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ST.AUGUSTINEGRASS FOR TURF

*Victor B. Youngner, V. A. Gibeault, K. Mueller**

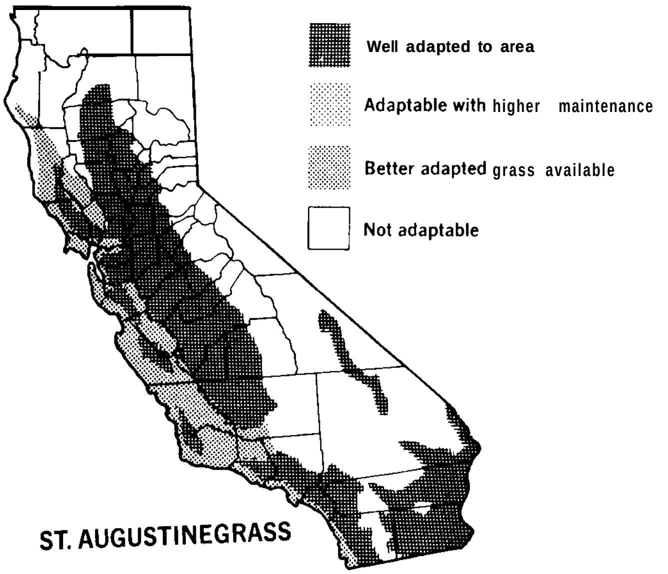
St. Augustinegrass *(Stenotaphrum secundatum Kutze.)* is a coarse textured warm season species indigenous to the West Indies, Mexico and perhaps the Southern coastal region of the United States. It is presently used extensively for lawns in the Gulf Coast States and to a lesser extent in Southern and Central California.

St. Augustinegrass, a creeping grass with heavy stolons but no rhizomes, can be identified in the vegetative stage by the following characteristics: leaves-folded in the budshoot, ligule-short fringe of hairs, blade-obtuse (rounded at tip) and glabrous (free of hairs), collar-petided or narrowed to form a stalk, sheath-greatly compressed and ciliate along the margins and at the summit. Kikuygrass *(Pennisetum clandestinum)* is often mistaken for St. Augustinegrass. This weedy species can be readily distinguished from St. Augustinegrass by several characteristics shown in Fig. 1.

Adaptation and Growth Responses

Because of its lack of winter hardiness St. Augustinegrass is restricted to the areas of Southern and Central California with mild winter temperatures shown in Fig. 2.

