Average number of live sod webworms per square foot one, three and seven days after treatment

Treatment and rate of formulation/1,000 sq. ft.	Live sod webworms		
	1 day	3 days	7 days
Ficam 76W + syn. pyr. 0.25 oz + 1.25 oz	2.3	0	0
Ficam 76W + syn. pyr. 0.5 oz + 2.5 oz	3.3	0	0
Dyfonate 5 @ 1.2 oz	0.3	0	0
Dyfonate 5 @ 1.78 oz	0.3	0	0
CGA 12223E @ 0.75 oz	0.3	0	0
CGA 122234E @ 1.5 oz	0.3	0	0
Oftanol 2F @ 1.5 oz	5.0	0	0
Oftanol 2F @ 3 oz	8.3	0	0
Deltic 2.4EC @ 3.2 oz	6.7	0	0
Deltic 2.4EC @ 6.4 oz	4.3	0	0
Ficam 76W @ 0.5 oz	6.3	0	0
Ficam 76W @ 1.0 oz	2.7	2.0	0
Dursban 4E @ 0.75 oz	1.7	1.7	1.0
Untreated check	6.3	9.0	2.3

Green June Beetle Larvae

Oftanol and Triumph (CGA 12223) granules were applied to 20- by 40-foot plots replicated three times on June 1, 1983, for control of green June beetle larvae. The plots were on a golf course practice area and irrigation was not available.

The number of active green June beetle larvae burrows were counted in an area 3 feet by 3 feet in five locations selected randomly per plot on June 8 and October 21, 1983. Results are shown in Table 3.

Table 3. Number of active green June beetle burrows

Treatment rate ai/acre	Total no. of active GJB burrows by replicates 6/8			10/21		
	I	II	III	I	II	III
CGA 12223, 5G @ 2 lb	11	16	10	5	6	8
Oftanol, 5G @ 2 lb	8	7	4	8	8	11
Untreated check	14	12	18	10	15	18

CHEMICAL EVALUATION FOR DISEASE AND NEMATODE CONTROL IN NORTH CAROLINA

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Selected fungicides were evaluated for the control of dollar spot on bentgrass that was maintained under putting green conditions. A blue dye from Millikan Chemical Company, Blazon, was mixed with each fungicide to evaluate the effect on disease control. A 1% dye solution, which equalled about 1 gallon of dye per acre and was about 8 times more than recommended, was used in these preliminary evaluations. Also, the length of control from the different fungicides was evaluated over a period of one month after application. The systemic fungicides and fungicides with long residual effects gave good control with and without the dye with the exception of Rubigan at the lower rate. The dye alone did not result in a significant increase in the amount of disease in control plots. These results indicate some possible positive and negative interactions of Blazon with certain fungicides. Additional experiments will be conducted in 1984 with recommended and high rates of the dye to further evaluate these preliminary results (Table 1).

A nematicide evaluation on a common bermudagrass fairway in Fayetteville was continued for two years. The chemicals were applied once on June 28, 1982, to an area with poor turf that had high levels of sting nematodes. Sting nematode counts and turf quality ratings were made in 1982 and 1983. Nemacur gave the best nematode control and turf quality of the chemicals that are labelled for turf. Counter, which is labelled on some agricultural crops, gave excellent nematode control during both years. The turf quality rating was not significantly different in the second summer, but the turf had a brighter green color early in the summer in the Counter-treated plots. Furadan, which is used on agricultural crops, did not give as good nematode control but resulted in improvement in turf quality in both years. Mocap, that is labelled on turf, did not control the sting nematode in the second year but did give good turf quality in the first year. The results with this chemical have been variable from one location to another. It did not give good turf quality in a similar experiment in Wilmington. Oftanol and Vydate resulted in improved turf quality but did not give good control of the nematode. Turf quality in all treatments including the check improved in 1983 due to a good weed control, fertilization and irrigation program. Several of these chemicals will be evaluated again in 1984 (Table 2).

Space and time do not allow for evaluating all fungicides and nematicides on turf in North Carolina. New fungicides and nematicides have been evaluated to compare with some older ones and to obtain information needed to label useful products on turf in North Carolina. Results may vary from year to year and data at different locations for several years are needed before accurate recommendations can be made.

Table 1. Dollar spot control on bentgrass with fungicides with and without Blazon Dye[1] in 1983.

Treatment (/1,000 sq. ft)	% Area with dollar spot on 8-12-83		10-6-83	
Bayleton (1 oz)	0.5[2]	e	2.8	ef
Bayleton (1 oz) + Dye	0.5	e	3.5	ef
Chipco 26019 (2 oz)	1.8	de	12.5	bc
Chipco 26019 (2 oz) + Dye	3.3	de	13.3	bc
Daconil 2787 (4 oz)	3.5	cde	17.5	b
Daconil 2787 (4 oz) + Dye	20.0	a	27.5	a
Rubigan (0.4 oz)	7.8	bc	11.3	bcd
Rubigan (0.4 oz) + Dye	1.3	e	7.8	cde
Rubigan (0.8 oz)	1.5	de	1.3	ef
Rubigan (0.8 oz) + Dye	1.3	e	4.3	def
Tersan 1991 (1 oz)	0.3	e	0.3	f
Tersan 1991 (1 oz) + Dye	0.5	e	2.8	ef
Tersan 1991 (2 oz)	0	e	0	f
Tersan 1991 (2 oz) + Dye	0.3	e	0.3	f
Vorlan (2 oz)	2.8	de	2.5	ef
Check	6.3	bcd	26.3	a
Check + Dye	10.3	b	28.8	a

[1]Blazon blue colorant from Millikan Chemical, 1% solution sprayed at 2.5 gal per 1,000 sq. ft. Sprayed on 7-6-83 and 9-1-83.

[2]Means followed by different letters are significantly different (P=0.05) using Waller-Duncan.

Table 2. Evaluation of nematicides for control of sting nematodes on common bermudagrass during 1982 and 1983.

Treatment (/1,000 sq. ft)	Sting nema/500 cc 11-5-82		7-20-83		Turf quality 10-13-82		7-20-83	
Counter 15G (2.5 lb)	0	c[2]	10	c	7.6	a	8.2	ab
Furadan 10G (2.7 lb)	54	bc	132	bc	8.8	a	8.0	ab
Mocap 10G (5 lb)	28	bc	230	abc	7.6	a	7.0	abc
Nemacur 15G (2.7 lb)	6	c	20	c	8.8	a	8.4	a
Oftanol 5G (2.5 lb)	76	b	354	a	7.8	a	7.2	abc
Soil Brom 90 (8.8 oz)	48	bc	278	ab	5.0	b	6.8	bc
Vydate 10G (2.7 lb)	84	b	260	ab	7.2	a	6.2	c
Check	160	a	350	a	3.6	b	7.4	abc

[1]Chemicals were applied on June 28, 1982, and immediately irrigated with 1/2 inch water.

[2]Means followed by different levels are significantly different (P=0.05) using Waller-Duncan.

HERBICIDE RESEARCH IN TURFGRASS

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Several new postemergence applied herbicides are available which have potential for controlling weedy grasses and broadleaf weeds in turfgrasses. Also they may be used to release a turfgrass from the competition of other turfgrasses. We evaluated the tolerance of bahiagrass (Paspalum notatum Flugge), centipedegrass (Eremochloa ophiuroides (Munro) Hack.) and tall fescue (Festuca arundinacea Schreb.) to Fusilade (fluazifop-butyl) at 0.2 to 0.6 lb active/A, Oust (DPX 5648) at 0.05 to 0.25 lb active/A, and Poast (sethoxydim) at 0.2 to 0.6 lb active/A. Centipedegrass was tolerant to Poast and Oust at all rates. Bahiagrass did not show initial tolerance to the three herbicides but 8 weeks after application it had recovered from all rates of Poast and the lowest rates of Fusilade and Oust. Tall fescue was more tolerant to Fusilade than Poast at 0.2 lb active/A or less. It did not show acceptable tolerance at higher rates of either compound.

Centipedegrass is adapted to roadside conditions in 60% of North Carolina according to long term studies. Since it is slow to establish we may have a way to release it from the competition of other turfgrasses with which it may or may not be seeded.

In studies of Poa annua control in common bermudagrass fairways we found that postemergence applications of Kerb 50W (pronamide) at 1 lb active/A and Sencor 75 (metribuzin) at 0.5 lb active/A were far more effective when applied in late October than late January. Paraquat (paraquat) at 0.25 lb active/A and Paraquat + Sencor at 0.25 + 0.25 lb active/A were equally effective applied late January or late February.

Two experimental products gave effective postemergence control of smooth crabgrass (Digitaria ischaemum Schreb.). One product was from PBI/Gordon which was a mixture of Trimec and MSMA. The other was from American Hoechst, HOE-A25-01. However, the latter did not control dallisgrass (Paspalum dilatatum Poir.).

ORNAMENTAL PLANT FERTILIZATION AND CARE

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The care and fertilization of plants in the landscape can be a rather unique experience for homeowners, golf course superintendents, and commercial maintenance personnel alike. In order to address some of the problems associated with the maintenance aspect we have to consider what a landscape is and then what purpose it serves. The landscape is a three dimensional conglomerate of turf, shrubs, trees, flowers and associated structures or features, which may include water, pathways, a gazebo, pergola, or garden house. It may be completely utilitarian such as a windbreak, screen, divider, or boundary between properties. Or, it may be purely aesthetic, similar to the formal gardens, which were popular at the turn of the century. The modern home landscape tends to be a mixture of the two and serves as an outdoor area where one can just relax, or where once can enjoy recreational activities such as gardening, tennis, golf, or swimming, in a serene environment. The modern home landscape requires a good deal of thought and advance planning if it is to be effective, and usually reflects somewhat of the personality of the homeowner. As an example, for that "country living effect" it may include a vegetable garden as well as fruiting shrubs (blueberry, viburnum, Oregon grape-holly, etc.) and trees (fringetree, serviceberry, plum, peach, etc.) as a part of the landscape.

Since a landscape is usually a mixture of diverse species of plants, advance planning is critical for proper blending, compatibility, and usefulness. All plants have maximum and minimum temperatures which they can tolerate, beyond which they are killed. The minimum is by far the more critical, and for this reason plant hardiness is based upon this factor. In North Carolina we have four distinct climatic or plant hardiness zones; zones 6, 7, 8, and 9, where average minimum temperatures reach -10°F, 0°F, 10°F, and 20°F respectively. This explains why oleander and banana shrubs grow quite well on the coast but we don't see them in other areas of the state. Familiarity with plant materials and climatic zones across the state are essential in plant selection, installation and maintenance.

Another factor to consider is plant quality, which encompasses several considerations. First, are you buying plants from a reputable grower who guarantees them to be true to name? Is there a good proportion of top to root system? Too often we look only at the top of the plant and don't take the time to knock it out of the container to check the root system. You need to be certain the plant isn't severely pot bound and that the root system is alive and healthy. Only buy plants which have good rich color and/or that which is typical for the cultivar. Starved plants usually perform poorly in the landscape. Plants with weeds around them in the container or soil ball indicate that they weren't taken very good care of by the grower; and, those

weeds may present further problems in the landscape. Have the plants been properly pruned or sheared so that their natural form is featured? And don't forget to check them for insects and diseases. Reputable nurserymen won't sell disease or insect infected plants.

Next consider the planting site. There are several critical factors to be concerned with in respect to the actual planting site. First, consider exposure (north, south, east, or west) since this will greatly influence the selection of plant materials. The next factor to consider is whether or not the area is adequately drained. Wet areas usually require installation of tiles to remove excess water. And don't overlook the location of downspounts from nearby buildings, since these can be potential sources of water problems. Water from downspouts must be moved away from foundation plantings even if it requires subsurface drains. A sample of the soil from the planting site should be collected well in advance of planting and sent in to the Department of Agriculture for analysis. Instructions for sampling and soil sample boxes are available at no cost from your County Agricultural Extension Agent. Intelligent adjustment of the soil nutrient status cannot be made without the results of a Soil Test. Don't Guess - Soil Test. All nutrients should be added at the rate specified on the Soil Test Report, and should be incorporated to a depth of 6"-12". A soil sample should also be taken if doing replacement within an existing planting. Also, maintenance applications of fertilizer should be made to shrubs and trees based on the Soil Test Report. The area to be fertilized should be measured off and the appropriate amount of nutrients weighed out accurately. These should be broadcasted uniformly over the planted area and be followed by 1/2" of irrigation.

In general, nursery grade or slowly available fertilizers are superior to field grade fertilizers when applied to landscape plantings. Field grade fertilizers usually release their nutrients over a relatively short period of time during the growing season. Most were developed for crops which are grown as annuals. Since most landscape plantings are perennial or "woody" in nature and remain in place for several years, they require a source of nutrients during much of the year. Nursery grade fertilizers were developed to satisfy this demand. They require several months to dissolve, which means that they release their nutrients over a much longer period of time than field grade materials. Thus, they afford more uniform fertility levels in the soil over a longer period of time. The nursery grade fertilizers are either sulfur or resincoated to prolong their availability or they may contain unreaformaldehyde.

In general, established plantings will require from 2-3 pounds of actual nitrogen per 1000 ft^2 per year. Large trees may have a higher and smaller shrubs a lower requirement. For non-flowering plants the fertilizer ratio will usually be 1-1-1 or 3-1-2. For recently planted areas or for flowering shrubs and trees the fertilizer ratio should be 1-2-1 or 1-2-2. However, to be certain of the exact ratio and amount of fertilizer to apply take advantage of the Soil Test. Remember, Don't Guess - Soil Test!

Landscape plantings also require regular irrigation if they are to develop to their finest. Unfortunately, this is often overlooked, and during the past two summers numerous shrubs and even large trees succumbed to drought. In order to prevent stress and to keep landscape plantings in a vigorous healthy state, they should receive 1 inch of water per week during the growing season. If this doesn't come as rainfall, it must be supplied through irrigation. Also, landscape plantings, especially evergreens, require irrigation throughout the entire year and not just during the normal growing season. Failure to do so may result in plant dessication (scorch or burning) which shows up the following spring and is quite objectionable.

Control of pests in the landscape should be done judiciously. Pesticides should only be used when there is a problem, and not as routine preventative measures. Use the correct pesticide, at the proper rate for the particular problem encountered. Whenever you're in doubt, contact your local Agricultural Extension Agent or State Specialist.

FENARIMOL (TRADEMARK RUBIGAN): GROWTH REGULATING PROPERTIES ON POA ANNUA WHEN USED AS A LOCALLY SYSTEMIC FUNGICIDE FOR DISEASE CONTROL ON TURFGRASSES

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Fenarimol (-(2-chlorophenyl)- -(4-chlorophenyl)-5-pyrimidinemthanol) is the genetic name for Elanco Product Company's RUBIGAN®. Fenarimol is a locally systemic fungicide effective for the control of a number of economically important diseases of fine turfgrasses. Fenarimol is currently under experimental use permit evaluation for this use and EPA production registration is pending.

During the course of experimental development and under broad scale EUP usage, fenarimol has exhibited a growth regulating property on Poa annua, an annual weed grass commonly found in intensively maintained turfgrass areas. Poa annua's occurrence is particularly widespread in close cut, frequently irrigated turfgrass areas such as golf course putting greens, tees, and fairways. It is considered to be the number one weed problem infesting these areas.

At low fungicidally efficacious rates, fenarimol' s growth regulating properties are more readily apparent on Poa annua than on any of the desirable perennial turfgrass species used in these turfgrass areas. Proper utilization of this property enables the turfgrass manager, in conjunction with good cultural practices favorable to the perennial grasses and normal environmental stress, to reduce Poa annua populations existing in turfgrass or to prevent excessive encroachment of Poa annua into areas relatively free of the species.

The label claim dealing with fenarimol's growth regulating effect on Poa annua reads as follows: "Applications of RUBIGAN to turfgrass areas containing Poa annua (annual bluegrass) have demonstrated a growth regulating effect on this species. Under certain environmental conditions and cultural practices, RUBIGAN applications may gradually reduce Poa annua populations in treated areas. Users desiring more information regarding this aspect of activity from RUBIGAN must obtain the RUBIGAN Product Information Bulletin on Poa annua from Elanco Products Company or their RUBIGAN distributors prior to use. Do not use RUBIGAN on turgrass areas containing Poa annua until this Product Information Bulletin is read and understood." The label also cautions users who do not want to reduce Poa annua populations to only use RUBIGAN at its minimum fungicidal rate (0.1 oz fenarimol per 1000 sq. ft.) or to alternate applications with contact type fungicides.

The Product Information Bulletin referred to in fenarimol's label claim for Poa annua reduction provides considerable information relative to Poa annua's occurrence in golf course turfs and cultural practices which encourage and discourage the species. The Bulletin stresses that most consistent reduction in Poa annua populations has been achieved when

fenarimol is used at low fungicidal rates (0.1 and 0.2 oz. fenarimol per 1000 sq. ft.). Applications should begin at the onset of normal dollar spot (Sclerotinia homoeocarpa), preventative fungicide treatment or following the completion of Poa annua's heavy spring flowering period and continue at two to three week intervals throughout the summer disease control season. Although no single accumulated dosage is recommended, most significant population reductions have been seen after 1 ounce fenarimol per 1000 sq. ft. has been accumulated on the treated area.

Remember, fenarimol is a locally systemic fungicide labeled for the control of a number of economically important diseases of turfgrass. Proper use of RUBIGAN as a fungicide may result in a growth regulating effect on Poa annua. This effect may enable the golf course superintendent to manage the Poa annua content of intensively maintained turfgrass areas. Most consistent Poa annua response has been observed when fenarimol is applied at low fungicidal rates (0.1 and 0.2 oz. fenarimol per 1000 sq. ft.) beginning at the onset of normal dollar spot preventative fungicide applications or following the completion of Poa annua's heavy spring flowering period and continuing at two to three week intervals throughout the summer disease control season.

