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OVERSEEDING BERMUDAGRASS FAIRWAYS

By JAMES R. BREECE, WILLIAM B. DAVIS, and VICTOR B. YOUNGNER*

More than 400 of California's 700 golf courses are located in areas where bermudagrass is the dominant turfgrass species. Even when original plantings on these fairways are of temperate species, bermudagrass will usually invade-given a little time. Unfortunately, temperates are not high enough to maintain an adequate growth of bermudagrass during the winter. The winter dormancy period of bermudagrass ranges from a few weeks to 3 or 4 months depending on location and the severity of winter temperatures.

Dormant bermudagrass fairways afford the golfer a playing surface but not a green, actively growing, quality turf. Golf is played year round in California and golfers prefer year round green turf. The aesthetic value of golf courses is also increasingly important since many courses also function as open space. The public expects grass to be green and developers have been quick to capitalize on pleasing aesthetics the open space of a golf course can bring to a new development.

Overseeding presents a budget problem to many turfgrass managers. While it may be standard practice to overseed tees, it only involves 1 to 2 acres. Equipment commonly used in the maintenance of greens can also be used on the tee to prepare it for overseeding. In considering an overseeding program for fairways, we are not confronted with 1 or 2 acres but must prepare and overseed approximately 100 acres on a standard 18-hole golf course. Since the mid '60's, renovating and aerating equipment suitable for preparing large turf areas for overseeding has been readily available. Fewer than 50 golf courses, however, have budgeted for a complete program of annual overseeding of their bermuda fairways.

Overseading has been thought of as an annual program because we were looking for winter color and our standard turfgrass species for this purpose has been annual ryegrass. If quick winter color is our primary concern, annual ryegrass is well adapted for this purpose. It has the advantages of fast germination even at cool temperatures, vigorous growth during winter months, rapid decline as temperatures become favorable to bermudagress growth, and seed cost is relatively inexpensive. However, ryegrass is a lighter green than most turfgrasses; it may be contaminated with *perennial* ryegrass which can cause poor transition into bermudagrass turf in the spring, and the existing bermudagrass turf must be prepared for annual overseeding.

In order to supplement our present information on overseeding, six duplicate trials were established in San Diego on five different golf courses. San Diego was chosen because most California climates where bermudagrass is commonly used could be duplicated within a 25-mile radius. Only four of the six trials were completed due to lack of winter irrigation at one site and inadequate site preparation on another. These two abandoned trials were observed throughout 1968 and 1967 and added to our understanding of the importance of site preparation and irrigation for a successful overseeding program.

The sites chosen for primary trials were located in the following major climatic zones:

1. Marine-La Jolla Country Club;
2. Coastal Interior-Lake San Marcos Country Club; and
3. Interior-Pauma Valley Country Club.

The range between maximum and minimum temperature for various seasons of the year is shown for each course, (see figures 1, 2, 3, 4). La Jolla has a temperate climate with summer maximums ranging from 75° to 80° F. and winter low's from 40° to 45° F. Turf surface temperature in the coolest La Jolla microclimate seldom falls below 30° F. on the coolest morning. At Lake San Marcos, the summer maximums are in the low 90's and it is not uncommon for winter temperatures to drop to a low of 30° F. Temperatures at the turf surface frequently range between 25° F. and 30° F. for several days during the winter months. The temperature range at Pauma Valley varies considerably between night and day and between summer and winter. Summer temperatures of 100° F. and above are typical from June through September, and temperatures in the low 20's are frequent in the winter. Several morning low's of 18° F. were recorded during our test period.

At each course, a large area of existing turf was aerated 1 week before heavy verticutting and/or renovating de pending on the equipment available at each course. At Lake San Marcos, one of the two trials was both aerated and renovated (W), while the other was aerated only (H). Five seeding treatments were laid out in 100 sq. ft. plots and repeated eight times to reduce the chance of variation due to soil type and irrigation. Grass seed was applied to each plot with a small hand seeder and worked into the surface with the back of a rake The entire area was fertilized with 1 pound of nitrogen per 1,000 sq. ft.

The grasses used in these trials were *Poa pratensis,* "Newport" Kentucky bluegrass, at the rate of 3 lbs./1,000 sq. ft.; Agrostis *tenuis,* "Highland" Colonial bentgrass, at 2 lbs./l,OOO sq. ft.; Festurca rubra, a mix of "Rainier" and "Illahee" creeping red fescue, at 8 lbs./l,000 sq. ft.; Lo*lium multiflorum,* annual ryegrass, at 13.3 lbs./l,000 sq. ft.; and a check plot was left unseeded. Seeding of the various areas was done on October 5,6, and 7, 1966. The trials were first evaluated in November 1966 and at 2-month intervals through March 1968. These trials have

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also been observed during the winter of 1968-69 and 1969-70 but no detailed ratings were made.

The visual evaluation of these trials took into account uniformity and density of the turf, color of the turf, and lay of the golf ball for fairway play. These trials were rated on a point scale of 1 to 5. A rating of 1 represents "undesirable" and 5 represents "excellent." In this report, the data have been summarized and statistically analyzed for each evaluation period so that significant differences between overseeding and no overseeding as well as individual treatment differences could be found. The first four figures show the check plots (not overseeded) as a constant zero. When the overseded grass species rated greater than zero, this meant the overseeded grass species had a higher rating than the existing check turf. To illustrate, the check may have had a rating of 3.5 and Kentucky bluegrass 4.5. This would show on the chart as 1.0 for bluegrass.