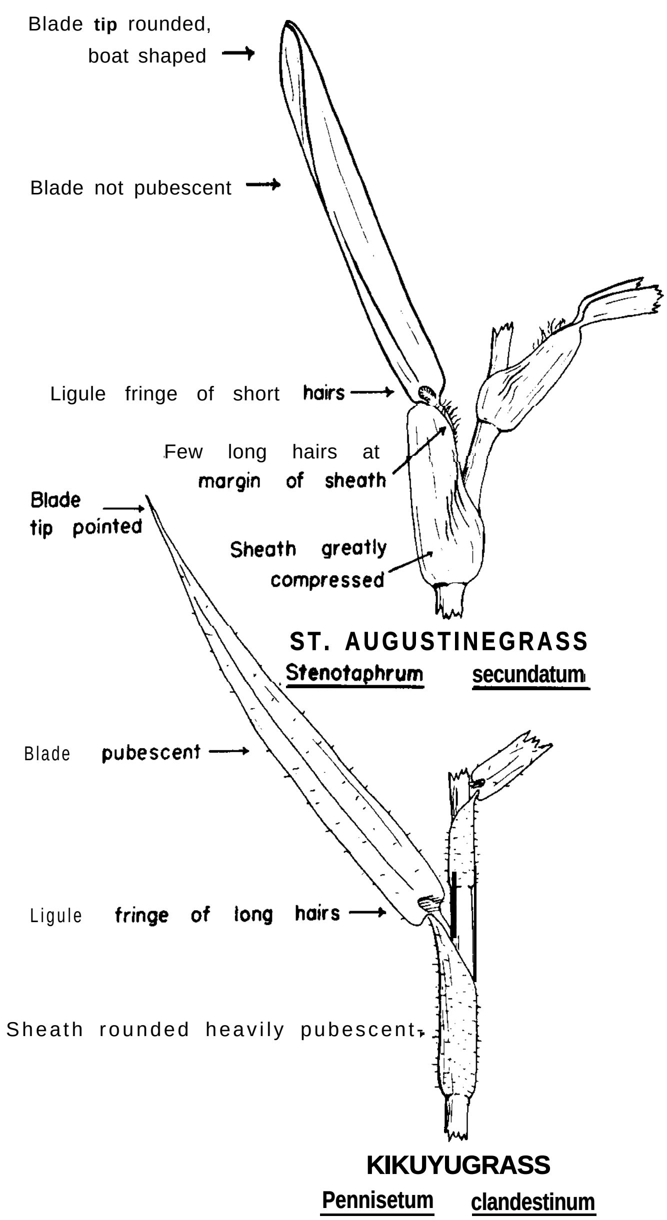
FIGURE 2



Like other warm season grasses St. Augustine loses color and becomes dormant during cool winter weather. However, it does retain its color to temperatures as much as 10°F lower than those which bring about discoloration of common bermudagrass.

Although optimum and maximum temperatures for growth have not been determined for St. Augustinegrass the species is known to be tolerant to high temperatures. It seems to thrive in the same temperature range favorable for bermudagrass. Growth is better than that of bermuda in the cool coastal zones.

FIGURE 1



St. Augustinegrass is one of the best warm season grasses for heavy shade, being as good or better than the Zoysiagrasses. It will produce a satisfactory turf under dense shade and high temperature if adequate water and nutrients are provided.

While soil requirements for St. Augustinegrass are not

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restrictive, it performs best on fertile, well drained soils that are slightly acid to neutral in reaction (pH 6.5-7.0).

X. SHADE TOLERANCE

Shade	Red fescue
	Zoysia
	St. Augustine
	Dichondra
	Colonial bentgrass
	Tall fescue
	Creeping bentgrass
	Meadow fescue
	Kentucky bluegrass
	Perennial ryegrass
	Improved bermudas
Sun	Common bermuda

It will make an acceptable turf on a wide range of soil types but will not tolerate highly compacted or poorly drained conditions (4).

St. Augustinegrass is highly tolerant of soil salinity, growing satisfactorily at salt levels as high as 16 mmhos (5). Its relative position with other turfgrasses for salt tolerance is shown below. It has been a popular species along the coast where salt levels may be high.

Until recently St. Augustinegrass had few pests in California suffering only from occasional attacks of brown patch and sod webworms. A few years ago the chinch

VI. SALINITY TOLERANCE

High	Improved bermudas
	Common bermuda
	Creeping bentgrass
	Zoysio
	St. Augustine
	Tall fescue
	Perennial ryegrass
	Meadow fescue
	Red fescue
	Kentucky bluegrass
	Colonial bentgrass
Low	Dichondra

bug, long a serious pest in Southeastern United States, was discovered in St. Augustinegrass lawns in the Whittier and Orange County areas. This insect species which appears to be specific to St. Augustine is now causing severe injury to many lawns in Southern California. Diazinon is an effective control material.

Gray leafspot, a common disease of St. Augustinegrass in the Southeast, has also been found in California lawns recently.

Although there are several varieties of St. Augustinegrass most if not all the lawns in California are of common. Until recently very little breeding work has been done on this species. Disease and chinch bug resistance studies are now underway in several states. Variety testing of St. Augustinegrass has been limited in California, however selection and breeding programs in the Southeast have provided the following varieties.

Bitter Blue is a selection made in Florida at least 25 years ago (1). It is a blue-green prostrate strain with close internodes. Its density and leaf width is considered to be superior to common.

Floratine was released by the Florida Agricultural Experiment Station in 1959 (3). Its color is also a blue-green but its leaves are narrower and its internodes shorter than those of Bitter Blue. It is reported to be tolerant of closer mowing.