RECERTIFICATION REQUIREMENTS FOR COMMERCIAL PESTICIDE APPLICATORS IN ORNAMENTALS AND TURF

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The North Carolina Pesticide Law requires persons who apply or supervise the application of pesticides to areas other than their own crops to be licensed as a commercial pesticide applicator. Most golf course superintendents and those engaged in care of lawns and landscape plants are required to pay an annual fee for a license in the ornamental and turf category. If you are applying pesticides to public property (city, county, state or federal), you are classified as a public operator. The same certification, recertification and licensing requirements apply except that an annual fee is not charged.

RECERTIFICATION REQUIREMENTS

In order to ensure that commercial pesticide applicators, public operators and pest control consultants continue to meet the needs of changing technology necessary for safe and effective use of pesticides, licenses will not be renewed annually for more than five years for individuals licensed to use ground equipment unless the individual has been recertified through one of the options below.

RECERTIFICATION OPTIONS

(A) Completion of approved Continuing Certification Credit requirements in the pest control category in which an individual is certified and desires to retain certification. A Continuing Certification Credit Unit (CCU) is defined as one hour of approved training. Continuing Certification Training must be approved by the N. C. Pesticide Board, and such training may consist of educational meetings, seminars, short courses or other presentations by extension personnel or other privately or publicly sponsored training organizations approved by the Board.

Continuing Certification Credit requirements for each pest control category are as follows:

(1)	aquatic	6 credits per 5-year period
(2)	public health	6 credits per 5-year period
(3)	forest	6 credits per 5-year period
(4)	right-of-way	4 credits per 5-year period
(5)	regulatory	6 credits per 5-year period
(6)	ag pest-animal	6 credits per 5-year period
(7)	ornamental and turf	10 credits per 5-year period
(8)	seed treatment	3 credits per 5-year period
(9)	ag pest-plant	10 credits per 5-year period
(10)	demonstration and research	10 credits per 5-year period

The Continuing Certification Credits established for each ground application pest control category must be obtained during at least two years of the five-year period.

(B) Participation in one training session conducted by extension pesticide personnel, or other approved organizations, during the recertification period and satisfactory passing of a written comprehensive examination administered by North Carolina Department of Agriculture personnel at the conclusion of training.

(C) Satisfactory passing of a written comprehensive examination administered by North Carolina Department of Agriculture personnel and based on training materials which have been approved by the Board.

RECERTIFICATION IN ADDITIONAL CATEGORIES

An individual may complete a different recertification option (either A, B or C above) for each pest control category in which he desires to remain certified.

Individuals who want to retain certification through Continuing Certification Training in more than one pest control category may do so upon completion of total CCU requirements in the category carrying the highest CCU requirements by completing three CCU's in each additional category.

EXPIRATION OF CERTIFICATION

The recertification period shall expire on June 30th. Specifically, persons licensed before January 1, 1981, must receive recertification credits prior to June 1985 in order to be recertified for a 1986 license. Persons licensed in 1981 must complete recertification by June 1986. A reminder - credit must be obtained in at least two different years.

A person who has completed none of the above recertification options prior to the recertification expiration date shall be required to pass a comprehensive license examination before a license will be re-issued in any category. This examination will be based on updated training materials approved by the Board.

No one will be allowed to carry over any Continuing Certification Credits from one recertification period to another.

CHEMICAL AIDS IN WINTER OVERSEED

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In the warm humid regions of the Southeastern United States. bermudagrass is the predominate turfgrass. Despite the fact that winters are relatively mild, sufficiently cold weather occurs to cause dormancy of bermudagrass for varying periods. Depending on location, the overseeding period may last only 3-4 months while in colder regions, it may be extended to 7-9 months. Overseeding is necessary on high maintenance turf where uniformity and aesthetic qualities are desired during the dormant period. It prevents attrition damage to turf from traffic and minimizes the disruptive invasion of winter annuals such as annual bluegrass, henbit and veronica. Traffic is the major cause of winter injury on turfgrass areas.

The basic attributes for overseeded turf are: 1) rapid germination and establishment; 2) tolerance to disease, close frequent mowing, traffic and frost; 3) good transition back to bermudagrass in the spring.

ESTABLISHMENT

Proper timing, seeding rate and degree of preparation are critical to the success of an overseeding both in terms of quality and expense. Seeding date will vary with location and is dependent primarily on prevailing temperatures in the area. Overseeding too early can result in poor quality due to the high incidence of *Pythium* under warm humid conditions and/or excessive bermudagrass competition. When seeded too late, germination will be slow and turf stands will be weak and fail to develop due to the lack of adequate growing temperatures. Research has been conducted to determine if measurements of environmental conditions such as soil temperature can be used to establish seeding dates that provide optimum seeding quality. Results indicate that predicting seeding dates with soil temperature alone is not very effective. Studies showed that unsuccessful seedings could occur during periods in the middle of successful seeding dates. Disease was the primary cause of failure during establishment. A closer look at air and water vapor factors may lead to a better understanding of the factors influencing success.

The degree and type of seedbed preparation has been shown to influence overseeding success and quality. Vertical mowing and topdressing are important in insuring good seed/soil contact. Lack of proper preparation often results in mid-season stand reduction during periods of temperature and moisture stress. Studies showed very little if any benefit from the Fall application of growth regulating chemicals to suppress bermudagrass competition. Seedbed preparation appeared to be more instrumental in seeding success than growth regulator treatments.

SPRING TRANSITION

Spring transition period is the time when the cool season overseeded species decline and the warm season permanent species emerge. The transition period occurs as a result of environmental stress and disease. This is an extremely difficult period and the cool season grasses decline so rapidly that there is a dramatic loss in turf quality.

The standard approach, to make the transition more gradual, has been to use cultural practices such as frequent vertical mowing and/or soluble nitrogen fertilizer applications. Studies with growth regulators were conducted to investigate their potential as aids in providing a more gradual transition with less loss in turf quality.

The growth regulators pronamide (Kerb), maleic hydrazide (MH), and mefluidide (Embark) were applied 3/1, 3/22, or 4/15 at three different rates. The lowest rates of the chemicals in all cases gave the best results. The mefluidide (0.5 lb/A) at 3/1 gave the best results for early transition. The % bermudagrass coverage was greater for all rates and application dates than in non-treated plots. The 0.5 lb/A rate on 3/2 gave the highest % bermudagrass with the best turf quality. Maleic hydrazide (2 lb/A) gave the best results when applied 4/15. This treatment resulted in the highest overall turf scores during the study and provides the best potential where late transition is most desirable. Pronamide even at the lowest rate (0.25 lb/A) resulted in the greatest reduction in turf quality during the study. The pronamide treatment showed rapid increase in bermudagrass %, but the discoloration of cool season turf and increase in % open resulted in an unacceptable reduction in turf quality.

Heat Stress in Bentgrass

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If you have bentgrass golf greens, you will have problems with heat stress. The causes of bentgrass death due to heat stress can be attributed to direct high temperature kill or indirect kill due to one or more secondary causes (diseases, insects, traffic, etc.). These secondary causes develop because of a weakened turf that developed due to prolonged or chronic heat stress. Most people feel that the latter or indirect kill is the most prevalent cause of heat stress related deaths in bentgrass.

There are several ways to gain information and insight into the problems associated with bentgrass and heat stress. One way is to look at a comparison of cool season (bentgrass) and warm season (bermudagrass) turfgrasses. A cool season grass by definition grows best at temperatures ranging from 60-75° F.; whereas, a warm season grass grows best at temperatures ranging from 80-95° F. What makes a warm season grass more heat tolerant than a cool season grass? The answer to this question has been related to their relative processes of food manufacturing (photosynthesis) and water use rates. Warm season plants are twice as efficient in food production and use half as much water compared to cool season plants. Based on these differences, one often comes to the conclusion that bentgrass depletes its food reserve under heat stress and turf is lost from starvation or poor nutrient uptake. Yet, other plant systems are altered which may also contribute to heat stress. It has been shown in warm and cool season plants that hormone production in roots is changed when plants are subjected to heat stress. Research has shown that two root produced hormones called kinetin and abscisic acid (ABA) are affected in plants under heat stress. Kinetin activity decreases and ABA activity increase in plants under heat stress. This situation results in a weakened plant due to a hormone imbalance and the plant declines in vigor. Although this knowledge doesn't help one to correct the heat stress problems in bentgrass, it does give us additional evidence of the importance of a deep, healthy root system as a means to survive heat stress.

From a management standpoint, heat stress in bentgrass can be approached from two angles. Figure 1 illustrates these approaches which are labeled as "reducing heat build-up" and "minimizing losses".

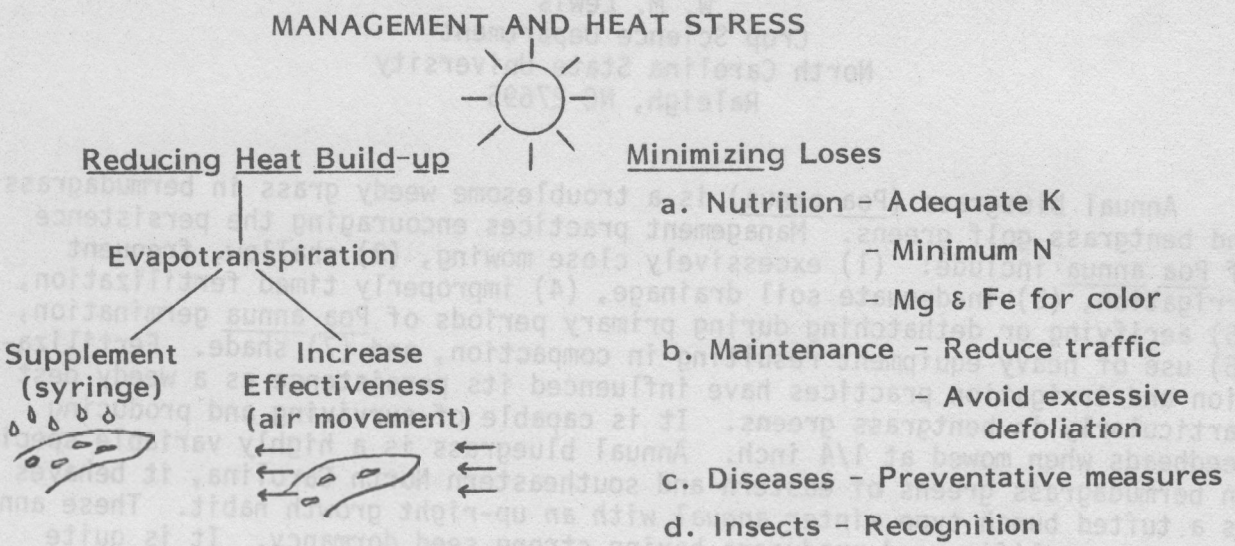

Figure 1. A schematic diagram of two approaches to deal with heat stress in bentgrass.

Reducing heat build-up in plants is best achieved by supplementing the plant's own system of heat control through evapotranspiration. Frequent syringing (light applications of water) and increasing air movement across greens (removing barriers including trees, shrubs, etc.) aid in evapotranspiration efficiency. Because one is not able to completely avoid heat build-up, procedures to minimize turf lost are also required to survive heat stress periods. Fertilization which provides adequate potassium (K), using little or no nitrogen (N) preceding or during heat stress and the utilization of magnesium (Mg) and iron (Fe) for improving color during heat stress all promote a hardy turfgrass plant. Maintenance practices which reduce traffic including more frequent changing of cup placements, changing traffic patterns on and off greens and practices which decrease defoliation of leaves (raising mower heights, changing or skipping the mower's clean-up ring, and/or skipping a day and not mowing) will help reduce secondary causes (diseases, insects, traffic etc.) of turf lost. Disease and insect recognition and in some cases the use of a preventative fungicide program may also be necessary to avoid these problems.

Because heat stress in bentgrass is a major problem, especially in the South, work at Mississippi State University was initiated 5 years ago to develop an improved heat tolerant bentgrass for golf greens. With the support of the Carolina Golf Association and the USGA-Green Section, progress has been made towards cultivar development by using tissue culture. Tissue culture technology uses bentgrass cells (callus) for selecting heat tolerant cell lines. These cells are selected for high temperature tolerance followed by plant regeneration and recovery of heat tolerant plants. Results are promising with hopes of a new bentgrass with greater heat tolerance in the future.

Poa annua CONTROL IN GOLF GREENS

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Annual bluegrass (Poa annua) is a troublesome weedy grass in bermudagrass and bentgrass golf greens. Management practices encouraging the persistence of Poa annua include: (1) excessively close mowing, (2) shallow, frequent irrigation, (3) inadequate soil drainage, (4) improperly timed fertilization, (5) aerifying or dethatching during primary periods of Poa annua germination, (6) use of heavy equipment resulting in compaction, and (7) shade. Fertilization and irrigation practices have influenced its persistence as a weedy pest particularly in bentgrass greens. It is capable of surviving and producing seedheads when mowed at 1/4 inch. Annual bluegrass is a highly variable species. In bermudagrass greens of eastern and southeastern North Carolina, it behaves as a tufted bunch type winter annual with an up-right growth habit. These annual types are prolific seed producers having strong seed dormancy. It is quite probable that in bentgrass greens short-lived perennial subspecies also exist. These perennials may grow more prostrate and produce less seed with minimal seed dormancy.

Prograss (ethofumesate) may be used for preemergence and/or postemergence control of annual bluegrass in dormant bermudagrass which has been overseeded with perennial ryegrass. The herbicide Prograss is primarily root absorbed and translocated into the foliage following uptake by the roots. The initial application of Prograss should be 30 to 45 days after overseeding according to our studies. The rate is 5.33 pints/A of emulsifiable concentrate (1 lb active/A) or 2 fl oz per 1,000 sq ft. This should be followed with one supplemental application 30 days later at the same rate. Reduced control has been observed when applications are spaced 60 days apart. Prograss gives excellent control of annual bluegrass applied at 1 lb active/A. Higher rates do not increase the degree of control. In addition, the turf quality of the overseeded ryegrass is generally better at the 1 lb active/A rate than at the 1.5 lb active/A rate.

Early applications of Prograss can cause "premature onset of dormancy" according to the label. Perhaps we should say that it has the appearance of winter dormancy. Prograss applied early reduces the green color of 'Tifgreen' bermudagrass in the fall. From the standpoint of bermudagrass going off color, it is best to delay the initial Prograss application until 30 to 45 days after overseeding. This also enables the overseeded grass to become better established. In areas where bermudagrass does not naturally go into winter dormancy, Prograss should not be applied. Also, it is advisable to delay Prograss application in unseasonably warm falls until periods of cool weather which encourage bermudagrass to go into winter dormancy. We have initiated Prograss applications as late as the first week in December with favorable results. The label states: "Do not apply Prograss after February 1. Late applications may temporarily delay resumption of active growth habit of bermudagrass in the spring." Our observations also indicate that Prograss applied at the date of overseeding and in early February reduced bermudagrass green-up in the spring. I prefer January 10 as the last date for applying Prograss. Our tests indicate the percent green-up of bermudagrass is the greatest from applications applied 30 and 60 days after overseeding.

In 1981 and 1982 we examined the effects of Prograss on three overseeded grass mixtures. They were CBS, Legend, and Legend + Sabre. The 'Highlight' chewing fescue component of the Legend mixture was susceptible to Prograss, as was Sabre. This was particularly evident in the 1982 test. However, by March and April differences among the overseeded grass mixtures were not as noticable as earlier in the season. In 1983 our tolerance test involved 28 cultivars of perennial ryegrass, two cultivars of intermediate ryegrass, annual ryegrass, six cultivars of chewings fescue and two cultivars of rough bluegrass (Poa trivialis). The chewing fescues and rough bluegrasses were not tolerant to Prograss. Therefore, the overseeded grasses should be ryegrass or mixtures of ryegrass cultivars.

During the past three years we have investigated Prograss for the control of Poa annua in 'Penncross' bentgrass greens. These tests have been conducted at Charlotte County Club, Quail Hallow Country Club, Greensboro County Club, Country Club of North Carolina, Pine Needles Country Club, Etowah Valley Golf Club and High Meadows Country Club.

The results of these tests and other demonstrations indicate that Prograss has potential for the control of annual bluegrass (Poa annua) in 'Penncross' bentgrass greens. The most favorable control was obtained with 3 applications of Prograss spaced at 30 day intervals applied at 0.75 lb active/A per application (0.75 lb active/A = 1.5 fluid ounces of Prograss emulsifiable concentrate per 1,000 sq ft.). Applications spaced 60 days apart have not given favorable control. Two applications at 30 day intervals generally give less control than three. For most favorable control in bentgrass greens, application should be initiated when the average daily temperatures drop to 65°F. This is the first week of October in the piedmont area of North Carolina and in the mountains, late August.

Slight discoloration of bentgrass turf may follow each application, however, no permanent injury has been noted under favorable management conditions. At all of our test locations in 1982, 'Penncross' bentgrass receiving three applications at 0.75 lb active/A per application was rated as having acceptable turf quality in early March. Observations indicate that bentgrass having a shallow root system, growing under stress conditions, or in compacted soil is more susceptible to injury from Prograss and therefore should not be treated. Prograss applications should not be made in late January or in February as injury to the bentgrass may result. Controlling heavy infestations of annual bluegrass may result in bare areas. If this condition cannot be tolerated the bentgrass should not be treated.

'Penncross' bentgrass was evaluated for tolerance to Prograss at 0.75 to 4 lb active/A. Tests were conducted at the North Carolina State University turf research plots and at Pine Needles Country Club. 'Penncross' showed excellent tolerance from three applications at 0.75 lb active/A per application at both locations. There was acceptable tolerance for three applications at 1 lb active/A per application at both locations though ratings were low in March at the turf research plots. Ratings taken on May 4 at Pine Needles indicated that three applications at 2 to 4 lb active/A per application were not acceptable while at

the research plots by May all treatments were comparable to the nontreated areas. These tests indicated that 'Penncross' bentgrass is tolerant to Prograss at reduced rates, however, extreme care must be taken in application not to overlap spraying or to exceed the rate of 0.75 lb active/A per application. In 1983-84 season we will be examining the use of 0.5 lb active/A per application spaced at 3-week intervals. It appears that bentgrass has the least tolerance to Prograss during the coldest part of the year. In other tests we found that 'Penncross' bentgrass has excellent tolerance to Prograss when applied from late April through August.