RESULTS

At the La Jolla Country Club (Fig. 1) the existing turf was a mixture of common bermudagrass, annual bluegrass, Kentucky bluegrass, and creeping red fescue. Due to the temperate climate this mixture seemed likely to prevail. but the predominant grass was common bermudagrass. Only at the third evaluation (March 1967) did overseeding prove to be of significant value. Annual ryegrass gave the best performance while creeping red fescue was only slightly better than the check. By June of 1967, the Kentucky bluegrass plots rated highest and were significantly better than all other grasses. Highland bentgrass failed to show any real improvement over the check at any time during the study.

This trial at La Jolla does indicate that the marine climate generally favors a mixture of temperate and sub tropical grasses and that renovating and increased fertilization in itself encourages good winter grass growth and color.

The trials at Lake San Marcos (Fig. 2-3) present an entirely different picture. The existing turf is a uniform stand of dense Tifway bermudagrass. At trial (H), all overseeded plots were significantly better than the check at the earlier evaluation during the winter of 1966-67, but the trend did not continue during the summer. During the winter of 1967-68, no significant differences were seen between the overseeded plots and the check plots. Minimum seedbed preparation apparently did not permit the overseeded grasses to establish.

Overseeding on the completely prepared trial (W) was outstanding in its response. At each evaluation during the 2-year period, except for the one in September 1967, overseeding was significantly better than no overseeding. Creeping red fescue, annual ryegrass, and Kentucky bluegrass were the superior grasses during the first year while creeping red fescue and Kentucky bluegrass predominated during the second year. In January 1970, this trial still showed a high persistance of creeping red fescue and Kentucky bluegrass.

The turf at Pauma Valley was a solid stand of common bermudagrass. Annual ryegrass was superior during the fall and winter of 196667 but declined rapidly in the late spring when Kentucky bluegrass gave the best results. Overseeding annual ryegrass, Kentucky bluegrass, and creeping red fescue were superior to no overseeding until June 1967. During the second winter, early temperatures were milder so the benefits of overseeding did not show up until late winter. At that time Kentucky bluegrass was superior to annual ryegrass, and creeping red fescue was no better than the check area.

Typically, most overseeding trials are evaluated primarily for their appearance during the period of greatest dormancy. This dormancy usually occurs between January and February. Data taken during these months is summarized in four bar graphs for each overseeding turfgrass species compared to the check or no overseeding. (See Fig. 5, 6, 7, and 8). Of particular importance is the rating of the checks in January 1967 as compared to the checks in 1968. The thorough renovating in October 1967 left the turf thin and the overseeded grasses rated much higher than the check. With no renovating in October 1968, the checks rated much higher. The difference between overseeding and no overseeding was not as great. During the second year, temperatures were warmer in the fall and did not remain as cool during the peak dormancy period.

This study in San Diego County did reveal several important points to be considered before beginning a program of overseeding fairways.

(1) The existing turf must be thoroughly aerated and renovated before overseeding. Seeds must be in contact with soil and aerating alone will not do the job. A partial thinning out of dense bermudagrass thatch is of limited value. This was borne out at one site which was abandoned because the seeds did not germinate sufficiently even though the site was aerated and adequately irrigated.

(2) Winter maintenance of the turf cannot be reduced or negelected, particularly irrigation. At one of our best prepared sites, irrigation was discontinued after the first 2 weeks. Annual ryegrass was the only species to germinate and by January plot differences were not discernable. Even in well prepared plots, most of the seed is lying on the surface of the soil or only partly covered with soil and shredded thatch. Light but frequent irrigation is important if reasonable stands are to be expected.

(3) Kentucky bluegrass and creeping red fescue can be expected to give 2 to 3 years of satisfactory color and improved turf quality in dense stands of bermudagrass if properly established and maintained.

(4) Year round high quality green turf, where the predominant species is bermudagrass, is possible only with a substantial increase in the budget for materials equipment, water, and labor, particularly during the fall and winter months.

