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The 1973 Summer

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Every summer has some turf wrecking days. Along with this, the safety margin for turf survival is always narrow at this season. This is especially true on finer turf areas. Enough has been said and written about the seasonal turf degradation that has taken place. The same is true for the lost pride of many good turf growers.

The important thing for all of us at this stage is to think (1) what happened?, (2) what, if anything, would we do differently? and (3) how can we repair the turf? Bringing the turf back quickly is the mark of a real professional.

In the category of what happened, as compared with other years, the major culprit was the added increments of hot weather. The local weather records show the average temperatures for June, July and August totaled 79°, 27° and 59° more for the 3-month period. Of course, a large part of this develops because of high temperature days. Higher temperatures cause a plant to grow less, have lower food reserves, suffer more from drought, suffer more from high nitrogen and become more susceptible to disease. Of course, high hot weather has other effects such as more insect problems, failure of water supply and the weariness and depression of the crew.

Since high temperature has so many serious effects, many things can be blamed for failure. However, a large percentage of the hot weather turfgrass losses can be avoided by precise watering, disease control and avoiding lush growth. Check these factors and any other possible causes.

Other difficult summer temperature periods will strike suddenly and cruelly in the years to come. Can we meet the challenge? Now is the time to think about future procedures and obtain the facilities. The water program may require a greater supply, a better system, or more good help. The disease control program must have good timing and proper diversification of fungicides. Talking over these concerns with others helps think these problems through, and it will help you find new enthusiasm for your next summer bout.

The Grass Seed Story — 1973
or
Grass Seed Shortages Are For Real

Roy C. Bossolt

The Terre Company

The recent rise in grass seed prices, particularly the Kentucky Bluegrasses, the Fescues and Perennial Ryegrass, has international overtones. It is associated with the world wide food shortage, world demand for grass seeds, poor seed crops in the world's major seed producing areas and maybe our deficient balance of payments in world trade.

While all the reasons for the short seed supply are difficult to gather, here are some of them —

The 1972 carryover of seeds into 1973 was very limited. A heavy carryover of seeds has a definite bearing on the market price the following year.

The weather in the major seed producing areas of the world — The Low Countries, Russia, Australia and the United States, was unfavorable for good crops. As a result of this, and the limited seed carryover from 1972, there is an estimated 100,000,000 lb. grass seed shortage world wide. The State of Washington, one of our large seed producing areas, suffered its worst drought in 50 years. There is a 9,000,000 lb. shortage of seed production in this state alone.

Weather beaten acreages are yielding poorly. Losses from cleaning seeds before they are tested and bagged for resale are running as high as 50%.

The world wide demand for food from the United States is at an all time high. Protein is in especially heavy demand. Soybeans were selling for \$2.50 a bushel a short time ago; current prices are +\$7.00 a bushel. Many grass seed growers have switched to growing soybeans and wheat to take advantage of greater per acre returns in the world market.

Foreign buyers are willing to pay top dollar for America's grass seeds. As a result, tons of seeds are being shipped abroad, which is another reduction in the quantity of seeds that would enter our normal channels of trade. This has had a pronounced effect on our seed costs.

We, as growers, all know the important part weather plays in producing good turf, or high yields of vegeables, or fruit. But, who would think that the world food shortage would have such a pronounced effect on our grass seed prices. It makes you wince when you realize that some of your seed production is going toward growing that T-Bone steak you had for dinner at \$3.00 a pound!

DROUGHT STRESS AS A FACTOR TRIGGERING FUNGAL DISEASE OF TURFGRASS**

*R. M. Endo and P. F. Colbaugh**

Fungal diseases of crop plants, such as potato and wheat, usually worsen with continued monoculture since pathogen populations tend to increase in the crop debris and in the soil. Although turfgrass diseases caused by facultative fungal parasites occur each year, their amount and severity varies from year to year, and from location to location, bearing little relationship to the age of the planting. The erratic occurrence of fungal diseases is also evidenced by the limited areas of turf that are diseased even under the most favorable conditions. The frequent failure of disease to develop is difficult to explain since even a small lawn consists of millions of ground-hugging plants of similar genetic make-up and disease susceptibility; the crowded plantings and the crop debris (mat and thatch) at the soil surface favors the formation and retention of high humidity and even temperatures required for the growth and rapid plant-to-plant spread of the fungal pathogens; guttation and dew formation is almost a daily occurrence; and the population of fungal pathogens apparently increase yearly in the soil, in the crop debris and on infected plants. Furthermore, turfgrass pathologists have had to rely on natural disease development for fungicide evaluations, because most attempts to create disease artificially in the field have failed. The factors responsible for this failure, and the erratic development of disease are probably biological in nature.