We have also noted that control with Prograss is more favorable on bentgrass greens with 88% sand or more. Also, it is felt that high accumulations of thatch contribute to less favorable control.

In summary, Prograss should only be used to control Poa annua by superintendents who have followed a careful management program on their greens and have provided a favorable environment for growth of bermudagrass or bentgrass. The rate should be selected carefully, the sprayer calibrated, and care taken to avoid overlapping when spraying, for bermudagrass and bentgrass are sensitive. Prograss is an effective material for control of annual bluegrass in bermudagrass greens overseeded to perennial ryegrass and in 'Penncross' bentgrass greens. We suggest that the superintendent follow our test results and observations, which have been discussed, for effective use and performance of Prograss.

MANAGING GOLF GREENS FOR SPEED

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Grooming putting surfaces to maximize putting green speed and quality is a process involving six basic steps. These steps are:

(1) Vertical Mowing
(2) Topdressing
(3) Cutting Height
(4) Cutting Frequency
(5) Brushing/Combing
(6) Fertilization

All of the above procedures must be integrated as a total program in order to maximize putting green quality and speed. Unfortunately, many people believe when greens are maintained for excellent uniformity and excellent putting speed, these programs detract from the overall health and quality of the grass. On the contrary, maintaining greens for the best uniformity and speed will also allow greens to be maintained in the best growing conditions and the best health conditions for the grass. Another misconception is that putting green speed is increased through lowering the cutting height of the greens. This is true to some extent, but to a much lesser degree than is thought by most. Much of the golfing public believe greens must be scalped to be fast, when in fact, greens maintained at the higher cutting heights, but have other grooming practices done on a routine basis can be significantly faster and more uniform than greens maintained at a lower cutting height but lacking other proper grooming techniques.

Light weekly vertical mowings with the triplex putting green units is one of the most beneficial grooming practices available today. This should be done once per week during the growing season of the turf, and involves the spring and fall months for bentgrass, and the spring, summer and very early fall for overseeded bermudagrass greens. Vertical mower blades should be set to where they just go down to - but do not touch - the soil surface. This type of vertical mowing program is not designed to remove thatch from the soil surface, but to encourage the most upright and vertical growth habit of the grass. A frequency of once per week is the most desirable. Setting depth for the penetration of the vertical mowing blades depends on how long the grooves remain visable after vertical mowing. A good guideline is dispersal of these vertical mowing grooves in about four days. This is during the active growing season of the grass, and should the grooves remain for five to six days, the vertical mowing heads are set slightly too deep.

The second consideration for an overall grooming program is light and frequent applications of topdressing in addition to the topdressings made at the time of aerification. Ideally during the growing season, topdressings should be made about every 2½ to 3 weeks at the rate of about 1/8 cu. yd./1000 sq. ft. This firms up the surface, allowing for a much more uniform and consistant putting surface throughout the entire green, and is also very important for smoothing up greens where unevenness can quickly develop through foot traffic and ball marks. These light applications, especially when using dry topdressing material, many times does not even need to be dragged in, but instead can be broomed in or even watered in with the irrigation system. Light topdressings are very important in keeping thatch levels down when done in conjunction with the light vertical mowings, and also allows the superintendent to better control the degree of firmness on the putting surfaces and thus better control the shot holding ability of the greens.

Cutting height and frequency are other very important considerations for maintaining the best quality putting greens, and greens should be mowed six to seven times per week during the growing season for the best putting conditions. Changing directions of cut each time is also important, and a cutting height should be established that is within guidelines and suits the growing conditions of the particular turfgrass involved. In the Southeast, bentgrass greens can be maintained at about 3/16" on almost a year round basis except during the extreme heat of the summer months when bentgrass is grown on poor soil. Here, 1/4" has to be approached to allow some additional leaf area, helping the bentgrass to withstand the summer stress. Tifgreen bermudagrass will have the same cutting height characteristics as the bentgrass for the most part, while Tifdwarf can be slightly lower. In many cases, Tifdwarf and bentgrass can be maintained during the growing season slightly under 3/16" with excellent results, as this lower cutting height does not severely stress the turfgrass because these two putting green grass cultivars will withstand these lower cutting heights very well.

Using grooved or Wiehle rollers on the putting green mowers is one of the biggest grooming assets of the putting green mower unit. The grooved roller has a much reduced surface area than does the solid roller, and thus does not lay the grass over before the reel has a chance to clip off the ends. It encourages a more upright growth habit of the grass, and does not allow floating head greens mowers to ride up over thatchier conditions which allows thatch accumulation to an even greater degree. Also, the bench height on putting green mowers are more realistic to field conditions with grooved than with solid rollers. I would encourage everyone to use the grooved rollers on their putting green mowers on a year round basis, with the only exception being on bentgrass during the stress months of July and August. Sometimes, the grooved rollers are slightly too bruising to the tender bentgrass during the heat of the summer.

Brushing and combing are other facets of the total grooming program which again encourages the most upright growth habit of the grass and

provides the greatest surface uniformity. Brushing during the growing season with the steel bristled putting green brushes can be done two to three times per week, preventing any lateral growth from occurring on the leaves and thus discouraging greater degrees of grain on the putting surfaces. Combs can also be set down slightly deeper during the growing season to further reduce the tendencies of grass to grow horizontally. Brushes can be set to where they stand the grass up on the ends but do not dig into the crown area. In this manner, brushing frequency can be increased to better aide in improving overall putting qualities.

Fertilization is the last consideration in an overall program for establishing and maintaining the highest degree of putting green quality. Annual soil tests should be taken on greens to determine proper soil nutritional levels as well as soil pH. Phosphorus and potassium should be applied according to soil tests, but an overall 3:1:2 ratio of nitrogen, phosphorus and potassium must be maintained, given good soil nutritional levels already exist to provide the best health to the turfgrass. Good phosphorus and potassium levels must be maintained in the soil so rhizome, stolon and root growth is at a maximum at all times to overcome damage from foot and mower traffic, as well as help it withstand reduced cutting heights putting green turf demands. Keep annual nitrogen levels low, reducing the overall grass tendencies to produce wide leaf blades and succulent growth. Usually, bentgrass greens in the Southeast require about 4 to 6 lbs. N/1000 sq. ft./year, and overseeded bermudagrass greens need no more than 7 to 10 lbs. N/1000 sq. ft./year, depending on their location in the Southeast. Overfertilization of putting green surfaces is one of the biggest problems present on golf courses today, and overfertilization with nitrogen only increases the instances of disease, weeds and insects, and reduces the drought and wear tolerance of that turf. Overfertilization also creates very wide leaf blades, thus greatly reducing the overall putting surface uniformity and putting quality.

Those golf courses that have reduced overfertilization tendencies, and have brought their overall fertilization program into a proper balance, have realized the greatest influence on putting green quality than almost any other program initiated. When proper fertilization programs are initiated and maintained, along with all of the above-mentioned grooming programs in their proper perspective, not only can healthy and hardy putting greens be produced, but also the best quality putting surfaces will be maintained.

WAYS OF PREVENTING ENCROACHMENT AND REMOVING BERMUDAGRASS FROM BENTGRASS GOLF GREENS

by
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With the advent of more "know-how" and better fungicides, bentgrass for putting greens has been moving further south for the past several years. Good superintendents have been able to maintain excellent putting surfaces with bentgrass, but the problem of having good collars adjoining the bent has been as much or more difficult.

In the upper south, bentgrass collars can be maintained if the soil mix for the greens has been extended, but thatch, disease, and insect problems increase due to the higher height of cut. With heavier soil in the collars, the bentgrass may be lost due to either inadequate or excess moisture.

With these problems, most collars are planted to the same bermudagrass as the fairways, with subsequent encroachment of the bermudagrass into the greens in the summer, and the bentgrass moving outward in cooler weather. This leads to a ragged appearance and poor definition to the collar and putting surface.

Many bermudagrass collars are overseeded in the fall with ryegrass. The newer varieties of perennial ryegrass will persist through most of the summer, and will prevent the encroachment of the bermudagrass. Ten to fifteen pounds ryegrass per 1000 square feet will give a dense stand and effectively set off the green from the fairway. The same maintenance should be carried out for the collar and green during the summer, with syringing and use of the proper fungicides. Some renovation and reseeding of the collar probably will be necessary, but hopefully several of the 53 perennial ryegrass varieties in our trial will persist throughout the summer and can be used in the future.

Mechanical edging between the bermudagrass collar and bentgrass green will sever the rhizomes and stolons and aid in the prevention of encroachment. In severe cases, a sod cutter or plugger may be needed to remove the bermudagrass.

The newer varieties of bermudagrass offer promise for use in collars. This coupled with chemical retardation may provide the solution to the problem. Tifdwarf and Tifgreen bermudagrasses are reported to be more susceptible to the herbicide Siduron than either Tifway or common bermudagrass. A study is proposed to screen the effectiveness of the available herbicides on the old and newer varieties of bermudagrass and Penncross bentgrass for retardation or elimination of the encroachment problem. Preliminary screening in the greenhouse will enable field studies to determine if there is a combination of a variety and chemical that will maintain the grasses in their proper place.

REBUILDING BUNKERS TO ORIGINAL SPECIFICATION

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HISTORY OF HOPE VALLEY COUNTRY CLUB

Hope Valley was constructed in 1926 by Donald J. Ross, consisting of 100 rolling acres with narrow, hilly fairways, and small greens and tees typical of the Ross style. In the mid 30's, Perry Maxwell was called in by Wallace Wade to look at Hope Valley and make some adjustments. He redesigned a few greens, and added numerous bunkers. The golf course then remained untouched for years, which is when the problems began. For the next thirty odd years, each green chairman would leave his mark with disastrous results.

REBUILDING THE BUNKERS

In 1981, plans were made to change the bunkers back to original Donald Ross specifications. The work began a full year before actual construction started. Field notes were located, senior members were consulted, and several Donald Ross courses were visited. With the notes and memories, we began the task of locating each trap by drilling. We started the project with a fairway trip on the 8th hole. After that, we worked on all of the old traps that were still original, changing the angle of the existing banks, and putting sod on all of the sand facings. All old sand was removed, and new drainage was installed. Any bunkers that were not original were covered and mounded.

FUTURE PLANS

The work on the bunkers is now about ninety percent complete, freeing us for other restoration projects soon. We are now in the process of studying original green and tee locations and shapes.

CONCLUSION

Standing back now and looking at the results of two long years of work, we like what we see. In addition to the many hours of maintenance saved repairing the bunkers after heavy rains, which tends to serve the maintenance aspect, the aesthetic value is priceless. It is a completely new course for our members offering a greater challenge along with the restored beauty of their course.

MAINTENANCE OF BUNKERS

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Because of the varying designs, maintenance budgets and types of sand used in sand bunkers at courses throughout the Carolinas, there is no set maintenance program for all superintendents to use. You can have a variety of bunkers that differ in required maintenance from a low maintenance bunker, such as the ones you will find at a links-type course to the high maintenance bunkers you find at many PGA tournament courses. We at the Cardinal have a combination of both low and high maintenance bunkers, plus the extensive use of grass bunkers. What I will describe now is our maintenance program for both sand and grass bunkers, beginning with our spring renovation, continuing maintenance and our tournament preparation programs.

We begin our spring renovation of sand bunkers in early March so as to have them completed by the end of the month in time for increased play. We try to allow ourselves two weeks to complete renovation in respect for our unrespectable weather.

Our first step is to locate and mark where the original lines of our bunkers end and bermuda begins. With the marking completed, we edge the entire sand bunker with a Byho single wheel edger. We then go around the entire bunker, first shoveling vertically to a depth of 6" to 8" and then pulling the cut bermuda by shoveling horizontally into the vertical cut, and in a sense windrowing the debris for final cleanup. During the debris removal phase, we remove as much sand from the edged bermuda and load it onto our utility vehicle with dumpbed.

Since we have 419 bermuda around 90% of our sand bunkers the bermuda debris we remove, we haul it to a site we are now establishing a 10,000 sq. ft. bermuda nursery.

Upon completion of edging the sand bunkers, we begin reshaping and contouring of our bunkers. If any sand is to be added because of erosion, we do it at this time. Except in a few cases, we only have to go to the lowest point in our bunkers and push the sand with our sandpro utilizing its push blade to redefine our bunkers contours. We then hand rake the bunker's lips so as to give the green side a 3" to 4" lip and the remaining edge of the trap no lip.

We begin our continuing or regular maintenance of sand bunkers according to weather conditions and amount of play. Upon completion of spring renovation, we resume raking sand bunkers approximately 2 to 3 times a week and during peak months of play, May through September, we rake traps 4 times a week. During our peak season, which is also bermudas peak growing season,

we reedge our greenside bunker lips with a weedeater approximately 3 times a season. We also reedge the entire bunkers in preparation for the Cardinal Amateur in mid July using the same steps as in spring renovation.

Because of the number of "outings" and tournaments we host in a season, it is a necessity for us to coordinate with our Pro Shop our maintenance program and their golf schedule so as to have our continuing maintenance schedule coincide with our bigger tournaments.

For bigger events such as our Member-Guest and the Cardinal Amateur, we like to have all edging of sand bunkers, adding of sand and reshaping or recontouring completed 2 to 3 weeks in advance of these events. This allows any sand that was added or moved time to settle and bunker edges to attain a fuzzy or natural look. During the tournaments, we increase regular bunker raking to include hand raking lips daily.

Since the Cardinal is a Pete Dye designed course, we have quite a few grass bunkers, which are indigenous to most of his courses.

With the large amount of mounding around our greens, we have several low areas or depressions, which are highly conducive to establishing grass bunkers. Since most of our grass bunkers were established by Mr. Dye's original designs, they all had drain tiles located in these depressions making our job of establishing their size and shape quite easy.

Our first job was to cover these drains with sheets of plastic and filling them with water to desired depth and marking them with a paint gun. After draining them, we instructed our trim mower operator to simply mow around them. Once the bermuda attained a height of 1½", we begin a regular program of mowing the grass bunkers with a snapper mower and grass catcher. We maintain our grass bunkers at a height of 1½" to 2¼" depending on tournament play. Maintaining grass bunkers does increase your maintenance cost, but with the darker color achieved, it adds definition around our green.

CLOSING STATEMENT

This is a basic yearly program that we follow; it may change when necessary due to new products, ie., Sand Pro with push blade, more or fewer tournaments and outings, and in the case more often than not a lower budget. We do what we can with what we have, and put a lot of pride into what we do.

NEW CULTIVARS FOR GOLF COURSES

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A number of new cultivars have been released that may be of interest to golf course superintendents. The following is a brief description of several of these cultivars as described by turfgrass researchers in the southeast, reported in the literature, and evaluated in North Carolina.

CREEPING BENTGRASS

Penneagle - A seeded creeping bentgrass cultivar reported to perform comparable to Penncross when cool temperatures prevail. Its less aggressive nature (less vigorous shoot growth rate) may make it more prone to environmental stress compared to Penncross. Performance ratings from superintendents managing Penneagle bentgrass, in the southeast, have been mixed. It has good resistance to Helminthosporium leafspot; moderate susceptibility to brown patch, Fusarium patch and Typhula blight but is highly susceptible to dollarspot. It reportedly is less prone to chlorosis compared to Penncross.

BERMUDAGRASS

Tifway II- An improved mutant of Tifway (Tifton 419) that looks like Tifway but makes a denser, more weed-free turf; is more tolerant of frost and sting nematodes, and is quicker to green up in the spring. It must be vegetatively propagated.

Tifgreen II - An improved mutant of Tifgreen (Tifton 328) that is similar in appearance to Tifgreen but is more weed free; denser; quicker to green up in the spring and more tolerant of sting nematodes. It has a lighter green color but exhibits less of the undesirable purple color in cool temperatures. It must be vegetatively planted.

Vamont- A wide bladed, vegetatively propagated cultivar that exhibits outstanding vigor resulting in rapid establishment, good wear tolerance and excellent recovery from injury. Vamont's aggressive nature makes it a heavy thatch producer, difficult to overseed with cool season grasses and one of the last cultivars to green up in the spring. It has also exhibitedexcellent cold tolerance compared to many other bermudagrass cultivars.

Guymon- A seeded cultivar released from Oklahoma Agric. Exp. Stn. that has wider leaves than common bermudagrass but exhibits greater winter hardiness. Density and overall appearance is comparable to common bermudagrass.

TALL FESCUE

A number of "turf-type" tall fescues have been released in the past few years that are denser, finer bladed and more shade tolerant compared to the standard . . . K-31. Some appear better able to withstand a lower mowing height compared to K-31. Claims of improved heat and/or drought tolerance have been inferred, however little published data is available to support these claims. Tables 1 and 2 present turf quality ratings for tall fescue cultivars seeded alone in the sun and in mixtures in the shade evaluated in Raleigh, N.C. during 1983.

KENTUCKY BLUEGRASS

Eighty-five cultivars of Kentucky bluegrass have been evaluated since 1980 to determine their potential under North Carolina conditions. The top ten performers for the first three years are shown in table 3. Glade was the only named cultivar that appeared in the top ten for two years. MLM-18011, PSU-173, and 225 are experimental selections that have remained in the top ten since the test began.

PERENNIAL RYEGRASS

Table 4 provides a listing of the top 15 perennial ryegrass cultivars during 1983 in the national perennial ryegrass trial established in Raleigh October, 1982. Citation, Blazer, Ranger, Barry, Elka, All*Star, and Derby appear the most promising.

CENTIPEDEGRASS

AU Centennial- A vegetatively propagated cultivar released from Auburn, Alabama that exhibits a darker color, shorter internodes and seedheads and higher density compared to common centipedegrass.