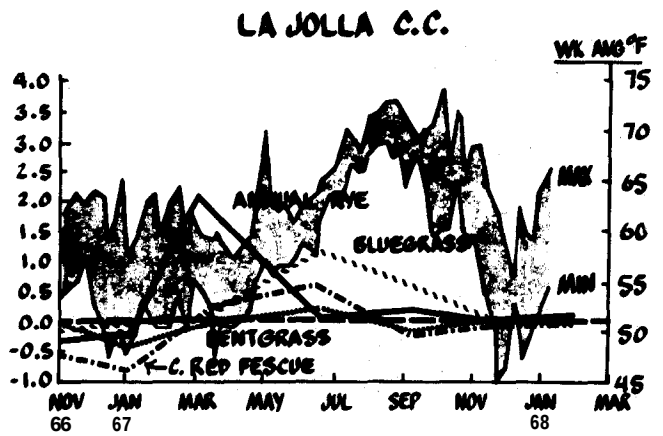

Figure 1

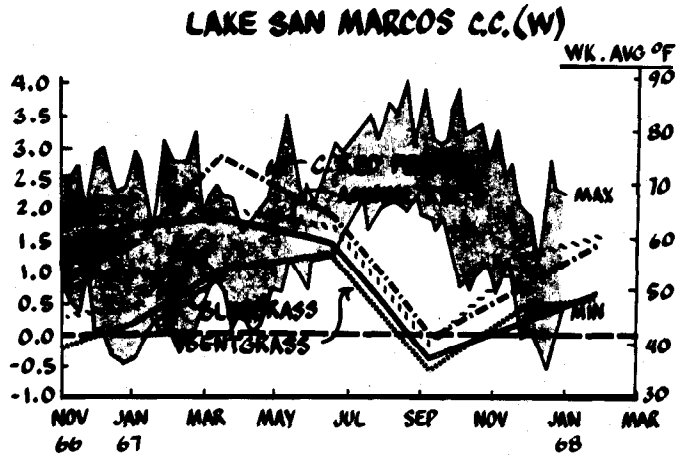

Figure 2

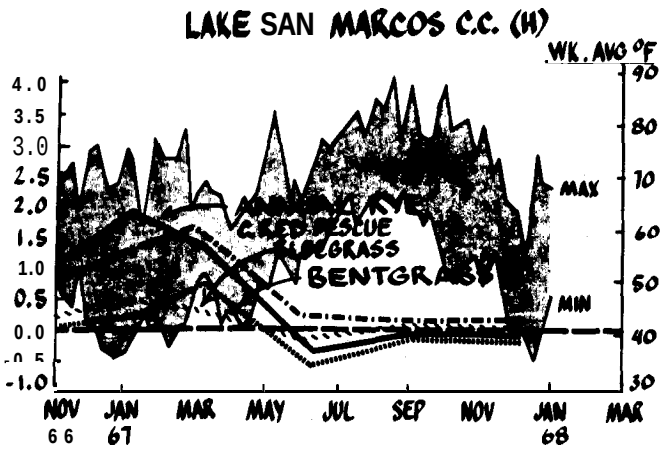

Figure 3

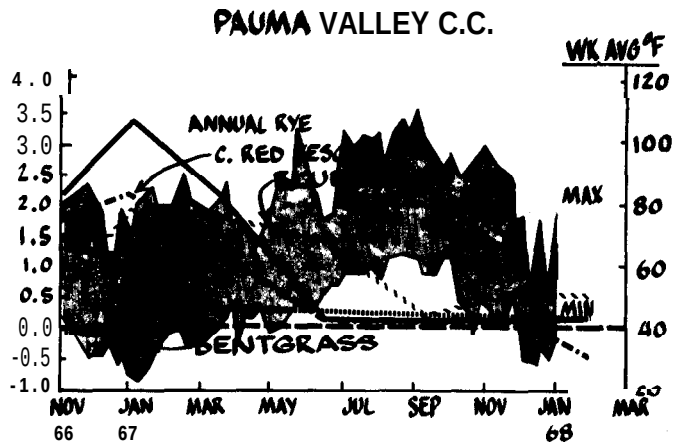

Figure 4

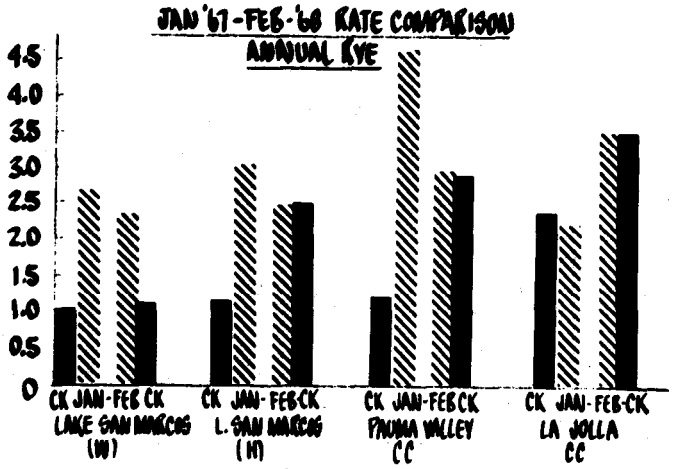

Figure 5

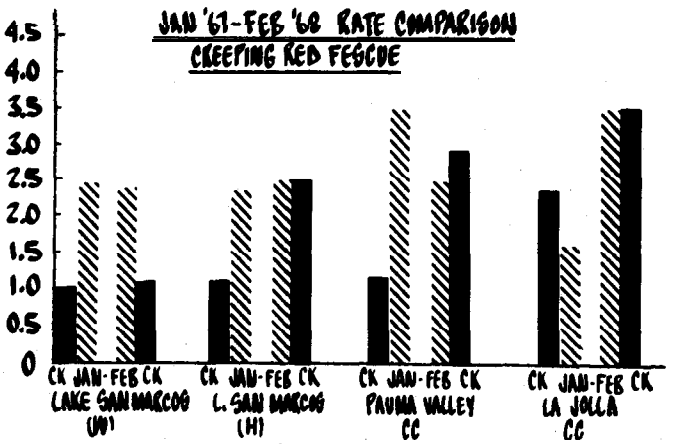

Figure 6

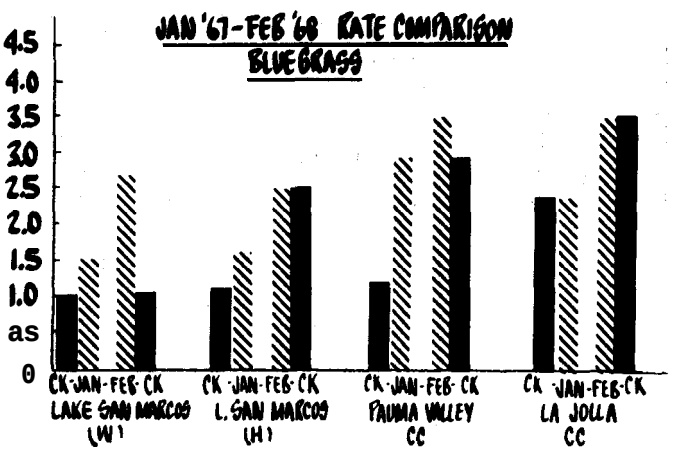

Figure 7

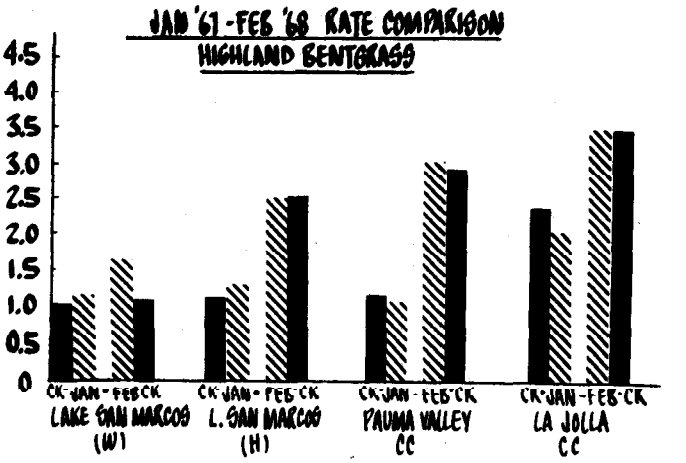

Figure 8

TURFGRASS DISEASE CONTROL

ARTHUR H. McCaAIN Extension Plant Pathologist, and R. M. ENDO,
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DISEASE	SYMPTOMS	SUSCEPTIBLE GRASSES	CONDITIONS FAVORING DISEASE	CULTURAL CONTROL	FUNGICIDAL CONTROL[1]
BROWN PATCH *Rhizoctonia solani* is a soil-inhabiting fungus, active as fine fungus threads that survive in the soil, or in and on the turf. Hard masses of fungus threads (sclerotia) are very resistant to fungicides.	Small irregular brown areas which may enlarge to many feet in diameter. Centers of spots may recover resulting in rings of diseased grass. Leaves and leaf sheaths turn olive green, wilt, become light brown, and die. Stems, crown! and roots also may be Infected. In light attacks, roots usually **are not** involved and plants recover.	Bentgrasses Bluegrasses Bennudas Ryegrasses **Fescues Zoysia**	Excess thatch and mat, high temperatures (75 to 95 F), high humidity, and soft, lush growth due to excess nitrogen favor brown patch. A cold-weather (40" to 60° Fl form of the disease occurs infrequently. Disease is more common in warm inland areas.	Reduce shading and improve soil aeration and water drainage. Water when needed to a depth of 4 to 6 inches if possible. Avoid nitrogen fertilization that results in soft growth of foliage.	**benomyl[2] daconil** mercurials PCNB thiram
DOLLAR SPOT Sclerotinia *homeocarpa* fungus survives in the soil by means of sclerotia. Disease is common near or on the coast, essentially on bentgrass.	Small circular areas of turf about 2 inches in diameter. Spots may merge to form large irregular areas. Leaves are water-soaked at rst, later brown and finally straw colored. Fine, white cobwebby fungus threads may be seen in early morning.	Bentgrasses Bluegrasses Bermudas **Ryegrasses Fescues**	Moderate temperatures (60 to 80° F) and excess moisture, excess mat, and thatch favor dollar spot. Turf deficient in nitrogen tends to develop more dollar spot than turf adequately fertilized with nitrogen.	Keep thatch at a minimum. Water only when needed to a depth of 8 to 12 inches. Apply adequate nitrogen.	anilazine benomyl cadmium cyclohexi-mide mercurials