Facultative fungal parasites of turfgrass (eg. *Rhizoctonia solani, Sclerotinia homeocarpa, Pythium aphanidermatum, Helminthosporium sativum* etc.) are constantly being exposed in the following ways to antogonism and competition from the microflora and fauna, and therefore their development is subject to biological influences throughout their lifetime: 1) The dense plantings and the short, prostrate growth habit place the aerial portions of the plants in contact, or in proximity to the microbiologically active surface litter and soil. 2) The plants are constantly being exposed to micro-organisms by means of foot traffic, by maintenance practices such as mowing, fertilization, irrigation and by the varied activities of the macrofauna such as earthworms, nematodes, birds, and insects. 3) The grass clippings and the death of lower leaves, stolons, rhizomes, roots and tillers form the surface litter which is composed of fresh and decaying grass debris in various stages of decomposition. The constant addition of fresh clippings to the litter during the growing season is unique and constitutes an effective and continuing source of food for the litter inhabiting microrganisms which actively compete with the fungal parasites for food. 4) Depending upon the depth of the litter, a variable amount of the stems and roots will be covered by the biologically active litter. 5) Because of the extreme root density and their surface location, the nutrients which leak out from fresh grass clippings may influence the growth of microorganisms living on or near the root surfaces as well as the litter inhabiting microorganisms. Thus, the total microbiological activity may, at times be very high in the litter and in the soil, and undoubtedly influences the activity and survival of parasitic fungi.

We suspect that the erratic occurrence of turfgrass diseases caused by facultative fungal parasites is due to the suppression of the parasites by the competitive and antagonistic activities of the microflora and fauna, and that disease usually occurs when disease resistance of turfgrass plants has been reduced, or when the micro environment favors the development of the pathogens more than the competing antagonists. Drought stress is an example of a commonly occurring environmental "trigger" which probably frees the facultative fungal parasite from the restraining influence of the competing microorganisms, and allows the parasite to develop. The occurrence of localized dry spots in turf is a commonly occurring problem due to compacted soil, infrequent irrigation, uneven terrain, lack of rainfall, excess mat and thatch which when dry tends to repel water, wind disruption of sprinkler patterns, and a high degree of water runoff.

The first experimental evidence that low soil moisture may increase certain turfgrass diseases was presented by Couch and associates. They demonstrated this relationship for dollar spot caused by *Sclerotinia homeocarpa* (3) and for greasy spot caused by the watermold fungus, *Pythium ultimum* (4). Bean (1) has not only noted that the field occurrence of *Fusarium* blight of bluegrass caused by *Fusarium roseum* is correlated with the occurrence of dry spots but also that the disease can be greatly reduced by proper watering.

The mechanisms responsible for this increase in disease in dry soils have not been investigated in turfgrass. It may therefore be instructive to consider the research of Cook and Papendick (2) who found that foot rot of wheat caused by *F. roseum*, the same fungus that causes *Fusarium* blight o fturfgrass, is favored by dry soils. They found that the number and activities of soil bacteria were reduced greatly at soil moisture levels below -8 bars, that the resistant thick-walled spores of *F. roseum* germinated in soil well below the permanent wilting point of plants (-15 bars) and that after germination occurred, the threads of the fungus were able to grow and infect plants. They also reported that soil bacteria were not only able to inhibit fungal germination but also were able to dissolve the walls of the fungal threads. Cook and Papendick therefore attributed the heightened parasitic activity of the fungus in dry soils to the reduction in populations and activities of soil bacteria.

Following the lead of Cook and Papendick, the effects of drought stress are currently being investigated in turfgrass by P. F. Colbaugh, graduate student at the Univ. of Calif. at Riverside. He has found that disease activity of *Helminthosporium sativum*, which causes leafspot and foot rot of Kentucky bluegrass, (Fig. 1) is increased in drought-affected areas. Field observations on the incidence of the disease indicated that leafspot symptoms decreased with increasing distance of sampling from drought-stressed areas of bluegrass lawns (Fig. 2). Severe foot rot and spore production by the fungus on crop debris and on infected plants were observed in drought-

**Professor and graduate student respectively, Plant Pathology Dept., U.C.R.*

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stressed turf but not in areas receiving adequate water; only occasional leafspots were found in watered areas of the lawn.