Table 1. Turf-type fescue quality ratings for 1982-1983. Raleigh, N.C.

Cultivar	1982	1983
Adventure	6.9	8.0
Rebel	7.5	7.5
Falcon	7.1	7.4
KY 31 + Glade + Kenblue	7.3	7.4
Galway (K5-27) --NK	6.6	7.0
KY 31 - Kenblue	6.5	6.9
Mustang	6.9	6.9
Brookston	6.4	6.8
Houndog	7.0	6.8
Clemfine	6.2	6.6
KY 31	6.7	6.5
Olympic	6.1	6.5
Finelawn TF	6.6	6.5
LSD	0.3	0.5

Turf quality ratings on a 1 to 9 scale, with 9=best.

Table 2. Turf quality* of tall fescues, Kentucky bluegrasses, and mixtures under shaded conditions during 1983. Top Ten Treatments.

Cultivar		Turf Quality
Rebel/Kenblue/Glade/Reliant	(80/5/5/10)	7.1
Rebel/Kenblue/Glade	(90/5/5)	6.8
Rebel Tall Fescue		6.8
Rebel/Kenblue/Glade/Pennlawn	(80/5/5/10)	6.7
Rebel/Kenblue/Glade	(80/10/10)	6.6
Houndog/Kenblue	(80/20)	6.6
Ky-31/Glade/Newport/Kenblue	(90/3/4/3)	6.5
Rebel/Kenblue	(90/10)	6.5
Rebel/Kenblue	(80/20)	6.4
Falcon/Kenblue	(80/20)	6.4
LSD		0.4

* Turf quality ratings on a 1 to 9 scale, with 9+best.

Table 3. National Kentucky bluegrass trial top ten cultivars, 1981-1983.

1981		1982		1983	
Cultivar	TQ*	Cultivar	TQ	Cultivar	TQ
CEBVB-3965	7.4	ADMIRAL	7.1	ASPEN	7.1
225	7.3	225	6.9	225	7.0
MLM-18011	7.3	CEBVB-3965	6.7	239	6.9
WWAG-463	7.2	BARBLUE	6.6	PSU-173	6.8
FYLKING	7.2	PSU-173	6.6	BONNIEBLUE	6.7
GLADE	7.2	MLM-18011	6.6	MLM-18011	6.7
MONOPOLY	7.1	WABASH	6.6	WWAG-463	6.6
PSU-173	7.1	K3-179	6.6	I-13	6.6
VICTA	7.1	GLADE	6.5	BANFF	6.5
MOSA	7.0	H-7	6.5	VANTAGE	6.5

* Turf quality ratings on a 1 to 9 scale, with 9=best.

Table 4. National Pernennial Ryegrass Trial, 1983.

Entry	Overall* quality	August* quality	April** frazzle rating
Citation	6.80	6.00	2.00
Blazer	6.60	4.33	2.67
Ranger	6.43	5.00	2.33
Barry	6.36	4.67	3.00
Elka	6.33	3.67	2.33
All Star	6.23	4.67	2.00
Derby	6.07	4.33	1.67
Acclaim	6.03	4.67	2.67
Birdie	6.03	5.00	2.00
Pennant	5.93	5.00	2.00
Delray	5.93	5.00	2.00
Gator	5.93	4.33	2.33
Pennfine	5.87	4.00	2.33
Regal	5.83	4.67	1.67
Cigil	5.80	4.67	2.67

* Turf quality 1 to 9, 9=best.

**Frazzle rating 1 to 3, 1 = none; 2 = some, 3 = unacceptable.

MAINTENANCE OF HIGH SCHOOL ATHLETIC FIELDS

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In the introduction to Carolina Lawns, a pamphlet published by the North Carolina Extension Service, which I consider to be the best source of lawn information in North Carolina, the authors state that it takes knowledge and work in order to have a good lawn. In my opinion, these two traits are doubly important in the intensive management of turf on athletic fields.

Much progress has been made in the last 25 years in turfgrass management. New varieties, better equipment, suitsuitable chemicals, improved fertilizer and a better understanding of management have all been great assets to the turfgrass industry. When I first began working with athletic fields we had basically two grasses which were recommended, Kentucky 31 tall fescue and common bermudagrass. These are still good grasses, but some of the newer hybrids will give much better results with fewer problems.

Traffic and the resulting compaction of the soil is the most severe problem associated with turf on athletic fields. There is no grass available which will stand up under the onslaught of football, baseball, soccer and physical education, not to mention the most damaging of all--track and a marching band.

Although soil plays a very important role in the growth of trufgrass, it is often taken for granted in the construction of athletic fields. Many high school fields are graded down into the subsoil and parent material, leveled somewhat, lime and 10-10-10 fertilizer applied, worked in the top few inches and seeded. Can we expect a facility constructed in this manner to support heavy traffic regularly? We must give more attention to the soil and provide it with all the help we can in its job of growing high quality turf. A good balance between mineral matter, organic matter, air and water must be maintained for porper turf. This is influenced not only by the type of soil but by how we are managing it.

One of the biggest problems associated with soil management at the high school level is the lack of suitable equipment. Golf courses are managing turf on a hundred acres

or more and must have the necessary equipment to mow, aerify, spray, etc. Most high schools have less than six or seven acres of high qualify turf and the expense of owning the necessary equipment is often more than can be justified. A possible solution to this problem might be getting several schools or an administrative unit to pool resources and secure the needed equipment. This will often create another problem of who uses the equipment and when. We have several schools using the same equipment in Guilford County and often we have two schools wanting to use it at the same time.

Overcrowded schools and a lack of grass areas is a very serious problem in many high schools. Practice fields are a must if you are going to have attractive and safe football and baseball fields. Football and band practice start at most schools on August 1 and the season extends well into November. September and October seeding of cool season grasses is virtually impossible on fields which are being used. November seeding is usually not satisfactory in most of North Carolina, especially in the clay soils of the Northern Piedmont which tend to spew in winter. Early spring seeding is normally difficult due to inclement weather and poor soil condition. Also, baseball, softball and track practice begins on March 1 and all the P. E. classes are wanting to get outside after being cooped up in the gym all winter. What chance does a little fescue seedling have under these conditions?

The other alternative, warm season grasses, has many problems also. The expense of establishing and managing high-quality turf is, in a lot of cases, more than a school can afford. Fertilizer, chemicals and equipment cost more each year. Add to these an elaborate watering system and the dollar value becomes enormous. They are a must, however. What would have happened to our turf without water this past summer? We have a system on our football field that will deliver 5,000 gallons of water in less than an hour and we still had some dry spots develop during the extreme heat of August and early September. On the other extreme, warm season grasses are often damaged or killed in very cold winters. Only time will tell the severity of damage suffered in the last two weeks.

Another major factor to consider in the management of turfgrass is the safety of the players. An athletic field in poor condition is one of the major contributing causes of player injury. A porous, properly aerated soil is fundamental to healthly plant growth. Through aerification, the soil condition is improved to permit the roots to develop freely and produce a healthly, lush carpet of grass. Studies

have shown that the number of player injuries drop dramatically when a thick turf is provided.

Maintenance of turf on high school athletic fields presents another problem in many schools. Improper mowing can be devastating to an otherwise excellent athletic facility. Students can be of valuable assistance during the school year but require considerable supervision. Unless there are some school personnel employed on a twelve month basis, the athletic fields will suffer during the three months which require the most mowing and watering. Neglect or abuse of a field during one growing season could create a situation where overseeding or normal care will not correct the problem. In that case we may have to renovate the entire field.

REBUILDING OF EAST CAROLINA FOOTBALL FIELD

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I think a little history is necessary to understand the need for rebuilding of Ficklen Stadium. Construction was begun in the summer of 1961 and the summer of 1962 it was finished and allowed to grow the balance of that year and the summer of 1963. The prints show that the site was at the head of a farm pond with a ravine through the west end of the field. The fill was from several sources and the top soil had sludge from the sanitary sewage disposal plant mixed with it. Tifgreen (T 328) was planted, and from records I found an ag grade 8-8-8 was used with a supplement of nitrate of soda. An aluminum portable irrigation system was used for watering with city water at city pressure.

In 1968 I came to the University and changed some of the field management procedures. We started using a turf type fertilizer and aerating and using different mowing patterns. The fall of 1969 proved to be too much for the field with several wet or rainy games; 5 high school games, 5 college games, band practice at least once a week, several scrimmages per season, and a pregame workout once a week. The straw that broke the camel's back was a 2A high school play-off game on Thanksgiving Day in a downpour. It had been raining all day and there was a downpour during the game. When the game was over there was no crown in the center of the field. In the summer of 1970 we rebuilt the center of the field, from the 15 yard line to the 15 yard line between the hash marks. After the crown was reestabilished, we sprigged with T 419 and sodded four small areas with Maryland Tufcote. The purpose of planting the Maryland Tufcote was for comparison of hardiness and wear resistance. I found no difference between Tufcote and T 419, however, both held up better than T 328. Tufcote is courser than T 419 and T 328, therefore, I found it to be less desirable. After a summer of moving portable irrigation pipes every 4 hours, I convinced the administration that it would be cheaper, in the long run, to install automatic underground irrigation. In the spring of 1971 we installed the irrigation and with a better fertilizer program and the new grass in it's second year, the field looked the best it ever had.

Everything was fine until 1977 when I noticed that the drainage was becoming increasingly poorer and I recommended that we do a major renovation . For one reason or another the field was not scheduled for renovation until the spring of 1983. The last two years the field was in very poor condition by mid-season.

In the fall of 1982 the firm of Rivers and Associates was hired to do the engineering for the renovation. Dr. W. B. Gilbert from NCSU was

hired as a consultant by Rivers and Associates. The plans were approved and bids were taken with an opening date of April 13, 1983. Because of completion time constraints, start up was on April 25, with completion no later than June 29. The project was started a week late because of rain, but was completed three weeks early. I cannot say enough about the contractor and his efficiency.

The site had a few existing conditions that had to be dealt with. There is a direct burial high voltage cable at all four corners and across both ends of the field. This cable could not be isolated, therefore, the work was done around three hot cables. The grade between the goal posts was changed to level the field somewhat from 30" higher on the east to west; to 18" east to west fall. The on field irrigation had to be removed and reinstalled as well as the field telephones. The site limits for excavation was 15 feet beyond the side lines and the back of the end zone line. The limits were placed on the site to avoid having to remove the irrigation controls and wiring and to avoid the high voltage cable, thus reducing the cost.

The field was excavated to 16" below finish grade. The sub-grade was compacted to the same contour as the finish grade so that drainage would be consistent over the whole field. The usable turf was removed from the field by the University prior to excavation for use on other fields. The excavation spoils were hauled to a storage site on campus for future use by the University.

The next step in the renovation was installation of drainage lines. They were installed 8 feet on either side of the centerline of the field and 16 feet on center in both directions, perpendicular to the slope of the crown of the field. (In other words, the lines ran from end zone to end zone rather than side line to side line). The trenches were 10" deep and 12" side. The pipe was laid on a 2" bed of stone and the stone was brought to the surface of the subgrade. The pipe is a 4" perforated field drain tubing wrapped in factory installed nylon screen. The screen is of such mesh that it is not blocked by fine silts. Care was taken so that the ditches and pipes were not crushed during installation and later construction. The contractor came up with a unique way of digging the trenches. A box 10" deep and 12" wide was built on the end of a large motor grader blade and they could dig the ditch and spread the spoil in one pass. Another motor grader was used to fine grade the spoil that was allowed for in excavation so that none of the spoil had to be removed.

The aggreate used in the trenches and the 4" layer above the subgrade is No. 78 M stone. The stone was hauled in between the trenches and spread with a Caterpillar D6. The D6 had enough track surface not to crush the drain lines, but enough weight to compact the stone so that there would a minimum amount of settling. The grade was checked almost constantly to insure the proper quantity and grade.

The 4" sand layer is composed of Standard Size No. 2S sand and was spread and compacted the same as the stone course. The purpose of the

sand course is a transition from the top soil to the stone. Another way of looking at it is an area that will support root growth and provide necessary drainage without the additional expense of the extra 4" of top soil.

The top soil course is composed of 70% sand, 15% peat, and 15% top soil. This homogeneous mixture was adjusted to 6.5 pH before heat sterilization. The percolation rate is 5 to 6 inches per hour. Porosity is greater than 40% and less than 50%, non capillary porosity is greater than 15%. Bulk density is 1.3 to 1.45 gram/cm^3. Water retension capacity is 15% -25% at 40 cm tension. Particle size: The top soil mixture shall contain no particle larger than 2 mm (fine sand). In addition, the mixture shall contain less than 5% silt and 3% clay. The prepared top soil was hauled to the site from the blending and sterilizing suppliers site in covered dump tucks. At the stadium the material was handled in the same way as the sand and stone. After spreading and compacting the prepared top soil, the goal posts were adjusted. Next, fine grading and scarifying of the area behind the goal posts to the limit of the work area was done. This area was existing soil that had been regraded to meet the new field grades; it was fumigated with methyl bromide.

The whole site was fine graded and fertilized with 0-20-20 at a rate of 15 pounds per 1000. The fertilizer was then incorporated into the top three inches of soil with a Lely Turfshaper. This operation also provided a good seed bed for the sprigs.

Irrigation had been reinstalled before the fine grading was completed; now the field was ready for sprigging. The turf company came in and fertilized the site with 16-4-8 at a rate of 1 pound of N/1000. The site was sprigged with 1500 bushels of T 419; this rate was approximately 800 bushels per acre, which is a heavy rate. As the turf company was driving out the gate leaving the site, a down pour started- we had 2" of rain in the next 24 hours.

Now with the grass planted, all we needed was sunshine, warmth, and water. If you remember, last summer we got more sunshine and warth than we bargained for; therefore the water bill got out hand! Generally speaking, the irrigation was set and it ran all summer. There are eleven stations that cover the field and each area was covered every 3 hours with 15 minutes per station. The system cranked up at 7:00 AM and ran until 10:00 PM every day unless it was raining and sometimes if it were light rain it ran regardless. During the summer adjustments had to be made in time and direction on part circle sprinklers, but generally the water schedule remained the same through September. I utilized some part time student help to work weekends to be sure everything ran on schedule like it was programmed.

For the first month, everything seemed to be going well. Then I realized that the sprigs were not spreading as they should and the color was not what it should be. I called the turf contractor and Dr. Gilbert and they came and looked at the field and it was decided that the grass

was starving. We had originally started out with 1 pound N/1000 every two weeks. It was decided to give one dose of 2 pounds N/1000 followed by weekly applications of 1 pound N/1000. The grass responded almost immediately with good growth. The problem was with the very porus soil and the heavy watering we were doing was leaching the nutrients below the root zone. For fertilizer we used a premium grade ag type 10-10-10 with six minor and trace elements guaranteed and 46-0-0 urea. We used 10-10-10 two weeks and then urea one week. By using 10-10-10 we kept the phosphorus and potash up as well as the minor and trace elements, while the N was kept at an even level. One of the things that confirmed our observations was the area behind the end zones where existing soil was sprigged; the color was good and coverage was accomplished in about six or severn weeks. Our problem in this area was too much water.

Weeds became a problem as the summer went by. At first, the students on weekends were able to pull the weeds as they germinated, but by mid July, they could not keep up with the weeds. The first week in August, with the weed problem getting worse rathar than better, I sent 10 men to the stadium and they spent four days on hand and knees pulling weeds and got them under control. There was a wide variety of weeds growing with a majority being broad leaves or nut grass. I was afraid to use a herbicide for fear of stunting or retarding the grass in someway, therefore, we used the least efficient, but least harmful way of weed control for the summer. An observation worth noting is that we did not have a weed problem in the area treated with methyl bromide. If I were to do it over again, I would gas the entire area.

The field was cut very close to start with and until mid August only raised a little. In mid August we raised the cutting height to about 1". The beginning of September, we raised the height to a little more than 1 1/4". The reasoning behind this was to provide a cushion and less tearing of the turf at the soil level. Even though the field looked a little ragged with the longer grass it accomplished what I was trying to do.

There were 4 college games, 5 high school games, 2 college scrimmages, 3 college JV games, and 1 high school scrimmage played on the field this year, which is far fewer activities than there has been in the past. The field came through the season in fine shape and with more grooming and top dressing next year, the field should be in the best condition ever.

I would like to give credit to the engineers, Rivers and Associates, and their consultant, Dr. Gilbert. Also, to Barnhill Construction Co., Tarboro, N. C. and to their subcontractors and suppliers, E & S Soil and Peat Industies, Inc., Rocky Mount, N. C., United Turf, Louisburg, N. C., and Hendrix and Dail Co., Greenville, N. C.

WARM SEASON GRASS RELEASE PROGRAM ALONG NORTH CAROLINA'S HIGHWAYS

W. D. Johnson
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North Carolina Department of Transportation
Raleigh, N. C.

The Department of Transportation is now considerably expanding what appears to have a tremendous potential as a part of our vegetation management program in Eastern and parts of Southern North Carolina. This has been referred to as our warm season release program.

We have under contract with turf specialists in the Crop Science Department at North Carolina State University a research project that will develop for the Department of Transportation a series of computer generated maps detailing physiographic planting zones for different types of vegetation. These physiographic zones will be determined by known information about different vegetation types along with gathered field information from plant test trials in all of our 14 Highway Divisions across the state. Different parameters are being considered in this physiographic zoning. For instance with regard to the water stress parameter, which considers the amount of rainfall and the days of significant rainfall, we find, as we might expect, that the Sandhills region is the area of highest water stress. Polk, Henderson, and Transylvania Counties have the area of least water stress.

Another example of a parameter being considered is that of temperature stress. In this regard the growing season or days that are frost free are considered along with the cold temperature extreme. An interesting aspect of this item is a band running through Warren, Franklin, and Wake Counties of temperature stress that is greater than stress in the Burke and Rutherford County areas. This, of course, would not be expected from an east/west or elevation consideration.