FUSARIUM PATCH *Fusarium nivale* probably overseasons as a network of fungus threads in grass residues. Disease is observed only in central and northern California.	Roughly circular patches of 1 to 2 inches may enlarge to 12 inches. Leaves first become water-soaked, turn reddish brown, then bleached. Minute, white or pinkish, gelatinous spore masses occasionally are seen on dead leaves. Fungus threads, also white or pinkish, my be seen in early morning.	Bluegrasses **Ryegrasses Fescues** Zoysia Common on *Poa annua* and creeping bentgrass varieties.	Cool (40° to 60 F), moist condition?, such as prolonged rainy periods in winter, favor the disease. Usually appears first on shaded plants.	Reduce shade; improve soil aeration and water drainage. Avoid excess nitrogen fertilization especially in the fall of the year.	benomyl mercurials
MELTING OUT *Helminthosporium vagans* probably survives in infested bluegrass plants or debris as fungus threads and as spores. It may be seedborne.	Circular to elongate purplish or brown spots with straw-colored centers occur on leaf blades, leaf sheaths, and stems. Leaf spots are general, indicating spread by windborne spores. Crown and roots frequently are attacked. Crown infected plants are weakened and may die in hot, windy weather, resulting in a thinning out of the turf in scattered areas.	Kentucky bluegrass. Improved selections, Merion and Newport, are resistant Common Kentucky bluegrass is very susceptible.	Cool (50° to 70° F), moist conditions favor the disease. First appears on shaded plants. Most **severe** on closely clipped **turf.**	Reduce shade, improve soil aeration and water drainage. Do not mow grass **lower than** 1% **inches.**	anilazine captan cyclohexi-mide daconil folpet mercurials
H. sorokinianum *(=H. sativum)* probably survives in infected grass plants or grass debris as mycelium and spores. May be seed-borne.	Same as for *Helminthosporium vagans,* except leaf spots usually show bmwn rather than straw-colored centers, and borders of spots are purplish to dark brown.	Bentgrasses **Bluegrasse Fescues** Ryegrasses Bermudas	Warm temperatures (70" to 90 IF and high humidity favor the disease. First appears on plants growing in shaded areas. Most damaging on closely clipped turf.		
LEAF BLOTCH H. cynodontis probably survives in infected bermudagrass plants and debris as mycelium, and as spores. May be seed-borne.	Tiny, purplish to reddish spots occur on leaf blades and leaf sheaths. Seedlings are very susceptible but plants rapidly become resistant. Affected seedlings wither, die, and turn brown. Roots and crown may develop small lesions.	Bermudagrasses	Leaf blotch damages young seedlings or adult plants weakened by excess thatch, deficient nitrogen, and unfavorable growing conditions.	Remove thatch at regular intervals. **Apply adequate nitrogen.**	As above