FIGURE 1
Bluegrass infection with Helminthosporium sativum showing typical infections of the leaf, leaf sheath and crown.

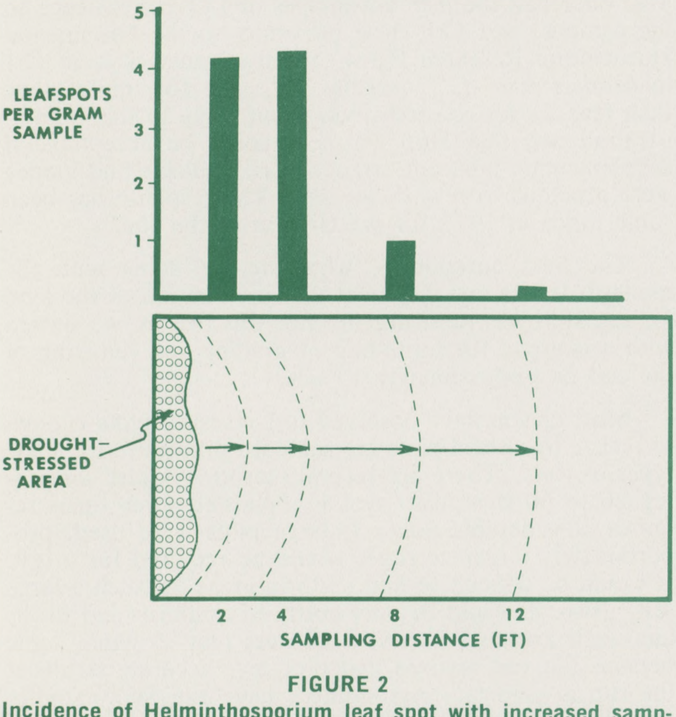

FIGURE 2
Incidence of Helminthosporium leaf spot with increased sampling distance from a drought stressed area of bluegrass.

The fungus has been recognized by previous workers to be a very weak competitor in the presence of other microorganisms. Evidence which strongly supports the involvement of microbial activity in suppressing the ability of the fungus to develop on the crop debris is shown in Fig. 3. Spores placed on moist crop debris do not germinate, even though adequate moisture is present, but when washed from the surface of moist debris, they germinate readily. The inhibitory effects of moist crop debris can be removed by thoroughly washing, sterilizing, or drying the debris. The inhibitory property can be restored to the sterilized crop debris if microorganisms are added to the debris. Immediately after remoistening dried crop debris, germination of *Helminthosporium* spores is greatly favored, but the inhibitory property returns after a few hours. At the time of remoistening dried crop debris, large quantities of sugars and proteins are released. Carbohydrate release from both dry and continually moist crop debris is shown in Fig. 4. Both the level of release and the rate of release from dried crop debris was greater than the release from continuously moist crop debris. Since abundant nutrients are present when the dried debris is remoistened, there is sufficint food to nourish not only the *Helminthosporium* fungus, which is a poor competitor, but the numerous competing microorganisms as well.

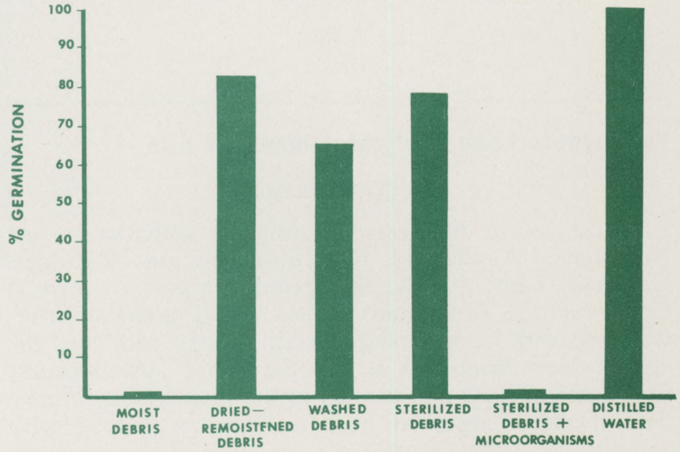

FIGURE 3
Germinability of Helminthosporium sativum conidia on Kentucky bluegrass crop debris.