The composite of these different environmental considerations will yield us a plant adaptation map showing by county (with also the major highway network imprinted) where each different plant type being considered is adapted. For instance, we find with fescue that adaptation is poor in the east as we might expect, but also very marginal in the Albemarle/Charlotte area which is our 10th Highway Division - an area that we would not have expected this show up.

As a part of our warm season release program, we have undertaken an extensive program of sod seeding with minimum tillage equipment, primarily the Tye Pasture Pleaser. This no-till grain drill allows the placement of seed in existing sod in conversion from one type of turf to another.

We have, with the use of this equipment, attempted to establish Bahiagrass along roadsides where we have existing vegetation that we do not desire complete renovation on. In our new seeding operations we are also attempting to establish Bahiagrass in the areas of our state where warm season grasses appear to be more adapted. We hope that our research project with North Carolina State University will refine and show us a better delineation of these areas.

Bahiagrass, for those that may not be familiar with it, is a warm season sod-forming grass which is used extensively along roadsides in the Southeastern United States with very good results. We have found it to be very drought tolerant with a reasonably low fertilization need.

Herbicides play the main role in our warm season release program. We began our program utilizing Roundup and Diuron as a combination to eliminate existing Fescue clumps and allow for a pre-emergence herbicide for broadleaf weed control. We also have utilized Roundup alone for the elimination of the existing clumps and a follow up with a post-emergence treatment of Garlon for broadleaf weeds.

I would be remiss if I did not mention our application equipment. We have been very successful in taking our old skid-mounted sprayers and mounting stainless steel wet booms for these applications. We now are in the process of refining this further with the use of control droplet applicators (CDA's). The theory of these applicators will be discussed by another speaker, but I might say that we have reduced our spray volume per acre from 50 GPA to 5 GPA with these units with very comparable or better results than the higher gallonages. This allows us to fill with water at one of our Department of Transportation facilities and not have to carry supply trucks and pumps up and down the highway servicing our sprayers. It also allows for many more acres to be sprayed in a day as time is not killed during the fillup operation. We are very excited about the possible potential with the use of CDA's in our program.

The Roundup and pre-emergence or post-emergence herbicide treatments have been very successful in reducing mowing and allowing us to release these desirable warm season grasses. Mowing on many of these routes has been reduced from the normal 5 times to 1-2 times, depending on the weed pressure.

We also have utilized and see a great potential in a new Dupont herbicide named Oust (Sulfometuron Methyl). This product is an analog to Glean, the new Dupont wheat herbicide. This is one of the new mini-herbicides with application rates in the neighborhood of 1/2 to 1 ounce per acre. We have used this herbicide on both Bahiagrass and Bermuda grass with excellent results on common Bermuda along our older roadsides. We have found that we have to use slightly lower rates on Bahia as it is not quite as tolerant to this herbicide. This particular product is soil active and acts pre-emergent to broadleaf weeds and many annual grasses. At the rate of one ounce per acre it will also take out fescue clumps, depending on the timing of application and environmental factors.

We have several routes where we applied Oust in the early spring and did not mow the roadway section but one time the whole season for a considerable savings in roadside vegetation maintenance. Bermuda grass seems to be relatively tolerant to Oust with only some delayed greenup at the one ounce rate. We are also very excited about the use of Oust as a growth regulator on Bahiagrass. At the quarter ounce rate we see very effective seed head control on Bahiagrass. This will give us a material cost of approximately $1.50 per acre for this treatment. We will be significantly expanding the usage of this product this coming season along our Bahiagrass sections for seedhead control. Application for seed head control is made in late May and early June.

Of special mention in our warm season release program is our usage of a waste product (Mallinckrodt Ammonium Sulfate Liquor) which is a by-product of the production of Acetaminophen at Mallinckrodt's Wake Forest plant. This by-product is a 7% ammonium sulfate solution, fully approved for roadside usage (even approved for some field crops) that allows us to topdress large portions of our roadsides with a liquid nitrogen solution. This particular product gives a brown stain to the grass, which is a pigment left in this product during the production process. It, of course, grows out of this in a short period of time giving a lush green color.

We are very proud of our new stainless steel 1200 gallon applicators which we use for both fertilizer applications and herbicide work. These have stainless steel wet booms hydraulically controlled from the cab equipped with flood jet nozzles and CDA's that we are now adding for herbicide work.

We also are making use of ropewick applicators in our warm season release program to eliminate escaped fescue clumps or weed escapes. We have mainly been using the Bo-bar rope type unit with hydraulic folding wings that is mounted on the front of our tractors. This has given us very good results for this type of application as long as the target species is above the desirable vegetation. Roundup has been our mainstay in this operation, although we have used some Banvel and Garlon for broadleaf weed control with good results.

We have also utilized and have several Carpet-Bagger units on order which combine the merits of a recirculating sprayer and a wiper type applicator in one unit. We feel there is much potential for the use of this applicator as it allows us to increase the ground speed as more herbicide can be wicked by this particular technology.

Hopefully the result of this total warm season release program will be better roadside turf and thus better roadside aesthetics along with fewer dollars required for routine vegetation maintenance.

CONTROLLED DROPLET APPLICATION FOR ROADSIDES

January 4, 1984

by

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Control Droplet Application will highly reduce labor and equipment cost through lower volumes and smaller equipment expenditures as well as reduce liability exposure caused by drift from conventional spray methods.

Three years of experimentation has led the Georgia Department of Transportation to accept Controlled Droplet Application (CDA) as a viable alternative to high volume spray application. Potential savings of time and money make the use of CDA's very attractive.

Testing during 1981 consisted of two small plot trials and two large test sections with a 1200 gallon, 20 foot boom, truck mounted sprayer with 5 CDA nozzles.

In May, 1981, a drift test was conducted with a hand-held CDA (Herbi). Paraquat was sprayed under high wind (gusts of 30-35 MPH) at different heights and spacings from sensitive vegetation. Observation of dead leaf spots show a pattern shift varying with height of nozzle but very little drift.

On July 16, 1981, 500 sq. ft. plots were established on bahiagrass stands at Tifton, Georgia. A 40 gallon per acre conventional hand sprayer was compared to the CDA (Herbi) for bahiagrass seedhead control. MSMA at 2 lbs. active ingredient (ai) per acre was used in one test and glyphosate at one quarter pound ai (eight ounces product) per acre in another. Ratings on August 18 showed no lasting seedhead suppression from the two high volume plots but good seedhead and foliage suppression from each chemical applied with the CDA.

With encouragement from these tests, 5 CDA's (Micromax) were purchased and installed temporarily on one of the Department's 1200 gallon spray rigs. Four foot spacings were selected based on literature published at the time. The modifications necessary to the rig were not difficult. The size of the bypass line was increased, the pressure was changed from 40 PSI to 25 PSI and 12 volt electrical was run to the boom.

The rotary nozzle was protected from hits on signs by a guard and breakaway bracket. The bracket also lowers the CDA from the 62 inch boom height down to about 37 inches.

With the modified sprayer two tests were conducted late in the 1981 season. One test was with paraquat in windy conditions and again little drift was seen. There was a narrowing of the spray pattern when raising the boom over signs. This problem is experienced with the flood jet nozzles but it was worse with the CDA's. In the second test, 25 miles of interstate was sprayed with MSMA. The equipment worked well but there was little information to get about control of vegetation because it was too late in the season.

In 1982, the nozzles were moved to a new sprayer and a fine mesh in-line filter added to the discharge line of the sprayer to try to solve problems with numerous cleanouts of the small filters at the orifice plate at each CDA. Five locations totaling 150 miles were sprayed with 2 lbs. ai/a MSMA for bahiagrass seedhead control. Application rate was 1.9 gallons per acre. Vegetation control was excellent and at least equal to the control obtained with the Department's standard application volume of 30 gallons per acre.

In October, 1982, the sprayer was converted to direct drive CDA's (Micromax) and spacing was increased to 60". In December, 1982, this sprayer was tested on moisture sensitive paper to learn more about drift and nozzle spacing. Results indicate that drift is much less than with flood jet nozzles and that a 60" nozzle spacing is about right for a reasonably uniform pattern at an operating speed of 15-18 MPH.

An additional 1200 gallon sprayer was converted to CDA in 1983 and the application rate for both sprayers was changed to 2.7 gallons per acre using a Spraying Systems orifice plate number 4916-70. Using MSMA at 2 lbs. ai/a, a total of 6,000 acres was sprayed and excellent results obtained. One hundred to 150 acres per day are routinely obtained with flood jet nozzles. One hundred fifty to 170 acres per day were obtained with the CDA rigs. Breakdowns kept the CDA rigs from reaching a hoped for 220 acres per day. It is anticipated that the problems causing most breakdowns can be solved and the Department is still optimistic. Plans are for an expanded program for 1984.

The Bogle Company has done testing in Florida on Rail Right-of-Ways using three to five gallons with CDA versus 35 gallons per acre with conventional method. Using 3 quarts of Roundup and 11 ounces of Oust per acre, tests show total control with both systems; however, with CDA and low volume, they register vertually no drift and a much quicker burn.

The North Carolina Department of Transportation also has done much testing as well as practical application with CDA and results seem to be most promising and positive.

Study and practical application show CDA to be a highly efficient, low cost alternative to conventional spray methods.

MANAGING AN URBAN PARKS SYSTEM

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City of Raleigh
Raleigh, NC

Those in Parks and Recreation were asked to identify themselves in this session. The vast majority of the people in the room were not Parks people. Therefore, I proceeded by describing the Parks System in Raleigh and asked that if there were questions to please interrupt and ask them.

RALEIGH'S PARKS SYSTEM INCLUDES

1. 40 buildings with 192,136 square feet of indoor space.
2. Approximately 2,000 acres of park land.
3. 128 different parks spread out over the City and Wake County (as much as 20 miles apart).
4. 5 swimming pools (with 4 more to be constructed.
5. 42 ballfields (softball, baseball).
6. 85 tennis courts.
7. 130 miles of highway system.
8. 3 City-owned cemeteries.
9. The downtown mall (Fayetteville Street).
10. The Greenway System - 16.9 miles.
11. The street trees for the entire City.
12. Number of employees: Fulltime - 124
    Seasonal - 55

Once a management system is established, the managing of the system becomes one of solving the problems as they occur. Problems in management of personnel, scheduling of maintenance, rainy day work shifts, daily, weekly, monthly seasonal and annual routines were discussed. A number of questions were asked and were followed by indepth discussions.

TURFGRASS RESPONSE TO GROWTH RETARDANTS

J. M. DiPaola, W. B. Gilbert and W. M. Lewis[1/]

Mowing is a time consuming and expensive maintenance procedure for turf. Many turfgrass sites are not easily accessible for mowers and are often dangerous for both the operator or nearby personnel. One alternative to mechanical mowing is the use of plant growth retardants to slow the growth rate of the turf. A thorough understanding of both the advantages and disadvantages of these chemicals is necessary to obtain the desired growth suppression with minimum side effects.

Plant growth regulators are natural or synthetic organic compounds that alter the physiological growth and development processes in plants. In other words, these substances are applied to a target plant to change its life processes in such a way as to improve quality, increase yield, or otherwise accomplish a desirable goal. An example of this with turfgrasses is the use of gibberellic acid to delay bermudagrass dormancy and shoot color loss in the Gulf Coast region of the United States. More recently, the growth regulators flurprimidol and pactlobutrazol have been demonstrated to dramatically increase the seed yield for several cool season turfgrasses.

Growth retardants are plant growth regulators which slow plant growth typically through the inhibition of cell division and/or cell elongation. Three commercially available turfgrass growth retardants are maleic hydrazide, mefluidide, and chloroflurenol. These compounds have demonstrated both vegetative and reproductive growth suppression for several turfgrasses. Unfortunately, turfgrass growth inhibition is usually accompanied by various expressions of phytotoxicity.

The ideal turfgrass growth retardant can be defined as a substance that suppresses shoot growth for a consistent and defined period, while permitting a full resumption of turf growth after this period. This compound must also suppress inflorescence elongation and development, be non-phytotoxic, and permit root and lateral shoot (rhizome and stolon) growth.

The ideal growth retardant has not yet been identified for turfgrass use. Leaf blade discoloration and the reduced recuperative potential of turf treated with growth retardants has limited the use of these chemicals to low maintenance sites where such phytotoxicity is more tolerable. Roadsides, highway medians, creek banks, slopes, fence rows, and industrial grounds are examples of turfs that can be considered as potential candidates for growth suppression using retardants.

Since 1979 turfgrass growth retardant studies at North Carolina State University have been conducted on both warm and cool season turfgrasses. Tall fescue (Festuca arundinacea Schreb.) has been examined under both roadside and home lawn conditions for the influence of the type

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and rate of growth retardants used, date of application, seed head control, age of stand and fertility effects. The warm season turfgrasses, bahiagrass (Paspalum notation Flugge) and common bermudagrass (Cynodon dactylon L. Pers.) have been similarly investigated. The growth retardants used in these studies are shown in Table 1.

Table 1. Growth retardants utilized in trials of warm and cool season turfgrasses at North Carolina State University

Trade name†	Common name	Application rates	Absorption site
		— lb ai acre^{-1} —	
Cutlass	Flurprimidol (EL500)	0.75, 1, 2	Root
Embark	Mefluidide	0.125, 0.25, 0.375	Foliar
Eptam	EPTC	4, 5, 6, 8	Root, foliar
Parlay	Paclobutrazol (PP 333)	0.75, 1, 2	Root
Slo Gro	Maleic hydrazide	2, 4	Foliar
	MON 4620	2, 2.5, 3, 5	Root

†The use of trade names in this paper does not imply endorsement of the products named, nor criticism of similar ones not mentioned.

Turf under Roadside Conditions.

All compounds resulted in temporary turf discoloration three to six weeks after spring applications. Turf quality was generally acceptable for roadside use, but not for more intensively managed turf. Leaf tip burn was the most common response to growth retardant injury. Applications during late spring tended to be more injurious to tall fescue than March applications. Phytotoxicity was greater on bahiagrass that tall fescue. Water stress conditions at or immediately following growth retardant treatment also increased injury to the turf.

Tall fescue seed head suppression exceeded 90% following spring applications of maleic hydrazide (4 lb ai A^{-1}) and MON 4621 (2.5 lb ai A^{-1}). Treatments with flurprimidol, mefluidide, paclobutrazol and EPTC resulted in seed head suppression below 80%. Seed head suppression was unacceptable when growth retardants were applied later than two weeks before the emergence of the tall fescue inflorescence. At this point, the inflorescence is enclosed within surrounding leaf sheaths and is about two inches in length. Fall applications of growth retardants to tall fescue were ineffective in suppressing seed head emergence and elongation.

Growth retardants were generally less effective in suppressing bahiagrass seed heads. Maleic hydrazide was the only growth retardant that provided acceptable seed head control of bahiagrass. Applications of

maleic hydrazide and MON 4621 in the last week of July still resulted in about 40% seed head suppression of bahiagrass.

Turfgrass stand density was not appreciably diminished at one year after treatment of either Pensacola bahiagrass or Ky-31 tall fescue. Increased nitrogen fertilization of tall fescue and bahiagrass under roadside conditions reduced the growth retardant induced discoloration without negating seed head suppression.

Turf under Home Lawn Conditions.

Growth retardants typically reduced turf quality of tall fescue under home lawn conditions due to discoloration of the leaf tips. This phytotoxicity was most visible from two to six weeks after March treatments with the compounds shown in Table 1. Turf quality did improve rapidly from 6 to 12 weeks after retardants were applied. Leaf color at eight weeks after application was enhanced for maleic hydrazide, mefluidide and MON 4621 treated turf, but not for flurprimidol or paclobutrazol treatments. Increased nitrogen fertilization enhanced turf quality following growth retardant treatment.

Newly established tall fescue (6 months old) was severely injured three to four weeks after March applications of MON 4620 and mefluidide, while injury from maleic hydrazide, flurprimidol and paclobutrazol was slight to moderate at this time. Turf discoloration at eight weeks was still visible on this young turf for all growth retardant treatments except mefluidide.

Reductions in the stand density of mature or newly established tall fescue following growth retardant treatments were temporary under home lawn conditions. June applications of flurprimidol to a common bermudagrass turf increased the number of stolons while suppressing vertical shoot growth.

The mowing requirement of tall fescue during April and May was reduced by one to two mowings after March treatment with growth retardants. Mowing savings are apt to be small under home lawn conditions where greater quality and uniformity is demanded. In these investigations, the turf under home lawn conditions was mowed when the shoot reached a height one-third above the normal cutting height. Mowings have typically been reduced from six to two for tall fescue under roadside conditions.

Summary.

Industrial efforts to discover and market new turf growth retardants have been expanded during the past few years. Some have speculated on the potential use of growth retardants in more sensitive turf applications such as home lawns and commercial grounds. Compounds introduced into these environments must be non-phytotoxic considering the turf quality demanded in such landscapes. The traffic that is often associated with these sites presents an additional barrier to the use of growth retardants. Damage to the crowns of the growth retarded turf is likely following wear and abrasion under traffic.

Weed encroachment is generally increased following applications of growth retardants. The growth inhibition of the turf renders these plants less able to compete with many weedy species which are typically unaffected by the action of chemical retardants. The unsightly presence of weeds is undesirable for both low and high maintenance turf. A well planned weed control program is an essential component of a turf management system that employs the use of growth retardants.

Plant growth regulators and growth retardants will continue to be useful tools in the culture of turf. The turfgrass manager must recognize the constraints as well as the benefits inherent in the use of these substances in turf.

CENTIPEDEGRASS CULTURE AND PROBLEMS

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Centipedegrass is a warm-season turfgrass that is popular in many parts of the South. A major reason for this popularity is the low maintenance requirements such as infrequent mowing and fertilization. Centipedegrass also grows well in acid (pH 5.0 to 6.0), low fertility soils and is generally free of pest problems when properly maintained.