[1] USE AT RATES AND FREQUENCIES RECOMMENDED BY MANUFACTURER.
[2] NOT REGISTERED AS OF 5-19-70.

DISEASE	SYMPTOMS	SUSCEPTIBLE GRASSES	CONDITIONS FAVORING DISEASE	CULTURAL CONTROL	FUNGICIDA CONTROL[1]
RED THREAD *Corticium fuciforme* overseasons as pinkish or red gelatinous crusts of fungus. threads. Disease occurs commonly along coast of northern and central California. It is rare in southern California.	Turf is affected in patches 2 to 15 inches in diameter. Pink web of fungal threads bind leaves together. Pink gelatinous, gungal crusts,. 1/4 to 3/4 inch long, projecting from leaves, are diagnostic.	Bentgrasses **Bluegrasse** **Fescues** Ryegrasses	Red thread usually appears on plants deficient in nitrogen, and during periods of prolonged cool, wet weather.	Apply adequate nitrogen and reduce shading.	cadmium mercurials
GREASE SPOT Species of **Pythium,** especially **P. aphanidermatum,** have thick-walled sexual spores that enable the fungi to survive in the soil for long **periods.**	Turf is killed in small roughly circular spots (2-6 inches) which tend to run together. Blackened leaf blades wither rapidly and turn reddish brown. Leaf blades tend to lie flat, stick together and appear greasy. Roots may be **brown.**	All grasses	Grease spot usually appears in low spots that remain wet. **Disease** depends upon excessive moisture. **P. aphanidermatum** can be very destructive at high temperatures **(80-95°** f).	Reduce shading! improve **soil aeration** and water drainage. Water when needed **to a depth** of 8 to 12 **inches.**	dexon koban
SEED ROT AND DAMPING OFF **Disease is caused by several species of Pythium, Rhizoctonia solani, Fusarium culmorum, and Helminthosporium sorokinianum.**	Seed rot, pre- and postemergence damping off may occur. Seed rot is not mushy **but rather dry. Hypocotyl area is particularly susceptible. At first, seedlings are water-soaked, then they blacken,** shrivel, and turn brown. Frequently, affected seedlings are not killed but are yellow and stunted with markedly reduced root systems.	All grasses	Seed rot and damping off are favored by excessive moisture sowing seeds of low viability and above the recommended rates, especially during periods unfavorable for seed germination and growth.	Improve soil aeration and water drainage. Do not overwater. Sow only fresh, healthy seed at recommended rates and seasons.	Treat seed with thiram chloranil, captan, or organic mercury. spray seedlings with captan or thiram. Fumigate soil before planting **with methyl bromide.**
RUST *Puccinia striiformis* and *P. graminis* overseasons in infected grasses and as spores which are airborne.	Elongate, reddish pustules containing spores appear on stems, leaves, and leaf sheaths. Reddish spores adhere **to fingers** when pustules **are rubbed.**	Bluegrass Ryegrass	Moderately warm, moist weather favors rust development. Moisture in the form of dew for 10 to 12 hours is sufficient for spores to infect plants.	Keep plants growing rapidly by fertilization and irrigation.	**oxycarboxin**
FAIRY RING Several species of mushrooms cause fairy rings. In northern and central California the predominant fungus is **Marasmius oreades;** in southern California, species of **Lepiota.**	A dark green band of turf develops in a circle or semicircle. Mushrooms may or may not be present., Frequently, just behind the dark green **band** is an area of sparse, **brown,** dying grass, caused by lack of water penetration. Need invasion common.	All grasses	**Fairy ring develops most frequently in soil high in undecomposed** organic matter.	Apply adequate nitrogen. Aerate soil for better water penetration and apply heavily in holes for 3-5 days.	Complete soil sterilization. Applications of organic mercurials may suppress mushroom production.
LOOSE SMUT **Ustilago cynodontis. Fungus** is perennial **in the** plant. Flowers **are replaced** by **masses** of dark **spores.** Spores **infect** germinating **seeds and young stolons.**	Flower heads are replaced by masses of dark spores.	Bermudas	Warm weather and conditions that promote flowering.	Keep grass growing vigorously and remove flower heads by mowing before spores are produced	Mercurial seed treatment. Try benomy

