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Managing Saline, Sodic or Saline-Sodic Soils for Turfgrasses[1]

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The quality of a turfgrass stand is the net result of the interactions of climatic conditions, ravages of pests, and the existing status of the soil, given the inherent genetic characteristics of the turfgrass species being grown.

Ordinarily, in addition to soil-related factors such as too low or too high moisture content, low fertility, and poor physical conditions, excess soil salinity may also inhibit normal turfgrass growth and development. Actually, in most arid and semi-arid regions where precipitation is insufficient to leach the salt from the root zone, accumulation of excessive amounts of soluble salts in the root zone is a major limiting factor in production and/or management of quality turf. Salinity stress on turfgrasses is also a serious problem near seacoasts because of tidal action and/or the presence of shallow and highly saline water tables.

Wherever salinization of soils occurs, it is a continuous process resulting from various combinations of insufficient precipitation, inadequate irrigation, poor drainage, irrigation with poor quality water, and/or the upward movement of salts from saline underground water. As a general rule, if the amount of water applied to the soil (irrigation plus natural precipitation) exceeds evapotranspiration, salt movement is downward. Conversely, salt movement is upward if evapotranspiration exceeds the amount of water applied. In the latter case, salt drawn to the soil surface gradually accumulates to levels toxic to turfgrasses. An additional, though minor, salinity problem in turfgrass culture rises from the application of large quantities of salt, primarily sodium chloride, to highways to aid in snow and ice removal. In areas with severe winters where highway de-icing is routine, brine flow from the road is pronounced near the paved surface, resulting in direct injury to turfgrass grown alongside the road.

Salt-affected soils may contain excess soluble salts, excess exchangeable sodium, or both. Such soils are generally divided into three groups:

1. Saline soils — The saturation extract of these soils has an electrical conductivity (EC) greater than4 decisiemens per meter (dS.m-I) (equivalent to millimohs per centimeter [m $mhos.cm^{-1}$]) and exchangeable sodium percentage (ESP) below 15. Soil pH is ordinarily below 8.5. Saline soils are often referred to as "white alkali," and are easily recognized by the white salt crust which forms at the surface as the soil dries. Given adequate water and drainage, these soils can be desalinized by leaching.
2. Sodic (alkali) soils — This category applies to soils in which the EC of the saturation extract is less than 4 $dS.m^{-1}$ and the ESP exceeds 15. The soil pH is generally above 8.5. These soils, often referred to as "black alkali," are recognized by the absence of the white surface crust when the soil dries. High levels of sodium in these soils, combined with relatively low levels of calcium and magnesium, cause dispersion of clay particles. The result is a structureless soil with low water and air permeability.
3. Saline-sodic (alkali) soils — The saturation extract of these soils has an EC greater than 4 $dS.m^{-1}$, and ESP greater than 15. Soil pH is seldom above 8.5. If existing soluble salts are leached downward while exchangeable sodium in the soil profile remains constant, soil properties are likely to closely resemble those of sodic (alkali) soils. As long as soluble salts are present, tiowever, these soils are more similar to saline soils in both appearance and physical properties.

Levels of salinity/sodium in a given soil can vary greatly over relatively short distances. Spotty stands of grass and bare spots are common in soils with salinity and/or sodium problems. Where various spots are covered with a white crust upon drying of the soil, salinity is usually responsible. In areas where bare spots occur without visible evidence, a sodic (alkali) environment is more likely at fault.

Depending on the salinity tolerance of the turfgrass grown, full stands of grass can sometimes be established at low or moderate soil salinity levels. Turfgrass growth in highly saline soils, however, is restricted. Specific symptoms of salinity stress in turfgrasses are likely to vary somewhat since existing salt can result in osmotic stress (physiological drought), nutritional imbalances, toxicity, or a

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combination of them. In general, however, the following symptoms are associated with turfgrass grown under saline conditions:

"Turf is likely to appear blue-green or light, bright-green in the early stages of salt stress, a coloration which is followed by irregular shoot growth. If specific ion (e.g., boron) toxicity occurs, necrotic spots may develop on leaves. As salinity stress increases, shoots appear increasingly wilted and become progressively darker green. Higher salinity levels cause burning of leaf tip with the burn eventually extending downward toward the entire leaf surface. At this level, shoot growth is greatly reduced and turfgrass is stunted. Also, as salinity stress increases, leaves generally become finer textured and root growth is stunted. The stunted shoot growth associated with turfgrass grown under salt stress also commonly results in a shallow root system. If corrective steps are not taken, grass growth will be minimal, shoot density will decrease, and the turf stand will thin as individual plants die."

Although a salinity problem can often be identified by visual symptoms alone, the magnitude of the problem and identifying potential solutions are possible only after chemical analysis of representative soil samples.

The extent of salt uptake and its consequent effects on turf growth is directly related to the salt concentration of the soil solution. Growth of most turfgrasses is not significantly affected by salt levels below 2 $dS.m^{-1}$. In soils with salt levels of 2 to 8 $dS.m^{-1}$, the growth of some turfgrasses is restricted; at 8 to 16 $dS.m^{-1}$, the growth of most turfgrasses is restricted; and above 16 only very salt-tolerant turfgrasses can persist. Obviously, this categorization provides only the most general guidelines to the effect of salinity on turfgrass growth. Due to pronounced differences among turfgrass species and cultivars in their tolerance of both individual salts and total salinity, each turfgrass must be individually evaluated with regard to a specific soil salinity characteristic.

The information given in the following table is a general guide to individual turfgrass salt tolerances.