Centipedegrass has a medium, coarse-leaf texture which is finer than St. Augustinegrass but coarser than bermudagrass. It naturally has a light green color and a slow growth rate. However, it will become dark green and grow rapidly under high nitrogen fertilization. It spreads by stolons and can be planted vegetatively or by seed. Centipedegrass grows best in sandy soils and is adapted to sun and shade. In fact, it has been reported to be more shade tolerant than St. Augustine (3). These traits make centipedegrass useful for lawns and other turf areas where traffic is limited, such as golf course roughs, cemeteries, airports, roadsides and some park areas.

The major faults of centipedegrass are its sensitivity to iron deficiency and low temperatures. Iron deficiency, expressed as chlorosis, is common when the pH is above 6.5, when phosphorus levels are extremely high, when potassium fertilization is high, and during periods of rapid growth (6). However, centipedegrass can be found growing well under such conditions throughout the South. If chlorosis does occur, foliar applications of iron as ferrous sulfate or iron chelate will temporarily correct the problem. Ferrous sulfate applied at the rate of 2-4 ounces in two gallons of water per 1000 square feet is commonly used. In general, centipedegrass is more winter hardy than St. Augustinegrass but less winter hardy than bermudagrass. Some studies indicate that centipedegrass survival is significantly reduced with exposure to 15°F temperature for more than five hours (2). However, much of the winter injury in centipedegrass is due to poor fertilization, especially excess nitrogen, thatch problems and general poor maintenance.

Fertility and management studies on centipedegrass have been conducted throughout the South. For example, the effects of iron, phosphorus and nitrogen on centipedegrass were studied in Alabama (1). These studies found that foliar applications of iron improved appearance, may improve spring recovery and had no effect on cold tolerance. Applications of phosphorus improved summer appearance slightly, did not affect spring recovery, and had no effect on cold

tolerance. Finally, nitrogen applications improved appearance, decreased cold tolerance and annual rates greater than three pounds per 1000 square feet decreased spring recovery.

Other studies have obtained similar results and concluded that annual rates of two pounds of nitrogen and potassium (K_2O) and one pound of phosphorus (P_2O_5) per 1000 square feet were best for home lawns (4). A common recommendation throughout the South for centipedegrass is an annual application of one pound of nitrogen per 1000 square feet on clayey soils and two pounds on sandy soils. If soluble nitrogen is being used, applications for one-half pound of nitrogen evenly split through the growing season is generally most efficient. There also appear to be fewer problems if the first nitrogen application is made in late spring or early summer. Nitrogen, especially high rates applied during spring green-up, often increases centipede chlorosis. Proper fertilization will also reduce excess thatch development which is important to winter survival.

Common maintenance practices which are important to centipedegrass include irrigation, mowing and cultivation. Irrigation during dry periods is important to centipedegrass because of its fibrous, shallow root system. Proper watering usually means applying enough water to thoroughly wet the top six inches of soil when moisture stress first appears. Mowing centipedegrass at a height of 1-1½ inches seems to reduce thatch build-up because the stolons grow closer to the soil surface. Coring is a good cultivation practice for thatch management and for improving soil conditions. Finally, if vertical mowing is necessary, a 2 or 3 inch blade spacing set 1/4 inch deep operated in one direction will remove thatch and stimulate rapid recovery (5).

Centipedegrass is suited to many locations in the southern landscape. Its popularity should continue to increase because it can provide quality turf under low maintenance practices. However, proper maintenance is as important for centipedegrass as it is for other turfgrasses.

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COOL SEASON TURFGRASS CULTIVARS FOR NORTH CAROLINA LAWNS
1983 EVALUATIONS

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TURF-TYPE TALL FESCUES.

Tall fescue is used throughout the Carolinas for many general turf areas including highway roadsides, industrial grounds, parks and home lawns. Tall fescue turf is important throughout much of the United States because it is generally more tolerant of summer heat than other cool season grasses, and considerably more cold tolerant than such warm season turfgrasses as bermudagrass. In the last few years many of the turfgrass plant breeders across the country have intensified their efforts in developing improved turf-type tall fescue varieties. The term turf-type has been used to describe these new tall fescues because of their finer leaf texture, improved disease tolerance, and/or enhanced persistence under shorter cutting heights compared to Kentucky 31 tall fescue.

Cultural Procedures. Evaluation of these new turf-type tall fescues has continued at NCSU since 1978. During this time, several field evaluation trials have been conducted under both full sun and shade conditions. A turf-type tall fescue trial that was initiated in October of 1981 contained many of today's commercial cultivars. The cultivars in this study were established from seed at a rate of 5 pounds per 1000 square feet and clipped at a height of 2 inches. Two of the trial entries had 1 pound per 1000 square feet of Kentucky bluegrass mixed with the tall fescue seed. Plots were fertilized with a 12-4-8 source at a rate of 2 pounds of N per 1000 square feet per year as split applications of 1 pound each in September and February.

Results. The turf quality performance data for 1982 and 1983 is presented in Table 1. Adventure, Rebel and Falcon tall fescues performed best during 1983 and were top cultivars during 1982 as well. The overall turf quality score is an average of each monthly evaluation and reflects the summer decline in turf quality as well as the fall and spring peak performance scores. Adventure, Rebel and Falcon recieved turf quality score of 7.7 for July 1983, but had October 1983 scores of 9.0, 8.3 and 8.0, respectively. The strong performance of mixtures of tall fescue and Kentucky bluegrass was again observed in the 1983

evaluations. The mixture of Ky-31 tall fescue with Glade and Kenblue Kentucky bluegrass had improved turf quality (by almost 2 points on a 1 to 9 scale) compared to the Ky-31 tall fescue alone. A National turf-type tall fescue trial was established in Raleigh during the fall of 1983 and includes 33 cultivars. A tall fescue cultivar evaluation trial for the Coastal Plains region of North Carolina is planned to begin in the fall, 1984.

TALL FESCUE/BLUEGRASS MIXTURES FOR SHADE CONDITIONS.

Cultural Procedures. A tall fescue/ Kentucky bluegrass mixture trial was established under shaded conditions in Raleigh during October 1982. Fertilization and irrigation was maintained similar to the previously mentioned turf-type tall fescue trial. During the first year of this shade study the turf entries were clipped at 1.5 or 2.5 inches to determine the influence of cutting height on turf quality performance.

Results. Turf quality scores for 1983 are presented in Table 2. Increasing the cutting height from 1.5 to 2.5 inches improved the turf quality of all entry cultivars and mixtures during 1983. All entries maintained acceptable quality, but turf performance ranged from the best score of 7.1 for the Rebel/Kenblue/Glade/Reliant (80/5/5/10) mixture to the lowest qaulity rating of 5.7 for the Ky-31/Newport/C. Red Fescue/Chewings Fescue/Carpetgrass (35/21/34/3/3) mix. The merit of tall fescue/bluegrass mixtures for shade conditions is clear from this study. For 1983, nine of the top ten entries were mixtures. Rebel was the only tall fescue as a monostand to rank (#3) within the top ten in this trial for 1983.

KENTUCKY BLUEGRASSES.

Cultural Procedures. The National Kentucky bluegrass cultivar evaluation trial was established in fall of 1980 and contains 85 entries including both commercial and experimental cultivars. Turfs were clipped at a 2 inch cutting height and received 2 pounds of N per 1000 square feet per year in split applications of 1 pound each in September and February. Plots were watered at the first sign of wilt.

Results. The top ten cultivars for the period 1981 through 1983 are presented in Table 3. The experimental cultivars 225, PSU-173 and MLM 18011 ranked in the top ten in each of the three years studied thus far. Glade and CEBVB-3965 ranked in the top ten during the first two years of study and was statistically equivalent in turf quality to those in the top ten during 1983. Turf quality score means for all entries during 1982 and 1983 are presented in Table 5.

Five of the top ten performers for 1983 are commercially available cultivars. These include Aspen (Northrup King), Bonnieblue (Burlingham), I-13 (Warrens), Banff (Pickseed West), and Vantage (O. M. Scott & Sons). Sources for the experimental cultivars are listed in Table 4. Other commercial Kentucky bluegrass cultivars that were statistically equivalent to those in the top ten during 1983 included A-34, Adelphi, Baron, Cheri, Geronimo, Glade, H-7, Holiday and Plush.

PERENNIAL RYEGRASSES.

Cultural Procedures. A national perennial ryegrass cultivar evaluation trial was initiated at NCSU during the fall of 1982. The 53 entries in this trial are being maintained at a 2 inch cutting height and receiving 2 pounds of N per 1000 square feet per year as split applications of 1 pound in September and February.

Results. The top fifteen perennial ryegrass cultivars during 1983 were Citation, Blazer, 282. HE-168, Ranger, Barry, 2ED, HR-1, ISI-90, Elka, SWRC-1, All*star, NK70309, NK80389 and Derby. Turf quality ratings (1 to 9, with 9=best and 5=minimum acceptability) ranged from a 6.8 fro Citation to a 6.1 for Derby. The lowest turf quality score of 4.7 was observed for the experimental cultivar, LP792. All cultivars in the top 15 had stand densities in excess of 90 % at one year after establishment. Cupido, Caravelle and Barclay had the lowest stand densities at 85 % cover.

Table 1. Turf- type tall fescue cultivar evaluation turf quality ratings* for 1982-1983. Raleigh, NC.

CULTIVAR**	1982 OCTOBER	1982 MEAN	1983 OCTOBER	1983 MEAN
ADVENTURE (5LL)--TS	8.7	6.9	9.Ø	8.Ø
REBEL--LF	8.5	7.5	8.3	7.5
FALCON--TS	8.2	7.1	8.Ø	7.4
KY 31 + GLADE + KENBLUE	8.5	7.3	8.3	7.4
Syn. GA--RG	8.Ø	7.1	8.Ø	7.2
TF 521--TS	8.Ø	6.6	8.Ø	7.2
KS 76-7Ø3-2--SC	8.Ø	7.Ø	8.Ø	7.1
GALWAY (K5-27)--NK	7.8	6.6	7.3	7.Ø
KY 31 + KENBLUE	7.8	6.5	7.7	6.9
KS 76-7Ø1-2--SC	7.7	6.6	7.7	6.9
KS 78-4-1--SC	7.8	6.7	7.7	6.9
MUSTANG--PS	8.2	6.9	7.7	6.9
BROOKSTON--ISI	7.7	6.4	8.Ø	6.8
HOUNDOG--ISI	8.Ø	7.Ø	7.7	6.8
TF 55B--TS	7.8	6.4	7.3	6.7
CLEMFINE--LF	7.3	6.2	7.7	6.6
KS 78-347-1--SC	7.7	6.6	7.Ø	6.6
KY. 31--WQ	7.7	6.7	7.3	6.5
OLYMPIC--TS	7.7	6.1	8.Ø	6.5
FINELAWN (579)--TS	7.5	6.6	7.7	6.5
LS 9--ISI	7.7	6.4	6.7	6.4
TF 8Ø5--ISI	7.2	6.6	8.3	6.4
NK 81453--NK	7.2	6.2	6.7	6.2
NK 81452--NK	7.5	6.5	6.7	6.1
LSD	1.6	Ø.3	1.2	Ø.5

* Turf quality ratings on a 1 to 9 scale, with 9=best and 5 as minimum acceptability.

** Seed source indicated as follows: TS=Turfseed; LF=Lofts; RG= Rutgers Univ.; SC= O. M. Scotts; NK=Northrup King; PS= Pickseed; ISI= International Seed; WQ= Wyatt Quarles.

Table 2. Turf quality* of tall fescues and tall fescue/Kentucky bluegrass mixtures under shade conditions during 1983. Raleigh, NC.

ENTRY**	Cutting height 2.5	1.5	1983 October	Mean
REBEL/Kbl/GLADE/RELIANT (80/5/5/10)	7.3	6.9	7.5	7.1
REBEL/Kbl/GLADE (90/5/5)	7.0	6.5	7.2	6.8
REBEL	7.0	6.5	7.0	6.7
REBEL/Kbl/GLADE/PENNLAWN (80/5/5/10)	7.0	6.4	7.0	6.7
REBEL/Kbl/GLADE (80/10/10)	6.9	6.3	7.2	6.6
HOUNDOG/Kbl (80/20)	6.8	6.3	6.5	6.6
KY31/GLADE/NEWPORT/Kbl (90/3/4/3)	6.7	6.3	6.5	6.5
REBEL/KENBLUE (90/10)	6.7	6.2	6.0	6.4
REBEL/KENBLUE (80/20)	6.6	6.2	6.0	6.4
FALCON/KENBLUE (80/20)	6.8	6.0	6.2	6.4
REBEL/Kbl/GLADE/ENSYLVA (80/5/5/10)	6.7	5.9	6.3	6.3
KY31/GLADE/NEWPORT/Kbl (90/3/4/3)	6.5	5.9	6.0	6.3
KY-31	6.5	6.0	5.7	6.3
KY31/KENBLUE (90/10)	6.7	5.8	5.7	6.2
HOUNDOG	6.4	6.0	6.3	6.2
KY-31/Kbl/GLADE (90/5/5)	6.6	5.7	6.2	6.1
KY-31/Kbl/GLADE (80/10/10)	6.4	5.8	5.7	6.1
FALCON	6.3	5.9	6.3	6.1
KY-31/KENBLUE (80/20)	6.2	5.6	5.5	5.9
BRI/VIC/BAN/JTWN/BIL (30/25/20/15/10)	6.0	5.4	4.8	5.7
KY31/NWP/CRF/CF/Car (35/21/34/3/3)	6.2	5.1	5.2	5.7
LSD		0.4	1.1	0.3

* Turf quality ratings on a 1 to 9 scale, with 9=best and 5 as minimum acceptability.

** Kbl= Kenblue Kentucky bluegrass; Bri= Bristol Kentucky bluegrass; Vic= Victa Kentucky bluegrass; Ban= Banner chewings fescue; Jtwn= Jamestown chewings fescue; Bil= Biljart hard fescue; Nwp= Newport Kentucky bluegrass; Crf= Common creeping red fescue; Cf= Common chewings fescue; Car= Carpetgrass;

TABLE 3. National Kentucky bluegrass trial top ten cultivars for 1981-1983. Raleigh, NC.

1981		1982		1983	
Cultivar	TQ*	Cultivar	TQ	Cultivar	TQ
CEBVB-3965	7.4	ADMIRAL	7.1	ASPEN	7.1
225	7.3	225	6.9	225	7.Ø
MLM-18Ø11	7.3	CEBVB-3965	6.7	239	6.9
WWAG-463	7.2	BARBLUE	6.6	PSU-173	6.8
FYLKING	7.2	PSU-173	6.6	BONNIEBLUE	6.7
GLADE	7.2	MLM-18Ø11	6.6	MLM-18Ø11	6.7
MONOPOLY	7.1	WABASH	6.6	WWAG-463	6.6
PSU-173	7.1	K3-179	6.6	I-13	6.6
VICTA	7.1	GLADE	6.5	BANFF	6.5
MOSA	7.Ø	H-7	6.5	VANTAGE	6.5
LSD	Ø.5	LSD	Ø.5	LSD	Ø.6

* Turf quality ratings on a 1 to 9 scale, with 9=best.

TABLE 4. Source companies for the National Kentucky bluegrass trial top ten cultivars for 1983. Raleigh, NC.

Cultivar	1983 mean	Source
	-- TQ* --	
ASPEN	7.1	Northrup-King
225***	7.Ø	Jacklin Seed Company
239	6.9	Jacklin Seed Company
PSU-173***	6.8	Penn. State Univ.
BONNIEBLUE	6.7	E.F. Burlingham & Sons
MLM-18Ø11***	6.7	Maple Leaf Mills Ltd.
WWAG-463**	6.6	E.F. Burlingham & Sons
I-13	6.6	Warren's Turf Nursery
BANFF	6.5	Pickseed West Inc.
VANTAGE	6.5	O.M. Scott & Sons
LSD	Ø.6	---

* Turf quality rating on a 1 to 9 scale, with 9=best

TABLE 5. Mean turf quality* scores from the National Kentucky bluegrass evaluation trial for 1982-1983, Raleigh, NC.

Entry	1982	1983	Entry	1982	1983	Entry	1982	1983
**ASPEN	6.3	7.1	**RAM I	5.9	6.3	Cello	5.9	5.8
225	6.9	7.0	PSU 150	6.4	6.3	**A20-6A	5.9	5.8
239	6.6	6.9	**BRISTOL	6.2	6.3	Mona	5.9	5.8
PSU 173	6.6	6.8	**ENOBLE	5.8	6.3	**NASSUA	6.0	5.8
**BONNIEBLUE	5.4	6.7	Bayside	6.3	6.3	K3-162	5.2	5.8
MLM 18011	6.6	6.7	Harmony	5.4	6.2	Kimono	5.4	5.8
WWAG 463	6.4	6.6	Piedmont	5.8	6.2	**VICTA	6.2	5.8
**I-13	6.4	6.6	**AMERICA	6.1	6.2	Argyle	5.2	5.8
**BANFF	6.0	6.5	**ECLIPSE	6.2	6.2	**MIDNIGHT	6.2	5.8
**VANTAGE	5.6	6.5	**MAJESTIC	5.7	6.2	**MERIT	5.6	5.7
BA 6191	6.0	6.5	**SYDSPORT	5.6	6.2	Apart	5.9	5.7
K1-152	6.2	6.5	Mer PP300	6.2	6.2	Welcome	5.6	5.6
**BARON	6.4	6.5	Somerset	6.4	6.2	K3-178	6.3	5.6
CEBVB 3965	6.7	6.5	**BARBLUE	6.6	6.2	**MERION	5.0	5.5
**H-7	6.5	6.5	**WABASH	5.5	6.1	**MYSTIC	5.2	5.5
K3-179	6.6	6.5	**BIRKA	6.0	6.1	**TRENTON	5.3	5.5
**CHERI	6.4	6.5	PSU 190	5.7	6.1	**KENBLUE	5.0	5.4
**PLUSH	6.0	6.4	**MONOPOLY	6.0	6.0	**NUGGET	5.7	5.4
Vanessa	6.1	6.4	**FYLKING	6.2	6.0	**A20	5.5	5.4
**GLADE	6.5	6.4	**RUGBY	5.8	6.0	WWAG 478	5.9	5.3
WWAG 480	5.5	6.4	Mosa	6.0	6.0	Escort	5.5	5.3
**A-34	5.7	6.4	**A20-6	6.2	6.0	SV-01617	5.5	5.2
NJ 735	6.5	6.4	**SHASTA	6.1	6.0	Lovegreen	5.4	5.0
**ADELPHI	5.8	6.4	Charlotte	6.0	6.0	**SD COMMON	4.6	4.8
**ENMUNDI	6.3	6.4	**PARADE	6.5	6.0	**TOUCHDOWN	5.3	4.4
**HOLIDAY	6.0	6.4	**CHALLENGER	6.0	6.0			
**GERONIMO	6.0	6.4	**DORMIE	5.3	5.9			
TPI-963	6.2	6.4	Bono	6.0	5.9	LSD	0.5	0.6
Admiral	7.1	6.3	Mer PP43	5.4	5.9			
**COLUMBIA	6.0	6.3	**S-21	5.3	5.8			

* Mean turf quality determined on a scale of 1 to 9, 9=best and 5 as minimum acceptability.