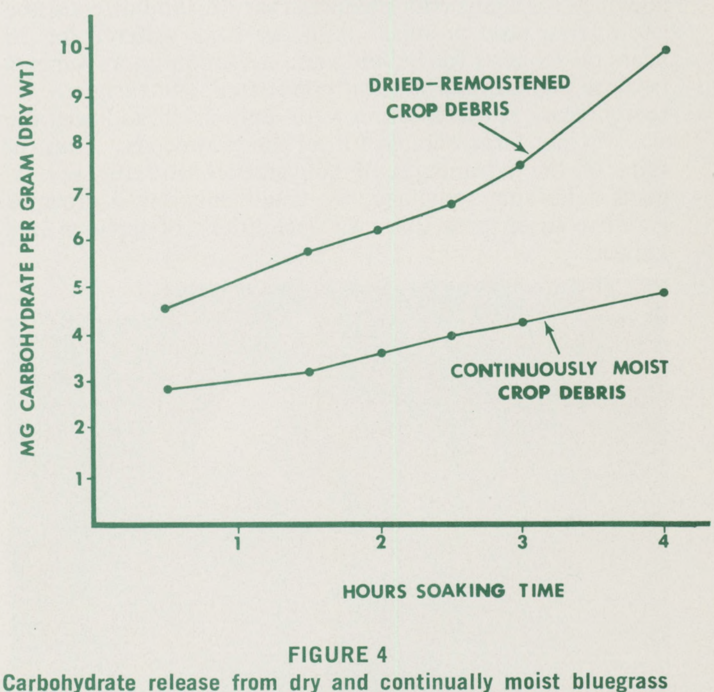

FIGURE 4
Carbohydrate release from dry and continually moist bluegrass crop debris.

It appears that the inhibitory property on crop debris is active only when the debris is in a moist state and when microorganisms are present and active. This coincides with the period of greatest microbial activity on the decomposing residue. Drought lowers both microbial numbers and their activities. Upon rewetting the dried crop debris, microbial activities are again resumed at high levels until an equilibrium is once again established with the available food supply.

Drought stress also stops plant growth. When growth stops, *Helminthosporium* infections at the base of the bluegrass plant tend to develop into the lethal foot rot stage. However, if growth is continuous as in the presence of moisture, such infections tend to develop into harmless leaf blade infections.

The effects of drought on reducing microbial activity and increasing the competitive ability of *H. sativum* have been briefly described. Other influences of drought and its effect on turfgrass disease activity await further investigation. The goal of our investigations is to understand the nature of facultative fungal parasites with respect to their saprophytic and parasitic development. This will enable us to propose meaningful control programs based on an understanding of the factors responsible for "triggering" the fungus into activity.

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The Ryders Lane Turfgrass Research Site

Ralph E. Engel

Most recent followers of turfgrass activities at the New Jersey Agricultural Experiment Station of Rutgers University know that the turf area of the past 50 years at College Farm Road and Dudley Road is being overwhelmed with Cook College needs. Along with this, the city of New Brunswick is negotiating for approximately four acres of land that centers in the main research area. This increased reservoir need is largely a step to solve some public water needs.

From our point of view, the current site was under so many threats for other type expansion that attempting to convince the University planners that we should retain the site offered little promise. Also, we have suffered for 25 years on requests for building and irrigation improvements because our Administration considered our turfgrass research years at this location were limited. In addition, the site was not large enough for all the plot needs. Thus, in spite of the advantages of convenience and the several good fields that remained, we could only say a gracious goodbye to an area that two generations of turfmen had known.

Dr. Lund checks soil structure at Ryders Lane Turfgrass Research Site.

Several years ago, some of you participated with us in planning a new turfgrass center of excellence. The University officials agreed with our thinking, but said the plan just could not be fulfilled when the University's needs and the availability of public funds were considered.

The next development was the offer by Dean Hess of Hort Farm II on Turfgrass Field Day of August 1972. This offer had the nice advantages of (1) convenience to the campus, and (2) close proximity to the Ornamental Horticulture Research Farm. Its disadvantages were (1) inadequate size, (2) variable soil, and (3) more slope than feasible for research plots. Our reply to the Administration was that Hort Farm II could be acceptable if supplementary adjacent acreage were available and money were provided to rework the soil. The response has been some funds in 1973 for preparation of the site.