Establishment:

St. Augustinegrass is planted by vegetative methods only. Seed is not available. Sprigging or plugging are the most commonly used planting methods but sodding or stolonization (broadcasting of chopped stolons) may be used as well . Planting should be done only when the soil is warm. Late fall or winter plantings are seldom successful. Plugs set 8-12 inches apart or sprigs planted in rows 6-12 inches apart will produce a solid turf in 2-3 months.

Management:

Nitrogen fertilization rates averaging one-half pound of actual nitrogen per month will produce a satisfactory turf on most soils. Applications of a quickly available nitrogen source (ammonium nitrate, ammonium sulfate or urea) are especially important for the maintenance of satisfactory color during the fall and spring. Phosphorous and potash should be applied as indicated by soil tests. If soil tests are not available one application of these nutrients in the spring should be sufficient.

Acceptable mowing heights for St. Augustinegrass range from 3/4 to 1 1/2 inches. Mowing closer than 3/4 of an inch will lead to a thin open turf while mowing about 1 1/2 inches will produce a rapid thatch accumulation. A reel mower will give a smoother more even surface than will a rotary.

Irrigation practices as recommended for any good quality turf should be followed. Adequate moisture should be maintained throughout the root zone at all times. However, University of California studies (2) have shown that water consumption by a St. Augustinegrass turf may be less than that of common bermudagrass.

An undesirable characteristic of St. Augustinegrass is its rapid production of a thick thatch, often several inches in depth. Because of its surface creeping habit (no deep rhizomes) renovation of a badly thatched St. Augustinegrass lawn is difficult. Scverc mechanical methods of thatch removal may often destroy so much of the turf that recovery is excessively long.

Frequent light vertical mowing may be a worthwhile approach but it has been inadequately tested on St. Augustinegrass under California conditions. A similar result may be obtained by an occasional scalping or mowing at one-half inch. A common method of renovation in Southeastern United States is to dig up the old turf, rework the soil and replant. This approach may in the end be the easiest and most satisfactory.

Summary and Conclusion:

St. Augustinegrass is a turfgrass of minor importance in California but the species does have characteristics that make it useful for certain situations. It is especially recommended for shaded lawns in the hot areas of the state. Its high salinity tolerance makes it a useful turf for lawns along the seacoast.

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TWO PESTS OF ST.AUGUSTINEGRASS

SOUTHERN CHINCH BUG

By Andrew S. Deal*

The southern chinch bug, *Blissus insularis* Barber, which to the best of our knowledge, first damaged St. Augustinegrass near Whittier, Los Angeles County, in 1967 has gradually spread into surrounding southern California areas and to two locations in northern California. California Department of Agriculture records now show this pest to be present in Los Angeles, Orange, Riverside, Sacramento and San Joaquin Counties.

This damaging pest injures the grass by inserting its beak into the leaves and stems and sucking out the juices. When large numbers of bugs are present, this removal of juices results in a wilting and dying of the grass. The first signs of the presence of these bugs is often a yellowing or browning of the grass in patches. If the grass in these patches or the margin of the patches is examined closely, the chinch bugs can usually be found crawling around down in the crowns and in the thatch near the soil surface.

The southern chinch bug has two adult forms. The long-winged form has a black body with white wings, which when folded flat over the back, extend to the rear, entirely covering the abdomen. The short-winged form also has a black body, but the wings reach only about halfway to the rear leaving more than half of the upper side of the abdomen exposed. Both forms of adults are quite small, only about one-fifth of an inch long.

The eggs are translucent white with a red spot.

The immature bugs, which are called nymphs, are wingless, but develop small wing pads which extend over the base of the abdomen in the later stages or instars. The younger nymphs are bright red but change to black as they mature. During the summer development from egg to adult takes about six weeks.

FIGURE 1
Long-winged form adult Southern Chinch Bug.

Studies completed by F. S. Morishita of the Department of Entomology at Riverside indicate that there are at least two generations of bugs per year. The first peak in population occurs around May to June. The second peak is in July and August. Generations overlap and both adults and nymphs may be found any month of the year, although in very low numbers during the winter.

The southern chinch bug is known to feed upon several species of grasses, including Bermuda, but St. Augustinegrass is the only species seriously damaged.