[1]**USE AT RATES AND FREQUENCIES RECOMMENDED BY MANUFACTURER.**
[2]**NOT REGISTERED FOR USE** AS OF **5-19-70.**

DISEASE	SYMPTOMS	SUSCEPTIBLE GRASSES	CONDITIONS FAVORING DISEASE	CULTURAL CONTROL	FUNGICIDAL CONTROL'
STRIPE SMUT **Ustilago striiformis.** Fungus spores from fruiting bodies in the leaves can contaminate seed and infect seedlings. Young tillers are also infected. Fungus is perennial in the plant.	Infected plants are often pale green and stunted. Long black stripes of spore pustules occurs in leaves. Infected leaves curl and later die and become shredded.	Bluegrasses Bentgrasses Common on some bluegrass varieties.	Favored by moderate temperatures and is prevalent in the spring and fall. Infected plants may die in hot, dry weather.	Plant resistant varieties.	Mercurial seed treatment. benomyl

'USE AT RATES AND FREQUENCES RECOMMENDED BY MANUFACTURER.

WARNING: Pesticides are poisonous and always should be used with caution. Follow all precautions and safety rules on the label.
CAUTION: Chloropicrin and methyl bromide are very hazardous materials. Anyone using them or planning to use them should become familiar with and strictly follow the warnings on the package label or any accompanying material furnished by t he manufacturer.
PHYTOTOXICITY: Certain chemicals may cause plant injury if used at the wrong stage of plant development or when temperatures are too high. Injury also may result from excessive amounts of the wrong formulation o from mixing incompatible materials. Inert ingredients, such as wetters, spreaders, emulsifiers, dilutents, and solvents often can cause plant injury. Since formulations often are changed by manufacturers, it is possible that plant injury may occur, even though no injury was noted in previous seasons.

TO SIMPLIFY INFORMATION, TRADE NAMES OF PRODUCTS HAVE BEEN USED. NO ENDORSEMENT OF NAMED PRODUCTS IS INTENDED, NOR IS CRITICISM IMPLIED OF SIMILAR PRODUCTS WHICH ARE NOT MENTIONED.

TURF FUNGICIDES *(Active ingredients and corresponding trade names)*

MERCURIALS

Organic

hvdroxvmercury chloroohenol: Semesan Turf Fungicide
mercuric dimethyldithiocarbamate: Kromoclor, Ultra-clor (see combinations)
methylmercury cyanide: Chipco Turf Fungicide
methylmercury dicyandiamide: Panogen Turf Fungicide
methylmercury oxinate: Metasol M Turf Spray
N-methylmercuri- 1,2,3,6-tetrahydro-3,6-endomethano-3,4,5,6,7 7-hexachlorophthalimide Memmi 8EC
phenylmercury ethylenediamine: Linck's Lawn Fungicide
phenylmercury monethanol ammonium lactate: Puraturf 10
phenylmercury triethanol ammonium lactate: Puraspra
PMA (phenylmercury acetate) : PMAS Fungicide, Scutl, Tag-C-Lect, Phenmad, Liquiphene

Inorganic

mercurous chloride (calomel) + mercuric chloride (corrosive sublimate) : Bi Cal, Calo-clor, Calocure, Calogran, Calogreen, Dap-Cal, Fungchex, Velsicol 2-1 Fungicide, Wood-Ridge Mixture 21

CADMIUM

cadmium carbonate: Ortho Lawn & Turf Fungicide, Ortho Lawn Fungicide (see combinations)
cadmium chloride: Caddy, Cad-trate, Patterson's Liquid Turf Fungicide, Vi-cad, C-A-D
cadmium calcium copper zinc sulfate chromate complex: Mico Turf Fungicide C, C-531
cadmium dimethyldithiocarbamate: Chipco Spectrum Turf Fungicide (see combinations)
cadmium-8-hydroxyquinolinate: Cadox
cadmium sebecate: Kromad (see combinations)
cadmium succinate: Cadminate
phenylamino cadmium dilactate: Purtaturf 177

ORGANIC

anilazine = 2,4-clichloro-6- (o-chloroanilino) -s-triazine: Dyrene Turf Fungicide, Turf Fungicide, Turf-To?; D-50
benomyl = methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate
captan = N-trichloromethylmercapto + cyclohexene-1,2-dicarboximide: Orthocide, Captan
cycloheximide: Acti-dione RZ, Acti-dione-Thiram, Acti-dione Ferrated
daconil = tetrachloroisophthalonitrile: Daconil 2787
dexon = p-dimethylaminobenzenediazo sodium sulfonate: Dexon
folpet = N-(trichloromethylthio) phthalimide: Phaltan, Ortho-Lawn & Turf Fungicide (see combinations)
koban = 5-ethoxy-3-trichloromethyl-1,2,4-thiadiazole: Koban, Terrazole
mancozeb = coordination product of zinc ion and manganous ethylenebisdithiocarbamate: Fore, Dithan M-45, Manzate 200
maneb = manganese ethylene bisdithiocarbamate: Dithane M-22, Manzate
oxycarboxin = 2,3-dihydro-5-carboxanilido-6-methyl-l,4-oxathiin-4, 4-dioxide: Plantvax
PCNB = pentachloronitrobenzene: Fungiclor, Terraclor, Best Turf Fungicide
polyethylenethiuramsulfide: Ethisul
thiram = tetramethylthiuramdisulfide: Tersan, Panoram, D & P Turf-tox, Thirmamad, Thiuram 75
zineb = zinc ethylenebisdithiocarbamate: Parzate, Dithane Z-78, Zineb