** Commercially available cultivar.

MAINTENANCE OF GROUNDS

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The subject of Grounds Maintenance is so large that it is obvious it cannot be covered in thirty minutes. However, there are areas that can be dealt with which will help in preparing an effective Grounds Maintenance Program. The importance of good grounds maintenance has increased dramatically over the past few years. Unfortunately, the cost of maintenance has increased even more. Therefore, it behooves each of us to use our ingenuity to stretch the maintenance dollar as far as possible.

This can be accomplished through proper planning, hiring and training good employees and utilizing to the fullest extent the labor-saving devices that are available to us.

With these subjects in mind, let's look at the requirements of a good Grounds Maintenance Program.

DESIGN

Grounds maintenance begins with the first line drawn in a landscape design.

A good landscape design takes into consideration the maintenance required and the cost to perform the maintenance. The design should be prepared with the owner's maintenance budget in mind.

If possible, a maintenance specialist should be used as a consultant on every design staff. If this is not possible, the maintenance supervisor should be allowed to review the plans and make suggestions before construction begins.

If maintenance problems are not given consideration during the design process, those responsible for maintenance will have difficulty in performing their duties. Most maintenance budgets are inadequate and design problems can only make matters worse. If the budget does not permit the necessary maintenance, a good design cannot achieve the desired results.

Four steps to a workable design and maintenance program:

1. Establish a maintenance budget. This is the amount of money available on a yearly basis to maintain the landscape.

2. The landscape architect should provide an estimate of cost to maintain the proposed design.

3. Provide a maintenance calendar. The people responsible for the maintenance need to know what tasks are to be performed and how often.

4. The maintenance estimate and calendar should be reviewed by a maintenance specialist to ensure that the design falls within the maintenance budget.

MAINTENANCE PLANNING

In planning a grounds maintenance program, it is necessary to establish objectives, set standards and produce a written maintenance plan. The general objectives of grounds maintenance are to ensure the health and well being of all plants and to maintain a neat and orderly appearance of all areas such as turf, shrub beds, parking areas, etc. Specific objectives, however, must be formulated to suit each situation. Type and intensity of use vary widely - some areas require thorough and frequent cleaning, weeding, seeding, fertilizing, spraying, or repair while others less frequently used or left in their natural state can be maintained on a much less exacting schedule.

Good judgment must be used when determining objectives. Be realistic about establishing objectives, taking into consideration the money and manpower available to complete the project.

MAINTENANCE STANDARDS

When establishing standards for maintenance, most property can be divided into two or three major areas.

Area 1 - Entrance ways to the property, entrance ways to the major structure, foundation plantings around the major structure, parking area for customers and visitors.

Area 2 - Areas away from the major structure not readily accessible by customers or visitors; areas such as picnic grounds for employees, employees' parking, dock areas, truck entrances. These areas must be maintained but not to as high degree as Area 1.

Area 3 - All areas that complete the transition from man-made structures to undisturbed natural landscape.

It is obvious that three different levels of maintenance are required for a property of this type.

Area One receiving the highest degree of maintenance or Level 1.

Level 1 maintenance might include the following:

1. Mowing one to two times per week.
2. Removal of clippings.
3. Edging walks, curbs and shrub beds on a weekly basis.
4. Weeding shrub beds on a weekly basis.
5. Removal of litter on a daily basis depending on traffic.
6. Turf areas fertilized four to five times per year.
7. Parking areas cleaned on a weekly basis.

Area Two - Maintenance Level 2

Level 2 maintenance might include the following:

1. Mowing one time per week.
2. Edging walks, curbs and shrub beds two times per month.
3. Weeding shrub beds two times per month.
4. Removal of litter on a weekly basis.
5. Turf areas fertilized two to three times per year.
6. Parking areas cleaned two times per month.

Area Three - Maintenance Level 3

Level 3 maintenance might include the following:

1. Grassed areas not maintained as lawn - mowing on a bi-monthly or monthly schedule.
2. Natural areas cleaned three or four times per year to remove dead wood or diseased plants.
3. Fertilize grass areas one to two times per year.

MAINTENANCE PLAN

After setting objectives and establishing standards, it is time to formulate a workable maintenance plan.

The maintenance plan should consist of two parts, a drawing or site plan and a written description of the work to be performed.

The drawing or site plan should show each individual area in a different color so that those responsible for the maintenance can tell where one level of maintenance ends and another level begins. The written description gives frequency of operation for each level of maintenance such as mowing, edging, pruning, mulching and so on. These instructions also give information as to what type of fertilize to use, amount to apply, chemicals for insect and disease control, amount of chemical to use, type of equipment, etc. A plan of this type provides the basic information to determine the cost of each individual operation and helps in scheduling and preparing budgets.

Each employee should be given a copy of the plan and drawing so that he can familiarize himself with each area and his personal responsibilities for maintenance in each area.

Accurate records should be kept for each area. These records will indicate if the program is working. If a problem exists, it can easily be spotted and appropriate action can be taken. If problems do exist, take steps immediately to correct the problem.

1. Alter maintenance - overmulching can become a problem. One to three inches is sufficient. Mulching every 16 to 18 months instead of every 12 months might be the answer. This would reduce costs for both labor and material.

2. Use special products - systemic insecticides could reduce sprayings required. Growth retardents could reduce the number of prunings. Pre-emergent herbicides could reduce the number of weedings.

3. Redesign landscape - Azaleas and Rhododendrons grow best in partial shade, well-drained, acidic soil high in organic matter away from hot dry windy locations. If you have them growing in an island in a parking lot surrounded by asphalt where temperatures stay around the 100-degree mark during the summer, wind blows continuously, the soil is heavy and poorly drained, problems are sure to arise - wilt, root rot and chlorosis are just a few. Lightening the soil, treating the plants with an iron salt or applying a fungicide is not the answer, proper plant and site selection is. Remove these plants and replace with ones that can survive under these conditions.

Hopefully, this discussion has helped to give you some ideas in setting up a Grounds Maintenance Program. If we stick to the basics of forming a plan, hiring and training good employees, the use of proper equipment and sound horticultural practices, our jobs will become much easier.

PROPER RENOVATION OF LAWNS

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Lawn renovation refers to any procedure beyond normal maintenance (short of soil modification) required to upgrade an existing lawn. A deteriorated lawn is often a symptom of some underlying problem. Failure to identify and correct the exact problem(s) can often lead to further lawn deterioration and the need for repeated renovation. Some of the major causes of turf deterioration include: 1) improper lawn management practices, 2) unadaptable lawn grasses, 3) improper nutrient balance, 4) excessive thatch buildup and 5) pest infestation. The cause(s) of lawn deterioration must be rectified before the renovation process begins.

WHEN TO RENOVATE

Late summer/early fall is the best time to renovate cool season (bluegrass, ryegrass, fescue) lawns. Warm season (bermudagrass, centipedegrass) lawns are best renovated in late spring/early summer. Attempts to upgrade existing lawns when conditions are not conducive to good growth are difficult at best.

WEED CONTROL

Control of undesirable vegetation is necessary to reduce competition to the newly planted grasses and must be implemented prior to renovating.

Some weeds growing in small areas may be effectively controlled by hand weeding or removal using a small hoe, rake or shovel. Hard to control weeds such as perennial grasses with underground shoots are best controlled with herbicides.

It is impractical to mechanically control weeds in large areas. Most broadleaf herbicides must be applied several weeks or months in advance of seeding, so read the label to determine the exact waiting period. Control of perennial grassy weeds is best achieved by applying a nonselective herbicide. It is recommended that the entire lawn area be killed if perennial grassy weeds are scattered throughout. Glyphosate (Kleenup, Roundup) has become a popular nonselective herbicide because of the short (7 day) waiting period. Remember: Read and follow label directions when using any herbicide and treat only those areas in need. Control is best achieved when weeds are young and actively growing.

PREPARATION FOR SEEDING

Preplanting renovation procedures are designed to create an environment best suited for the establishment of newly planted grasses. This includes 1) a reduction in competition from existing grasses and removal of unwanted vegetation to include thatch 2) application of required nutrients and 3) development of a good seedbed.

Reduce Competition

Remove all undesirable vegetation, including thatch so that soil is exposed. (This may not be necessary if a slit seeder is used). A rake or hoe is ideal for small areas however, several passes with a dethatcher (power raker, vertical mower) is usually the best choice for large areas. Set the mower at the lowest setting and collect all clippings and debris. It may be necessary to make another pass with a dethatcher following mowing if thatch is excessive. Both of these operations will reduce plant competition and enhance light penetration for good germination and fast establishment.

Apply Nutrients

Uniformly apply needed fertilizer and lime based on soil test results. Hand application is fine for small areas but a rotary or drop type spreader should be used on large areas to insure uniform application.

Prepare Good Seedbed

A good seedbed can be provided in small bare spots by loosening the soil to a depth of 4 to 6 inches using a rake, hoe or shovel. Fill in low areas and smooth surface so clods are less than golf ball size.

Large areas and areas containing desirable grasses should be cultivated with a piece of equipment that brings small cores to the surface. Core in several directions, allow plugs to dry and pulverize with mower, dethatcher or drag mat. Coring is best achieved when soil is damp. (Tines have a difficult time penetrating dry, compacted soils).

SEEDING

Bare spots larger than four inches in diameter should be planted. Smaller areas tend to fill in naturally provided the lawn grass is capable of spreading. (Tall fescue exhibits a bunch-type growth habit and is incapable of spreading). Choose a blend or mixture that is compatible with the environment and the existing vegetation.

To insure uniform coverage, use a rotary or drop-type spreader applying half the seed in one direction and the other

half moving at right angles to the first pass. Lightly incorporate seed and fertilizer into the top 1/8" of soil by lightly pulling a leaf rake over loosened soil or running a vertical slicer over areas that were just power raked and cored.

A slit seeder, consisting of a vertical grooving seeder and seed box can be used to drill seed to insure good seed to soil contact with minimum disruption. Seed should be drilled in a diamond like pattern. Dry compacted soils, obstructions such as rocks and trees, and excessive slopes may limit the usefulness of a slit sleeder in some instances.

Bare areas should be mulched to enhance germination.

POST PLANTING CARE

Keep renovated areas continually moist with light sprinklings several times a day. As the seedlings grow, continue to decrease the frequency of waterings while increasing the duration to promote deep rooting. After the third mowing, water to a depth of 6 inches.

Mow the area as you normally would, using a sharp blade. (Exception: Continue to severely stunt existing vegetation by scalping until desirable grasses have germinated and the desired mowing height is achieved. This will reduce the competition to new seedlings).

Fertilize the new seedlings approximately 4 to 5 weeks after seeding to enhance establishment. Keep unnecessary traffic off the renovated lawn until it is well established.

TREATING PROBLEM TURF AREAS IN TIDEWATER

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The gardens, grounds, and greens throughout Colonial Williamsburg's properties offer many challenges to agronomic skills. There are one hundred and seventy-five acres within the Historic Area, composed of about ninety individual gardens having different turf problems. Within this area, we strive to depict various grades of maintenance that would be authentic to the eighteenth century. Grade "A" gardens have a high degree of maintenance, while grade "D" gardens or greens represent turf in orchards or pastures.

The following quotes from letters, diaries, orders, and records emphasize the concern and problems our forefathers had in purchasing and establishing various seeds for their gardens.

Landon Carter Diary 10/27/1766 Greene County:

"Sowed this day the grass seed Charles Carter of the Park sent me, by the name of lion grass, brought down by poor Chiswell from the back park."

Robert Beverly's Letterbook 3/5/1764 to William Hunter & Co.:

"I observed an artificial grass, called Burnet, has lately met general approbation from the Society of the Arts and it was invented by Mr. Rogue who sells it. I wish you would send me ten pounds of it by some careful Captain."

From Washington Diary 3/24/1760:

"In the evening, in a bed in the yard that had been prepared with a maxing of dung on Saturday last, I sowed choice Lucerne and Rye Grass Seed in the Garden, to try their Goodness, doing it in the following Order: at the end next to the corner clover seed; the next Rye Grass, the last also thinnest sown was Lucerne. First a few seeds at every four inches distance, the next thicker, and so on to the last which was very thick."

Washington to Robert Cary & Co. 7/21/1766, Mount Vernon:

" I desire 6 corn and 6 grass scythes might be sent me (also 6 Turners chissels). I find last years manifest disadvantagous

from having them. Grass Scythes some of one length some of another, some crooked, and some strait, that I now beg the favor of you to ship."

In John Greenhow's Store in 4/11/1771:
Williamsburg inventory listed, "Moor's best Grass Scythes."

Another reference:
"Sowd 17½ drills of Trefoil seed in the ground adjoining the Garden. Numbering from the side next to the Stable to the owrk shop, the residue of them was sowd with Lucerne Seed - both done with design to see how these seeds answer in that ground."

Other Grasses Mentioned:
"- Orchard grass seed, English grass seed,- it goes under so many different names - in short it is the kind of grass which affords the best turf for walks and lawns, and is the purpose for which I want it. Could these seeds be had from the Farms, or of the growth of this Country. There would be more certainty of its coming up. Imported seeds often gets heated in the Ship, and the vegitation thereby destroyed." -- "try Red clover, Goose Grass, Spear grass or English grass for lawns."

Our Historic Area attracts almost one million people annually to visit restored and reconstructed exhibition buildings, colonial homes and sixteen various craft shops and demonstrations. An authentic colonial atmosphere and safety for our visitors is emphasized throughout our exhibit area.

Many of the other landscaped areas around our hotels, restaurants, sports facilities, private roads, greenbelt areas, and parking lots afford quite a challenge to keep them neat, attractive and of low maintenance. Various types of turf and grasses are used in some of these situations, while others must be planted with a more desirable ground cover. These problems occur in many different exposures and soil types, some are very difficult to maintain, while others are part of a scenic view or easement. The following are some of the plant materials that we use in Tidewater Virginia to achieve these special effects.

Dry Conditions:

Hemercallis fulva
Armeria maritima
Epimedium macranthum
Gaylussacia brachycera

Dry Conditions (cont.):

Opuntia sp.
Liriope spicata
Euphorbia cyparissius
Phlox subulata
Polygonum capitatum
Sempervivum sp.
Sedum spurium
Santolina Chamaecyparissus

Moist Conditions:

Carex conica morrowii
Hakonechloa macra
Xanthorhiza simplicissima
Sagina subulata

Shade Conditions:

Pachysandra procumbers
Pachysandra terminalis
Ophiopogon japonicum
Leucobayum glaucum
Aegopodium podagraria
Vinca major & minor
Ajuga reptans
Liriope muscari
Polystichum sp.
Hedera helix
Trachelospermum jasminoides
Lamium maculatum

Sun Conditions:

Jasminum floridum
Stranvaesia davidiana prostrata
Juniperus horizontalis cultivars
" conferta "
" chinensis "
" procumbens "
" sabina "
Euonymus radicans
Cotoneastor sp.
Nandina domestica nana
Pyracantha coccinea 'lowboy'
Genista vecemosa

CONCERNS OF THE LAWN CARE INDUSTRY

James R. Brooks
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"It was the best of times, it was the worst of times..." wrote Charles Dickens in 1859 as he introduced readers to A Tale of Two Cities; a story of the French Revolution. If "old Charlie" were alive today and asked to write a story about the lawn care industry, I suspect he would use the same introductory phrase as he did in 1859. "It is the best of times, it is the worst of times..."

It Is The Best of Times

$1.85 billion estimated gross sales in 1982 as compared with $1.50 billion in 1981; an increase of 23%.

An estimated 3 to 4 million residential lawns being serviced, as compared to an estimated 1 to 1 1/2 million lawns in 1980, still only 25 to 30% of the estimated potential market.

A continued reasonable profit margin; an industry average of 15.8%.

Annual expenditures estimated at over 1/2 billion dollars in products, equipment and services; good news for the growing number of manufacturers and suppliers to the lawn care industry.

The fastest growing segment of the turf industry with major growth potential in the sunbelt sector of the country.

An annual growth rate of 30% for PLCAA; the only national organization dedicated to representing the needs and interests of the professional lawn care businessman. As the young association grows (4 years), so will its influence and number of services to members.

It Is the Worst of Times

FIFRA (Harpers's Ferry Amendments) US House Bill 3818 and US Senate Bill 1774, if passed, will affect almost every aspect of pesticide manufacture, distribution and use. Of particular interest to users call for (1) increased record-keeping; (2) establishment of buffer zones when using pesti-

cides to protect against over-spraying and drift; (3) pre-notification and sign posting to warn individuals present in the areas to be sprayed. PLCAA joined 33 other associations in opposing this legislation. Fortunately, we have gained some additional time to fight this legislation with the change in leadership at EPA.

Pre-notification is now the law in Manchester, CT and Wayland, MA.

No commercial appications of pesticides is the law in Lebanon, ME.