Several insecticides have been tested against the southern chinch bug and the pest has not been found difficult to kill. One insecticide found to be highly effective is diazinon. This material is recommended by the University of California to be applied as spray or granules at the rates of 3 ounces of active ingredient per 1000 square feet of lawn surface. The treated area should be watered well after application to carry the insecticide down into the grass crowns and thatch to the soil surface. The insecticide should not be washed away by flooding. A repeated application of the insecticide may be necessary in two to four weeks.

Southern chinch bug damage to grass will usually be less severe if the lawn is kept in a healthy, vigorous condition by proper fertilization, irrigation, aeration and thatch removal.

For your information, some other insecticides which are registered and available for control of southern chinch bugs in lawns are Akton®, Aspon®, Baygon®, and Dursban®. These materials are not presently recommended by the University of California because the research work with them is still in progress. If you should decide to use one of them, be sure to follow the manufacturer's label directions.

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GRAY LEAF SPOT OF ST. AUGUSTINEGRASS

By Kenneth E. Mueller*

The gray leaf spot of St. Augustine *(Stenotaphrum secundatum* [Walt.] Kuntze) is caused by the fungus *Piricularia grisea* (Cke) Sacc. In the southern portions of the United States this organism can cause serious disease problems on St. Augustine during warm weather, especially during periods of heavy rainfall and high humidity.

After infection by *P. grisea*, lesions first appear on the blade and sheath of the leaves as small brown spots, which enlarge to oval to elongated ovate spots. Typical lesions on the leaves are shown in Figure 1.

This disease has commonly been found in the coastal area of Orange County in home lawns. Usually only scattered spots are found on the leaves and seldom does the disease appear to cause a serious problem. Although only limited field observations in this area have been made of this disease, it has only been noted to be serious enough to be noticeable to the average observer in one instance. In the only serious case a general area of several

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FIGURE 1

Photo by R. Endo. Typical expanded leaf spots on St. Augustine grass caused by P. grisea.

square feet was observed with numerous leaf spots which had reduced healthy leaf area and appeared to give a grayish-green color to the area. This color difference made it stand out from surrounding, less seriously affected plants.

The infrequent rains and lower humidities of the southern California area during the warmer months is probably the major factor why this disease has never become serious in this region. Isaac and Owen (1) have indicated three factors necessary for gray' leafspot development, actively growing susceptible tissue, high humidity and moderate temperatures (70° · 90° F) . They were able to develop their heaviest infection when inoculated plants were held in a moist chamber for 24 hours or longer. They have also noted that under field conditions in Florida a dry period of ten days or more, along with high temperatures appears to diminish the observable symptoms. However, those leaves previously infected remain as sources of inoculum when weather is more favorable, and the new growth which was not infected during the dry period readily becomes infected with increased humidity.

Nitrogen appears to be an important factor in the severity of disease. Freeman (3) tested five rates of nitrogen and two sources (NH,+ and NO,-) and found significant increase in lesions with increasing nitrogen application. There was good correlation with number of leafspots per leaf and total leaf nitrogen and amino acid concentration of the leaf. Although Freeman's data indicated definite correlation with nitrogen, he was unable to define a single compound, or compounds which were the cause of increased disease. Isaac and Owen (1) have noted under field conditions that plots heavily infested the previous year showed no infection the following year in unfertilized plots.

Freeman (2) has noted that, under Florida conditions, St. Augustine gave 35.5% better coverage when the disease was controlled as compared to an uncontrolled check plot. Plots were established from "4-inch plugs on 12-inch centers," The increased coverage was obtained in a 10-week period. It is conceivable that gray leaf spot could delay establishment of new St. Augustine lawns under southern California conditions if establishment was taking place during a humid period and light, frequent irrigations were carried out during the daylight hours when humidity is normally lower. Tests of this nature have not been carried out under California conditions, to the best of the author's knowledge, because of the limited nature of the disease.

According to Freeman (3) there is a certain degree of resistance inherent in the yellow-green types of St. Augustine, but not in the blue-green types. Whether this resistance of yellow-green types is somehow related to nitrogen relationships in the plant is not mentioned.