COMBINATIONS

Acti-dione RZ = cycloheximide + PCNB
Acti-dione-Thiram = cycloheximide + thiram
Auragreen = malachite green + auramine + crystal violet
Bandini Turf Fungicide = PCNB + PMA
Cad-trete = thiram + cadmium chloride
Chipco Fore No. 3 = folpet + thiram
Chipco Spectrum Turf Fungicide = phenylmercury dithiocarbamate + cadmium dimethyldithiocarbamate
Fung-0-Cide = cadmium chloride + methylmercury dicyandiamide + fertilizer
Kroma-clor = mercuric dimethyldithiocarbamate + potassium chromate + cadmium succinate + malachite green + auramine + fertilizer
Kromad = thiram + cadmium sebecate + potassium chromate + malachite green
Mercuram = thiram + phenylmercury dimethyldithiocarbamate + malachite green
Mico Turf Fungicide = thiram + cadmium calcium copper zinc sulfate
Ortho Lawn Disease Control = captan + PCNB
Ortho Lawn Fungicide = captan + cadmium carbonate + PCNB
Ortho Lawn & Turf Fungicide = folpet, cadmium carbonate, thiram
Pro Turf Fertilizer plus Fungicide = phenylmercury acetate + thiram + fertilizer
Pro Turf Fertilizer plus Funcicide II = PCNB + fertilizer
Scutl = thiram + phenylmercury acetate
Tersan OM = thrram + hydroxymercury chlorophenol
Thimer = thiram + phenylmercury acetate
Thiuram M = thiram + mercurous chloride + mercuric chloride
Turf-Tox MC = thiram + mercuric chloride + mercurous chloride
Ultraclor = mercuric dimethyldithiocarbamate + potassium chromate + cadmium succinate + fertilizer

SOIL FUMIGANTS

D M T T = 3,5-dimethyl-tetrahydro-1,3,5-2H thiadiazine-2-thione: Mica-fume, Mylone, Soil Fumigant M methyl bromide: Bed Fume, Bromex, Brom-o-gas, Dowfume MC-2, Iscobrome MBC Fumigant, Pano-Brome, Pestmaster Soil Fumigant, Tri: brome, Weedfume
MIT = methylisothiocyanate: Vorlex (Vorlex is 20% MIT, 80% clorinated hydrocarbon)
SMDC = sodium N-methyldithiocarbamate: Vapam, VPM

BAHIAGRASSESFORLAWNS"

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Common bahiagrass, *Paspalum notatum* Flugge, was introduced from Brazil in 1914 by the United States Department of Agriculture where it readily became adapted to Florida and lower Coastal Plain conditions. A major warm season grass, it was found to be aggressive and well suited for pasture use on poor sandy soils and where good fertilization programs were not practiced. Since 1914, many other varieties of bahiagrass have become available, some of which were introduced from other countries. Other varieties originated as a result of breeding work and a few as selections from naturalized stands. Originally these grasses were selected for pasture where they are still widely used. Bahiagrasses make excellent pasture grasses because of their value as forage, ability to persist on poor sandy soils under low water and fertility conditions, and resistance to nematode, insect and disease problems. With the exception of forage value the preceding characteristics are also desirable for lawn grasses and, as a result, certain varieties of bahiagrass have become increasingly popular within the last 10 years.

Bahiagrasses have become increasingly important to the turf picture in Florida for several reasons. Most important, bahiagrasses can be propagated from seed that is relatively inexpensive. Once established by seed these grasses develop a deep dense root system and spread slowly by means of short, stout, woody rhizomes. These rhizomes and naturally tough leaves enable behiagrasses to withstand heavy foot traffic and recover from its detrimental effects more quickly than either centipede or St. Augustine grasses, making them ideal for lawns. In addition, estab lished bahiagrass sod has fewer pest problems than any of the other grasses available for turf use in Florida.

Principle disadvantages of bahiagrasses for turf use are their relative open growth habit and the tall unsightly seedheads that are produced continuously from May through November. Bahiagrasses are difficult to mow because of their heavy tough leaf and stem growth which requires weekly mowing with a rotary mower.

Several types of bahiagrasses are available for use. Before one is selected for a turf area read carefully the characteristics of each.

VARIETIES

Four varieties of bahiagrass seed or sod are on the Florida market in quantity for home lawns. These are Common, "Pensacola," "Argentine" and "Paraguayan" bahia. Two other bahias. "Wilmington" and "Paraguayan 22" may also be used for lawns, however, commercial seed production of the former and sod production of both is very limited. Characteristics of all bahiagrasses are somewhat similar, yet considerably different when examined closely. For example, the varieties Common and Argentine have broader leaves than Pensacola and Paraguayan. Following is a brief description of each of the previously mentioned varieties in descending order of their value for lawn use.