The next question is, what are we doing with the money? It was our judgment that preparation of the land for research was most urgent. For this reason, we started with a contract for topsoiling or grading and remixing of the soil on approximately 13 acres.

Most of you have observed turf research plots enough to realize that small plots are standard procedure for some types of tests. There are several reasons. A test containing 20 to 60 treatments that is replicated three times requires considerable area. If large plots were used, proportionately larger acreages would be required for a test. It would be difficult to find uniform areas for such a large test. Also, it would be very costly to establish and maintain such areas. Possibly, small test plots frighten some persons but rest assured that they give accurate results if the site is uniform. Agronomists have run many studies that show tests with small plots are as good as large plots if the site is uniform.

With this background, you might visualize why the soil of a former fruit farm would need reworking. With this past culture, the assortment of minor and major nutrients are not applied uniformly to the soil. The same is true for most herbicide and tillage treatments. Removal of sizable trees causes deep localized disturbance of the soil. Old ash piles existed. Thus, it was clear that regrading, remixing the soil and replacing a uniform layer of topsoil on a uniform base would greatly increase research test efficiency by giving a more usable land and uniformity of site.

Mercer Contracting assists in crop rotation from fruit to turf.

Currently, Mercer Contracting has stripped approximately six acres to the depth of topsoil. The Soil Conservation Service has advised us on layout and Professor Kurt Nathan of the Agricultural Engineering Department has developed the sub-base grading layout. The remixed topsoil layer will be screened before it is replaced on the fields. Underground irrigation will be installed on approximately one-half of the current work area. This will be a snap-in system that has two times the required outlets and allows alternate settings of the sprinkler head position for more uniform watering. It is our hope that with good weather and good luck, we will plant a series of vegetative bentgrasses in October. The roadways and borders will receive permanent type seeding. Part of the area will be seeded to temporary cover while soil settles.

Like all turfgrass establishment endeavors, we do not need large or hard rains. Since most of the land has 1½-4% slope, we must be concerned about soil erosion. We would like to follow standard SCS layout but this would interfere with plot layout. We hope that spreading the water gently in two directions and a minimum of roadway terraces will suffice on a rectangular layout plan.

Another approach on some fields will be utilization of remixed topsoil from the old turfgrass research site on two fields. The theory is that existing variability will be blanketed by a uniform layer of topsoil. Mercer Contracting is doing the work on these fields and it is hoped these sites will be available for seeding in the fall of 1974. Some of you may wonder why Mercer Contracting has the contract for soil work. They were the only ones who bid on the work as advertised by the University contracting office. I fear they will wish they had not before finishing. We are greatly appreciative of their helpfulness. I rather expect their only salvation is the hope they don't lose too much.

Some of you have asked for more dispersal of our turfgrass research sites. Now you have it. A few tests will continue temporarily at the original College Farm Road site, several tests will be underway at the Ryders Lane Turf Research Farm (Hort Farm II). Adelphia has a block of maintained turf (in addition to nurseries) and various turfgrass research tests exist on some of your turfgrass grounds. Thus, we must anticipate that turf research field days will be more difficult to conduct in the future. At least, we will have more variability of site. At the moment, it is necessary to adopt a wait-and-see attitude for the 1974 Turfgrass Research Day. If such a day doesn't occur next year, we will still report any research conclusions or developments during our January 3-Day Courses.

New State Pesticide Regulations

R. C. Bossolt

The New Jersey Pesticide Advisory Council is in the last stages of writing a draft for the new pesticide law, affecting all of New Jersey. No specific details concerning the new law are yet available. Public hearings are to be set for late February, or early March. There is a proposal to list all pesticides in two classes, A and B.

CLASS A — will contain 96 compounds, which will be removed from public sale and can only be sold under the new law by registered pesticide dealers, or applicators. Registered dealers must submit for annual registrations to get their permit. They must keep sales records. They must store the pesticides according to the law's requirements and they must post emergency procedures in case of breakage, or mishandling. They only will be allowed to sell these compounds to registered applicators.

Registered applicators must submit to annual registration to get their permit. They must supervise all uses of pesticides by their workers. They must follow label directions implicitly. Their equipment must be correctly maintained. They must follow good business practices. Violation of any part of this section may cause them to lose their permit.