Chemical control of this fungus is readily obtained with thiram at the rate of 4 oz. per 1000 square feet. Captan has also been mentioned as a suitable material for control under Florida's conditions.

The causal agent *(P. grisea)* of gray leaf spot is very similar, if not identical, to the fungus *P. oryzae* Briosi and Cavara (6). This organism has been reported as the causal agent of rice blast disease which is one of the more serious diseases of rice in the humid rice producing areas of the world. Sprague (6) notes that *P. grisea* is not readily distinguishable from *P. oryzae* and probably both should be known as *P. grisea.* Sprague also notes that this organism has been reported on creeping bentgrass *(Agrostis stolonifera* L.) and bermudagrass *(Cynodon dactylon* [L.] Pers.) besides a large number of other grasses. Isaac and Owens (1) have reported studies in which *P. grisea* taken from St. Augustine and crabgrass *(Digitaria sanguinalis* [L.] Scop.) did cause infections on both St. Augustine and crabgrass. However, they reported no infection from these isolates on bermudagrass, centipcdegrass, or Emerald zoysiagrass. The conflicting information on infection of such grasses as bermudagrass would indicate the variable nature of this organism and suggests that probably a number of races of the fungus exist in nature. This is certainly true for the blast organism on rice where a number of races have been identified (5). In rice, under tropical conditions, varietal resistance appears to be the most practical means of control (4) though much can be accomplished by controlling source of nitrogen, cultural practices, and rate of application of nitrogen.

In southern California it would appear that under our present environmental conditions where St. Augustine is grown, gray leaf spot is not a serious disease; and there is adequate leeway in cultural practices to give satisfactory control of the problem. Only under ideal condition for the fungus during the establishment of new lawns would there appear to be a possibility for the need of a fungicide to control damage. This has not been proven under our conditions, but appears a reasonable assumption from information derived in Florida. If in the future gray leaf spot becomes more serious, it might be necessary to look for more resistant varieties to be grown in southern California.

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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 homeocarba, Pvthium aphanidermatum, Hejminthosporium 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 micrörganisms 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 iroblem 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-

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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.

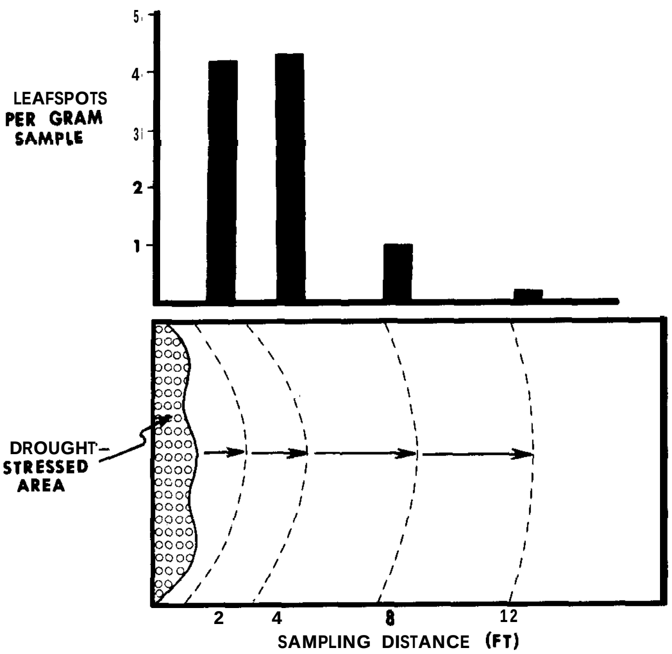

FIGURE 2
Incidence of Helminthosporium leaf spot with increased sampling distance from a drought stressed area of bluegrass.