The states of Maryland and Vermont may ban the use of 2-4-D.

Rhode Island is considering the ban of chlordane.

In Wauconda, IL it is now the law that before each occasion of a pesticide application, the applicator must post a sign, not less tha 144 square inches, at eye level, stating the exact chemical being applied, active ingredients, and a warning to children and animal that dangerous chemicals have been applied.

In Maine, Public Law 558 has introduced for the first time the concept of chemical trespass. If you apply pesticides and there is drift or off target areas effected, you are in violation of the law. Unfortunately, the state must still determine the degree of control issue. Is chemical trespass to be measured by percentage, parts per million, parts per billion?

In New Jersey, Senate Bill 3672 is under consideration which would give any person the right to bring a civil action without having to show harm or the possibility of harm. Now, fear has become the issue. The bill also calls for pre-notification when applying outdoor pesticides with the following list of provisions: (1) give 7-10 days prior notice to all individuals owning or renting property within 1000 feet of the application; (2) post the time, date and location of the application; (3) make available the name, address, phone number and registration number of the applicator business; (4) brand name, and EPA Product Registration number of the pesticide(s) being applied; (5)complete formulation and list of label precautions of the pesticide(s) being used, pest(s) to be controlled, and alternate application dates; (6) and any other information which would enable persons who may be adversely affected to take any

action necessary to avoid or minimize exposure to the pesticides being applied.

These people are serious, and I bet some of these provisions will become law.

The list of states and towns considering legislative and regulatory restrictions on the use of pesticides is much more numerous than the examples given...and growing almost daily. States like Illinois, who were confident that such "problems" were those of the northeast, now find it at their own door step.

Let me put the magnitude of pestricide regulatory problems in another perspective for you. In 1980, there were 6 states which had major pesticide legislation problems; CA, MA, WI, LA, NY and ME. In 1983, there are 26 states with significant pesticide issues, according to the NACA. This year 500 pieces of restrictive pesticide legislation was introduced throughout the U. S., with 200 considered detrimental to pesticide users. Of those 200, 42 were killed, 45 passed and 115 are still pending. Only a few years ago, we needed only concern ourselves primarily with federal legislation and the states; 51 entities. With the new philosophy of bringing goverment "back to the people", we now have over 80,000 local government entities who can propose and enact legislation in the U. S. Over 80,000 governmental bodies...think about what this can mean to our industry.

Meanwhile, pesticide applicators, who are highly visible in plying their trade in the urban/surburban setting have been for the most part silent, uninformed and unorganized in their efforts to combat unfavorable regulatory and legislative matters related to pesticide use. The prevailing attitude has been one of "It's not my problem", "I'm not being directly affected", "I'm not my brothers keeper", or "I'm too busy to get involved".

Attitudes are beginning to change as the number of restrictive occurrences increase, and more applicators are confronted directly by well organized and financed anti-pesticide organizations. The several national trade and professional organizations are concerned and working on particular issues, but none of these organizations individually have the resources or personnel to effectively cope with the magnitude of the growing problem. There was a need for a single, national organization designed to become the industry's pro-pesticide coalition organization...The Pesticide Public Policy Foundation, Inc.

3PF began to organize some 11 months ago when a group of concerned urban pesticide applicators gathered in Boston to discuss how to combat the growing number of regulatory problems and begin to tell the "pro-pesticide story". As many of you have read in the trade press, the National Environmental Law Foundation (NELF) became the first of several names for the national organization.

3PF is a reality, and has established a number of ambitious goals and objectives. The number one priority is to organize a network of state organizations to insure adequate and timely re- sponse to local and state regulatory issues, and utilizing the state organizations to keep 3PF and the national associations informed of local actions and trends. Unfortunately, we have experienced too many situations where regulatory decisions were learned after the fact. Additionally, 3PF will provide consultation and assistance to state and local organizations to better insure effectiveness of organizational efforts and giving testimony. We learned from Wauconda that most applicators weren't certain what to do, what to say, or how to present effective testimony. This is important, because the battles are going to have to be fought by local applicators, not the national organizations or manufacturers.

3PF is operational and David Dietz and Associates, Salem, Oregon has been contracted to direct its efforts. The Dietz organization has extensive experience in representing pro-pesticide interests at the federal and state levels. 3PF is already involved in opposing the FIFRA amendments mentioned earlier. An 800 number, 800-438-7773, has been established for use by any interested person or organization for information and help. An east coast office has been established in Washington, DC to insure adequate coast-to-coast involvement. That address is: 3PF,1511 "K" St., N.W., Suite 623, Washington, DC 20005. Nearly $200,000 has been pledged to fund the start up, but $1,000,000 is needed for the annual budget. 3PF has been formally endorsed by PLCAA and NAA.

As a pesticide applicator, I urge you to do two things immediately, (1) volunteer to actively serve with the state and local organization. Do this by contacting PLCAA, NAA, or 3PF in Washington; (2) pledge your support to 3PF by writing a check today and pledging a regular amount throughout the year. Checks can be made out to PPPF and sent to PLCAA, NAA, or directly to the Washington address. How much? As a rule of thumb, an earlier survey of PLCAA members indicated a willingness to invest 1/10 of 1% of gross sales to insure we're not regulated out of business. Such contributions

should be viewed as a "cost of doing business" item. Contributions received by PLCAA are entered as "special dues", thus, making the contribution tax deductible by the lawn care company.

There are certainly other problems and challenges facing the lawn care industry, i.e., need for more professionalism, pricing, salaries, personnel, management education, cost of materials, competition, etc. But they seem to lose much of their importance if we're regulated out of business!

Old "Charlie" Dickens' Tale of Two Cities chronicled a very brief era in history, the French Revolution. I hope we never read the chronicle of some historian who begins, "The lawn care industry, it was the best of times, it was the worst of times...and now it's gone".

SHADE AND TREE ROOT COMPETITION PROBLEMS IN LAWNS

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Too much shade is often a problem in home lawns and other turf areas. Competition for water and nutrients by tree roots is usually associated with shade problems.

Shade causes several different effects on turfgrasses. The major effect is usually reduced light intensities. Also, the quality of light that reaches turfgrasses under trees is of lesser quality than that found in open sunlight. Other changes in shady environments are moderation of temperatures, higher humidities, longer periods of leaf wetness, reduced air movement, lower or higher soil moisture levels, and higher levels of carbon dioxide. More carbon dioxide for the grass may be a positive factor; however, it is not enough to overcome the reduced light intensities.

The type of trees in the lawn affects the amount of shade produced. Dense trees such as oaks and maples allow very little sunlight through the canopies. Turf with satisfactory quality can often be obtained under trees with branches high off the ground such as some pines but not under trees with low limbs and dense canopies. For enough light to reach the turf under trees such as oaks, the limbs must be high enough for light to come under the trees in the morning or afternoon.

Reduced air movement under trees keeps the relative humidity higher and turfgrass leaves remain wetter for longer periods. The temperatures in shade usually are not as high during the day and are not as low as during the night when compared to nearby open areas. Soil moisture levels may be higher from reduced evapotranspiration rates or may be lower during dry weather from root uptake of the soil water.

When light intensities are too low, turfgrass plants produce fewer leaves and those which are produced are longer and more succulent. Also, fewer roots are produced. Turf quality declines when the compensation point for light is passed. In other words, the plants use more energy than they produce from photosynthesis when this level of light is not maintained. These factors that

result in weak plants in combination with higher humidities and longer periods of leaf wetness encourage the development of some diseases. Diseases such as brown patch, rust and powdery mildew are often more severe in shady environments. These diseases are often the final factors that cause poor quality turf in shady environments.

The solution to shade problems are to remove the shade, use shade tolerant grasses, ground covers or mulch, or learn to tolerate and expect the poor quality turf. Shade can be removed by cutting down trees or pruning to remove lower limbs and thin the canopy. Increased air movement and higher light intensities will be the result. Remove enough limbs on trees to provide good light intensities for at least 6 hours a day. The idea of selective shade removal may be more acceptable to the customer than first suggesting cutting down trees.

New landscape designs using shade tolerant plants such as azaleas or ground covers such as ivy, periwinkle, lirope, or others adapted to your area is an option that can be used. Mulches such as bark, pine needles, or leaves can be used to develop attractive landscapes. Turf maintenance companies should be willing to suggest these alternatives because the desired quality for you and the customer in severely shaded environments will not be obtained. If these shady areas are not needed for activities such as for children to play or for open walking space, these alternatives are often less expensive in the long run and more attractive.

Turfgrasses such as ryegrass or tall fescue may be planted annually in the fall under deciduous trees shortly before leaf fall. The grasses will grow in the fall and winter (in southern climates) and in the spring. Leaves must be removed frequently for the grass to grow. The grasses may die in the summer and will have to be replanted in the fall. Some of the red fescues, bluegrasses and newer tall fescues are more shade tolerant than other grasses and may survive throughout the year. Under heavy shade the quality may be poor. Under partial shade some of the bluegrasses and ryegrasses may give acceptable turf quality. The warm season grasses in the southern United States will not grow well in shady areas. St. Augustine grass is the most shade tolerant of these grasses.

Homeowners often say that they used to have good quality turf in some areas but now they cannot grow grass

there. Shade in a landscape with trees increases with time as the trees enlarge. Trees grow and often hedges are planted that produce more shade and reduce air movement each year. Therefore, areas that once had enough sunlight for growth of turfgrass may become too shady after a few years.

Tree roots often compete with the turf for moisture and nutrients. If sufficient light is present, tree root competiton may be overcome with extra irrigation and fertilization. Turfgrasses growing in shady environments may actually use less fertilizer if tree roots are not taking nutrients from near the surface. Root pruning with a ditching machine or a blade may be an option with some trees. Do not cut so many roots that valuable trees might die. Also, tree selection will help prevent shade and root competition problems. In the southern U.S., pine trees have rather deep root systems and allow more light through the canopy. Some deciduous trees such as tulip, poplar and oaks have rather deep roots and do not compete as much with turfgrasses. Trees such as maples have shallow roots that compete more with the grasses and the roots often become raised above the soil. Taller growing trees can often be pruned to allow more sunlight to come under the trees in the morning and afternoon.

In summary, too much shade is a common problem on turfgrasses in lawns and increases over the years. Several different alternatives should be considered in solving the problem.

NATURAL AREAS/MULCHES

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NATURAL AREAS

Modern trends in landscape design include 'natural areas.' These 'natural areas' are accepted as functional support systems to a project because of the lesser amount of maintenance required. Wooded areas which receive 50% shade or more are prime targets for this design approach. A 3-4" layer of organic mulch spread over the area is a rather simple solution. The aesthetic qualities require consideration in the design process. The design qualities and characteristics (size, form, texture, color) of the mulch should be considered as design criteria.

Natural areas should appear natural. The mulched area should include the entire ground canopy area of the trees. Free-flowing curves can be easily over-used in these type projects. Try not to create boundaries that project too abruptly, as they will not appear natural and also compound any maintenance on contiguous turf areas. Accentuate the design by selectively thinning the tree density of the smaller, less significant species, then replant a few native flowering species to add seasonal interest to the area.

Natural areas do require less maintenance than turf or flower-bed areas -- but some maintenance is required. The use of herbicides will be necessary to control weed competition, mulches will need to be replenished every 6 months or so, and most importantly, the boundaries of mulched areas should be maintained as crisp, finite borders.

MULCHES

Professional landscapers and grounds managers rely heavily on mulch in the ornamental plantings for several reasons. Functionally, mulches discourage weeds from growing, conserve moisture during drought periods, allow better use of water by controlling runoff, and increase water holding capacity of light, sandy soils. Mulches help maintain a uniform soil temperature. A 3-4" layer of mulch can add to the aesthetic value of a garden while protecting the base of plants from being injured by mechanical equipment.

Many organic materials can be used as a mulch. North Carolina gardeners use pine needles, pine bark, compost, peat moss, and decayed sawdust. Most of our native soils benefit from working organic matter into the root zone area. This could include all the previously mentioned

materials (except pine needles) and also manure, wood shavings, tobacco stems, and composted lawn clippings.

Mulch can be applied just about any time of the year when trees and shrubs are being planted, but the best time to apply in established bed areas would be in mid-spring when soil temperature has warmed up enough for sufficient root growth. If applied earlier, the mulch will keep the soil temperature lower and root growth delayed.

Mulches should be applied 3-4" in depth over relatively clean, weed-free soils. Don't make the mistake of just covering bermudagrass, nut-grass or other garden weeds with a layer of mulch. Identify and eradicate the weeds before the mulch. Use a directed spray of a recommended herbicide and then apply mulch. It will not be necessary to pull the mulch back everytime you fertilize or water. If the mulch you use is not completely decayed, incorporate 2-4 lbs. of 10-10-10 per 100 sq. ft. of mulched area. This is especially true for wood chips, sawdust and shredded hardwood bark.

Several inorganic materials are often used as mulches. These might include gravel, rock or black plastic. Be certain that the gravel, stones or lava rock coincide with the overall design. Often they are not compatible landscape components. Black plastic will discourage weeds but at the same time interfere with the normal oxygen and water supply to the roots. When plastic is used, a very shallow root system is created and during drought periods, the plants may not withstand the stress. Therefore, it is recommended not to use black plastic around ornamentals. A 3-4" layer of organic matter maintained on weed-free soil will be both functional and aesthetically pleasing.

Relative Value of Mulches

1. Excellent
2. Good
3. Fair
4. Poor
5. Unsatisfactory

Organic Material	(Attractiveness) Aesthetic Value	Source of Weeds	Resists Wind Blowing	Resists Compaction	Availibility	Comments
Compost	2	3	1	2	1	Depends on ingredients
Lawn clippings	4	3	2	4	1	Should be composted
Leaves	2	2	4	5	1	Should be composted
Manure	5	5	1	2	3	Good only for incorporation into soil
Peat Moss	1	1	2	2	1	Readily available - expensive
Pine Needles	1	1	2	1	1	Excellent mulch - easy to handle
Bark granules	1	1	1	1	1	Excellent mulch - generally used in large amounts.
Wood shavings	3	1	2	2	3	Good for incorporation - add nitrogen
Sawdust	3	1	2	3	2	Should not be too deep and beware of "crusting over"
Waste Paper	5	1	5	2	1	Not recommended when used alone
Inorganic Materials						
Black Plastic	5	1	5	tears	1	Must anchor - but not recommended
Gravel	3	1	1	1	1	Must be compatible with design
Crushed Rock	2	1	1	1	1	Must be compatible with design
Lava Rock	2	1	1	1	3	Must be compatible with design

COST ANALYSIS-ONE WAY TO CHARGE FOR SERVICES

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Obviously, a company cannot determine how to charge for services rendered if it does not know what the expenses of doing the job are going to be. I sometimes have the feeling that many companies use what I call the "look see" method of estimating a job.

Turf Tech is often called to subcontract the chemical end of a maintenance job which includes fertilizing, weed control, etc. The first question that I will ask the maintenance company spokesperson is, "How large is the area?" "Oh, three or four acres maybe. I don't know for sure" is the usual answer. My point here is how does a company charge for services if they do not know the exact size of the job? Every part of the business deals in square footage. All chemical rates are applied by the number of square feet, be it in acres or thousands of square feet. Mowing machines are sold and priced on their ability to cut X amount of acre(s) per hour or day. Seed is spread at X pounds per thousand square feet depending on the seed use; straw too, for that matter.

Of most importance is the use of pesticides. Calibrations when applying pest controls, whether the targets are insects or weeds, must be accurate. Square footage must be known to prevent misapplication and damage to the environment.

Labor costs can be applied to the square foot method. How long does it take your employee to mow an acre? How long does it take to clean a 10,000 square foot parking lot? Do you know the size of the parking lot? If square foot records are kept on parking lot size, lawn size, and natural area size it will not be long until you have a reasonable cost on servicing such areas. Size takes the guess work out of bidding.

The winter is the perfect time for accurately determining these costs. In your I.R.S. report, you will be deducting all wages (including your own), equipment costs, gasoline, supplies (fertilizer, etc.), advertising, telephone, and other items. Divide these costs by the total thousands of square feet of your business. Now you know what it costs the company to do one thousand square feet. This will not show any profit, which you will have to add. If you made 15% profit last year, you do not need this method since you are doing something right!

In short, if you know the square footage of the job, you can more accurately determine the man hours involved, chemical and equipment costs, and of course, your profit. No more "look see" and other inaccurate estimates ... be prepared to bid with authority.

THE TURFGRASS COUNCIL OF NORTH CAROLINA, INC.

The Turfgrass Council of N. C. is a Non-Stock Association incorporated under the laws of North Carolina and is tax-exempt.

PURPOSES AND OBJECTIVES

The purposes of the Turgrass Council are: (1) to promote the turfgrass industry; (2) to encourage study and research in turfgrasses; (3) to disseminate information relating to turfgrasses; (4) to represent the turfgrass industry in matters of policy. The objective of the Council is to help obtain the best turf possible for lawns, recreational areas, roadsides and cemeteries throughout the state.

ACTIVITIES

The Annual North Carolina Turfgrass Conference and the NCSU Turf Field Day are co-sponsored by the Turfgrass Council and N. C. State University. A newsletter is published to inform the membership of Council activities and turf programs in the state. Turfgrass research, extension and scholarship programs receive financial support from the Turfgrass Council. A Turfgrass Research and Extension Fund has been established at N. C. State University to obtain additional funds for research and extension programs.

MEMBERSHIP

Individuals interested in turfgrasses, representatives of turf related organizations and sales representatives of turf products are encouraged to become members. Dues for individuals are $10 per year. Sustaining memberships at $25 are also available.

BOARD OF DIRECTORS FOR 1984

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MEMBERSHIP APPLICATION

Name ..... Address .....

City ..... State ..... Zip .....

Circle type of work - Golf Course, Lawn Care, Commerical Sales, Parks and Recreation, Educational, Other .....

Make check for $10 payable to Turfgrass Council of N. C. and mail to Turfgrass Council, Box 7616, Raleigh, N. C. 27695-7616.

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