CLASS B pesticides will not be allowed for sale in New Jersey. There are 9 compounds in this class. They were not identified.

All other products not listed in Classes A or B will be opened for sale to the general public in New Jersey.

The EPA offices in Trenton must be kept informed on any experimental product being used in the state. All pesticide products must be registered with federal and state officials.

For further information concerning this law, when it becomes a fact, contact Ronald Turner, New Jersey State Dept. of Environmental Protection, P.O. Box 1390, Trenton, New Jersey.

Warm Weather Turfgrass Diseases Often Occur In Groups

by H. B. Couch, Virginia
Plant Protection Newsletter — August 1973

The climatic conditions for development of many of the more important warm weather turfgrass diseases are similar. For example, Rhizoctonia brown patch; Fusarium blight, Pythium blight and Helminthosporium leaf spot are all most severe under prolonged wetting periods and daytime air temperatures of 85°-90°F and night temperatures that do not fall below 70°F. It is not uncommon, then, for these diseases to occur simultaneously in the same stand of turfgrass. This has most certainly been the case for Virginia during this part of the growing season.

When these combinations do occur, field diagnosis is very difficult. Oftentimes, the problem is identified as simply one disease with attending "atypical symptoms." This type of diagnosis can lead to serious problems. Many of the turfgrass fungicides now in use are limited in their spectrum of disease control. The primary materials used for Pythium blight control, for example, will not control the other three diseases mentioned above. The most efficient fungicide for Fusarium blight control will not control Pythium blight or Helminthosporium leaf spot. Programs developed for the control of summer diseases, then, should contain fungicides of sufficient spectrum to cover all of the major problems that may be encountered. Furthermore, the turfgrass management specialist should not become so preoccupied with the control of one disease that he allows attending disease situations to get out of hand before he is fully aware of their presence.

Abstract: Environmental and Cultural Preconditioning Effects of the Water Use Rate of *Agrostis palustris* Huds., Cultivar Penncross — R. C. Shearman and J. B. Beard, CROP SCIENCE 13: 424-427 (1973)

Preconditioning effects of light intensity, growing temperature, irrigation frequency, cutting height, mowing frequency, and nitrogen nutrition level on water use rate and stomatal density of "Penncross" creeping bentgrass (*Agrostis palustris* Huds.) were investigated. Water use rates were recorded as percent moisture lost during exposure to (1) 33°C, (2) 40% relative humidity, (3) 4300-lux light intensity, and (4) a constant airflow of 186 cm sec^{-1} in a special wind tunnel apparatus. Stomatal density counts were made at 430X from nitrocellulose replications of the leaf surface.

The preconditioning effects of cutting height, light intensity, and nitrogen nutrition level had the greatest influence on water use rate. Irrigation and mowing frequency were intermedate in their influence. Growing temperature had the least effect among the factors considered.

Stomatal density was influenced most by light intensity, and growing temperature had the next greatest effect. Irrigation frequency had an intermediate effect. Nitrogen nutrition level had the least influence of the factors studied. Water use rate was positively correlated ($4 = 0.88$) to stomatal density in the light intensity study. However, it was negatively correlated ($r = 0.98$) to stomatal density for the nitrogen nutrition level study. No significant correlations were observed for growing temperature or irrigation frequency.

Comments:

The Michigan State Research Group deserves a lot of credit for spending time and money to find answers on such basic questions. The study also shows the difficult nature of research. The topics under investigation seem clear and the organization of procedure is highly commendable. While the results answer questions, they raise questions. The plants grown with increasing light intensity, prior to moisture loss tests, experienced increasing moisture loss. This does not support the belief that plants grown in the sun are more drought resistant. With increasing cutting height, moisture loss increased. Again, this does not support the theory that higher mowing increases drought resistance. This result may not be contradictory since the test was conducted in a constant temperature system which would nullify any outdoor temperature advantages of higher cut. Thus, with the constant temperature of this test, the greater water loss with the higher cut could be determined largely by the relative amount of leaf area exposed. For the grower, this study shows that (1) allowing the grass to near the wilting stage before water, and (2) low levels of nitrogen are advantageous in periods of moisture stress. Of course, experience has taught us some other advantages for these management procedures in severe summer weather. I trust these comments show some of the fun and frustration of research work and interpretation.

R.E.E.

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