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 sufficient food to nourish not only the *Helminthosfiorium* fungus, which is a poor competitor, but the numerous competing microorganisms *as well.*

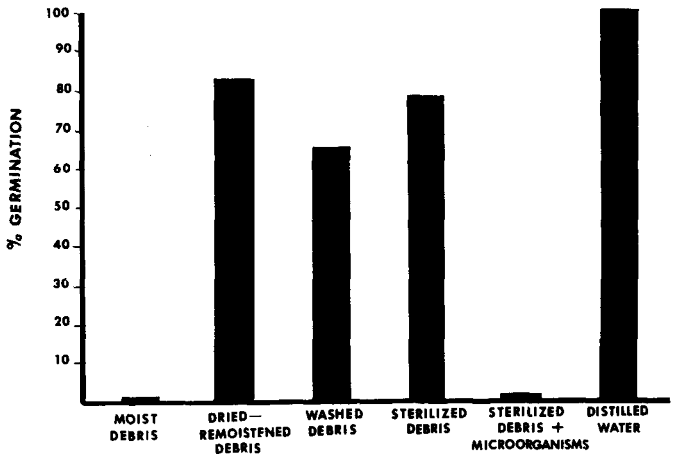

FIGURE 3
Germinability of Helminthosporium sativum conidia on Kentucky bluegrass crop debris.

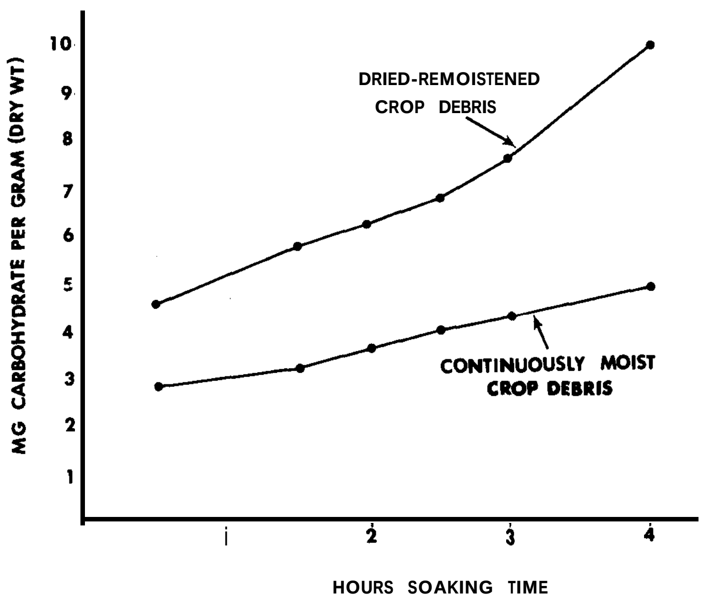

FIGURE 4
Carbohydrate release from dry and continually moist bluegrass crop debris.

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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TURF GRASS SEEDS BY THE POUND*

Kenneth Gowans**

Turfgrass seed mixtures are labeled in percentage of each kind of grass seed by weight. This can be very misleading if the number of each seed in a pound is not considered. Seed characteristics of some commonly used turfgrasses are listed in the accompanying table. There can be as much as a 40 fold difference in seed count between different seeds. This means that 5 percent of Colonial bent grass in a ryegrass-bentgrass mixture by weight has more bentgrass seeds than ryegrass seed.

To calculate the number of live seeds in a pound of seed the percent germination and purity is required. Each package of turfgrass seed is required by law to have this information.

TABLE 1. Common Turfgrass Seed Characteristics.

Common Name	Scientific Name	Approximate No. Seeds/lb.	Appmximsts No. of Days to Germ.
8entgmss			
Colonial	Agrostis tenuis	8,500,0GI	7-14
Creeping	Agrostis palustris (stolonifera)	8,000000	7-14
Bermudagrass	Cynodon dsctylon	1,800,000	14-21
Bluegrass			
Kentucky	Poaa pmtensis	2,200,000	10.20
Rough	Poa trivialis	2,500,000	1020
Fescue			
Creeping Red	Festuca rubra	615,000	7-14
Chewing	Festuca rubra (var. or subsp. commutata)	615,000	7-14
Meadow	Festuea elatior	230,000	6-10
Tall	Fastucs arundianacae	230,000	7-14
Ryegrass			
Annual (Italian)	Lolium multiflorum	230,000	110
Perennial	Lolium psrenne	230,000	5-10
Dichondra	Dichondm repens	800,000	7-14

The nnmber of live seeds in a pound is equal to the percent purity divided by 100 times the percent germination divided by 100 times the number of seeds per pound. Or to write this another way:

$$\# \text{ LS/lb.} = \frac{\%P}{100} \times \frac{\%G}{100} \times \# \text{S/lb.}$$

Where
\# LS = number of live seed
P = purity
G = germination
\# S = number of seed

Example 1

Seaside creeping bentgrass has a germination of 95%, a puritv of 99.5% and from the table we find that there are approximately 8,000,000 bentgrass seeds per pound.