ARGENTINE — This variety, best for lawn use, was selected as one of two distinct types of bahia in 1945 by the Florida Agricultural Experiment Station, Gainesville, from seed brought in earlier by Lorenzo R. Parodi from Argentina (P. I. no. 138996). Argentine is a semi-erect broadleafed bahia with leaves wider than those of Pensacola but longer, narrower, more numerous and more hairy (pubescent) than those of Common. Although its leaves are pubescent during most of the season there are times when they appear to be glabrous (no hairs). Pubescence of leaves appears to be associated with age, environment and management practices.

Seedhead production (numbers and height) is greater than other varieties, with the exception of Pensacola, and their detrimental appearance more noticeable. Its color, however, is rated superior to all other varieties except Wilmington and can be maintained, with the proper cultural practices for a long period of time in the fall. Generally, its ability to retain color after a frost (frost resistance) and its ability to survive during the winter months throughout Florida (cold hardiness) is also better than all other varieties except Wilmington:

Argentine bahia is the least susceptible of all bahias to dollarspot, *Sclerotinia homoeocarpa,* which is the most damaging disease that attacks bahiagrasses . In addition, yellowing is less of a problem with Argentine than other varieties when soil pH exceeds 6.5. Argentine bahia also tolerates severe vertical mowing better than any other bahia. The overall appearance of Argentine bahiagrass is actually improved when recovery is completed following severe vertical mowing in late February. This practice is not recommended for other bahiagrasses.

WILMINGTON — Second only to Argentine in de sirability for home lawn use. Original plants were collected in 1940 from a naturalized stand near Wilmington, North Carolina by Paul Tabor. Wilmington is a semi-erect bahiagrass that produces a dense sod with leaves that are finer textured than other varieties discussed. This bahia produces less topgrowth and fewer seedheads, that are lower in height, than other varieties. Limited seedhead production is very desirable for maintenance purposes but also results in reduced seed availability and higher costs per pound.

Wilmington's color and cold tolerance are rated best among the bahiagrasses. This variety was the only one tested at Chapel Hill, North Carolina between 1941 and 1953 that was not injured by cold. Dollarspot fungus is a problem on Wilmington since its resistance to this disease is lower than that of other varieties.

PENSACOLA — A long narrow-leafed bahia used extensively in Florida for soil stabilization and beautification of highway rights-of-way. Seed of this variety are thought to have arrived by boat from Central or South America since original plants were found growing along docks and railroad tracks in Pensacola, Florida. Pensacola bahia was first observed and collected by Ed Finlayson, the county agent, in 1935 and performed quite well in later comparative tests at the Florida Agricultural Experi-

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ment Station, Gainesville, Florida, where it was approved as superior forage grass in 1944. Sprigs collected from a vacant lot on Government Street, Pensacola, Florida, were taken to the Soil Conservation Service Nursery Americus, Georgia, in May 1940 by Paul Tabor and evaluated. Seed were later distributed by the same nursery in 1942 with the first large scale distribution in 1944.

Pensacola is similar to Common bahiagrass except it is more cold hardy, has narrower blades, smaller seeds and is more 'responsive to fertilization. Seed germination is excellent and cold tolerance and winter color generally better than other varieties except Wilmington. Year round color of Pensacola is poorer than other varieties with the exception of Common.

Top growth production of Pensacola is midway between that of Argentine, which has the highest and Wilmington the' lowest of the varieties discussed, however seedhead production (numbers and height) is more than other varieties. Pensacola is the most sensitive of the bahiagrass varieties to yellowing.

PARAGUAYAN — Also known as Texas bahia. The origin of this variety is obscure and may possibly be the result of early introductions that became established along the Gulf of Mexico. Leaves are shorter than those of Pensacola and narrower (finer textured) than all other varieties except Wilmington. Production of top growth, and seedheads (number and height) are similar to Common but less than other varieties except Wilmington. These characteristics are desirable from a maintenance staindpoint and when combined with a fine texture make Paraguayan more acceptable for lawn purposes than Common. The leaves of Paraguayan are very pubescent. This characteristic may be considered undesirable by some because the hairiness can impart a grayish appearance to the lawn and also cause it to remain wet for a longer period of time than other varieties following rain, irrigation or dew. Paraguayan has a very low cold tolerance and is very susceptible to dollarspot fungus.

PARAGUAYAN 22 — Sometimes confused with Paraguayan or Texas bahia because of its name and other times thought of as a selection of the same grass because of its number. Seed of Paraguayan 22 were originally collected by J. L. Stephens from the Barrerito Ranch in Southern Paraguay and received by the U.S. Plant Introduction Office on April 4, 1947, under plant introduction number 158822. After being increased at the Coastal Plain Experiment Station, Tifton, Georgia, one plant was selected from the source nursery, increased, and later released as Paraguayan 22.

Paraguayan 22 has a long broad leaf as compared to Paraguayan. It is less pubescent, produces more top growth and greater numbers of seedheads that are taller than those of Paraguayan. Its topgrowth production is similar to Argentine and therefore greater than other varieties, Seedheads of Paraguayan 22 average 20-30 inches in height in contrast to 12-15 inches for Paraguayan.

Paraguayan 22 does not produce as dense a turf as Paraguayan because of its more open and upright growth. This grass has excellent color and is similar in plant size and texture to Argentine, except it is more upright and has shorter stolons.

COMMON — A short broad-leafed bahia introduced from Brazil in 1914. The poorest of the bahias for lawn use because of its color coarse texture and prostrate, open type growth which produces low density. Generally not suited for Florida use because of its very low cold hardiness.

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