No. live seeds/lb. =

$$\frac{95}{100} \times \frac{99.5}{100} \times 8{,}000{,}000 = 7{,}500{,}000$$

Now let us determine the number of seeds of each grass in a mixture.

Example 2

A mixture of 10% Creeping Red Fescue, 20% Kentucky bluegrass, 68% Perennial ryegrass and 2% crop, weedseed and inert material by weight can be converted to number of seeds and percent by count. The percentage of Creeping Red Fescue seeds remain the same for purity (% by wt.) and by count. There was a reversal in the percentage of Kentucky bluegrass and Perennial Ryegrass. The 20% Kentucky bluegrass seed by weight became 65% by seed count and the 68% Perennial ryegrass by weight became 25% by seed count.

Table 2. Conversion To Number Of Seeds And Percent By Count.

Turfgrass	Purity %bywt.		Germination		No. Seed/lb		No. Live Seed/lb.		% Live Seed/lb. by Count
Creeping Red Fescue	10%/100	x	90%/100	x	615,000	=	55,500 / 548,000	=	10%
Kentucky Bluegrass	20%/100	x	80%/100	x	2,200,000	=	355,000 / 548,000	=	65%
Perennial Ryegass	68%/100	x	85%/100	x	230,000	=	138,000 / 548,000	=	25%

Seed count is not the only factor to be considered when comparing grass seeds. The number of days to germinate the seed and the aggressiveness of the grass are also important. Ryegrasses germinate the quickest of all

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**Area Farm Advisor, Alameda, Contra Costa and Santa Clara counties.

grasses and are aggressive, that is, they tiller and fill in rapidly. This means that a seed mixture containing less than 50% of live ryegrass seeds by count can result in a turf containing nearly all ryegrass.

Purity

Purity is an important factor. It refers to the number of seeds of the particular grass. All grass seed may contain some inert material and weed and crop seed. The percentage of these materials are subtracted from the total to obtain the purity.

Germination

Germination or the percentage of seed that will germinate will vary between seed source. The purity and germination can be considerably lower in poor quality than in good quality seed. Therefore, when purchasing seed obesrve these characteristics of the seed and when comparing price calculate and compare the number of live seeds in each mixture.

Inert Material

This is the percentage of material by weight that will not grow. Poorly cleaned seed may contain a variety of material from the thrashing process. Again, quality seed should contain a very small percent of this material.

Crop

This is the percentage of seed by weight other than those specified that can be grown as a crop. For instance, tall fescue seed may be included as a crop seed in Kentucky bluegrass. If only a few tall fescue plants appear in a Kentucky bluegrass turf you have problems; therefore, it is important that quality turfgrass seed be free of crop.

Weeds

This is the percentage of weed seeds. Again weight of the seeds of different weeds vary considerably, therefore there is no indication of the number of seeds. Unfortunately, some of the problem weeds of turfgrass are not included on the noxious weed lists for most other crops. Again, quality seed should be nearly free of weed seeds.

A MOSAIC VIRUS DISEASE OF DICHONDRA

*L. G. Weathers**

A mosaic virus disease was recently seen in some dichondra plantings in Orange County. Symptoms consist of alternation of light and dark green areas on the leaves, but with only slight retardation of growth. The causal virus is readilv transmitted bv the cotton aphid, Aphis gossypii, that occasionally feeds on dichondra: The virus causing the disease has been identified as the cucumber mosaic virus. Because of the ease with which the aphid spreads the virus, it is likely that more instances of the disease will be seen in the future. But in light of the insignificant damage that the virus causes in dichondra, it should not become a serious problem for dichondra growers.

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