Approximate Salinity Tolerance Levels of Turfgrasses
Electrical Conductivity ($dS.m^{-1}$=m $mhos.cm^{-1}$)

Turfgrass	<4	4-8	8-16	>16
Cool season	Kentucky bluegrass	Tall fescue	Creeping bentgrass	Alkali-grass
	Colonial bentgrass	Perennial ryegrass	Western wheatgrass	
	Red fescue	Smooth brome	Tall wheatgrass	
	Meadow fescue	Orchard-grass		
Warm season	Centipedgrass	Blue grama	Bermuda-grass	&ashore paspalum
			Zoysiagrass	
			St. Augustine-grass	

The only practical way to correct excess soil salinity is to leach and remove the soluble salts from the root zone by periodically applying large amounts of water to the soil. The excess water dissolves the accumulated soluble salts and carries them below the root zone. This is possible only if the soil's internal drainage is adequate. Shallow soils overlaying rock, hard clay, or clay pan restrict water percolation and drainage. Breaking through this layer can improve drainage and the downward movement of salts. In the absence of adequate internal drainage, installation of drain tiles to remove the excess water along with dissolved salts may be the only solution to the problem.

It should be stressed that there are no amendments or soil conditioners which can remove salts from the root zone or make them less harmful. Selection of salt-tolerant turfgrass species, good irrigation practices, and adequate drainage are practically the only factors which ensure successful management of turfgrasses under saline conditions.

Although there are similarities in the formation of sodic (alkali) and saline soils, and the two terms are often used interchangeably, their effects on turfgrass growth and development and corrective measures are distinctly different.

As mentioned earlier, sodic (alkali) soils contain excess sodium ions in contrast to calcium and magnesium ions. Sodium does not usually cause direct injury to turfgrasses, which, in comparison with other plants, are relatively tolerant to sodium. However, if the soil exchangeable sodium percentage (ESP) exceeds 15, a turf stand may be damaged by resulting soil impermeability to water and air. Symptoms of reduced soil permeability include water logging, slow infiltration rates, crusting, compaction and poor aeration, any of which can restrict the normal turfgrass growth and development. In the case of saline-sodic (alkali) soils, obviously, leaching of the salts will not be possible without first removing the sodium from the soils and restoring porosity.

To remove sodium from the soil, amendments such as gypsum, sulfur and other sulfur-containing materials are often used. Gypsum (calcium sulfate) is the most commonly used material. Calcium ions, introduced to the soil by application of gypsum, replace sodium ions which then can be leached out of the soil.

Sulfur or sulfur-containing materials may be used on soils naturally high in calcium because they make this calcium more soluble to replace the sodium. The two major factors in a successful sodic (alkali) soil reclamation are:

1. Incorporation of amendments into the soil's top l-2 feet.
2. The presence of internal drainage to facilitate the leaching of sodium ions from the root zone.

In conclusion, only a soil chemical analysis can determine the extent of saline and/or sodic (alkali) problems. The frequency of leaching and amount of water needed will depend largely on the soil's texture and its salt concentration. Also, the amount of amendments required to improve a sodic (alkali) condition depends on the soil texture and its sodium ion concentration.

REFERENCES

Beard, J.B. 1973. Turfgrass, Science and Culture. Prentice Hall, Inc., Englewood Cliffs, New Jersey.

Harivandi, M.A., J.D. Butler, and P.N. Soltanpour. 1982. Effects of sea water concentrations on germination and ion accumulation in alkaligrass (Puccinellio spp.). Commun. In Soil Sci. Plant Anal. 13(7), 507.517.

Harivandi, M.A., J.D. Butler, and P.N. Soltanpour. 1982. Salt influence on germination and seedling survival of six cool season turfgrass species. Commun. In Soil Sci. Plant Anal. 13(7), 519-529.

Harivandi, M.A., J.D. Butler, and P.N. Soltanpour. 1983. Effects of soluble salts on ion accumulation in Puccinellia spp. J. of Plant Nutrition. 6(3), 255-266.

Richards,L.A.(Editor). 1954. Diagnosis and lmprovement of saline and Alkali Soils. U.S. Dept. Agr. Handbook No. 60. 160 pp.

Swift, C.E. and J.D. Butler. 1982. Growing Turf on Salt-Affected (Alkali) Sites. Colorado State University Service in Action No. 7. 227 pp.

Weed Control in Dichondra Progress Report

M. Ali tlarivandi and Clyde L. Elmore[1]

Dichondra *(Dichondra micrantha* Urb.) is a low-growing herb often used for lawns in the subtropical regions of California. A member of the morning glory family (Convolvulaceae), dichondra is the only broad-leaf species used as a lawn; thus, weed control in dichondra lawns presents an unusual problem.

Common annual weeds in dichondra are crabgrass, annual bluegrass, annual ryegrass, barnyardgrass, pigweed, lambsquarters, fleabane, weedy clovers and spotted spurge. Perennial weeds, such as bermudagrass, nutsedge, johnsongrass, Kentucky bluegrass, dandelion, oxalis and bindweed also become problems in dichondra lawns.

Although proper cultural practices often produce a strong, dense turf and, thus, prevent weed infestations, it is not always possible to limit weed control to good cultural practices. Where a chemical approach to weed control is called for, pre- or postemergence herbicides may be used to contain most annuals and some perennial weeds. Several herbicides are registered for broad-range weed control in dichondra. The study described here evaluated three registered pre-emergence and one postemergence herbicide for control of weeds in an experimental dichondra plot at the San Jose Deciduous Fruit Field Station. Weeds present in the dichondra plot were: prostrate pigweed, fleabane, crabgrass, and annual bluegrass. The herbicides napropamide (Devrinol) and diphenamid (Enide) at rates of 4 and 16 lb ai/A; monuron (Telvar) at 1 lb ai/A and sethoxydim (Poast) at 0.5 and 2 lb ai/A were applied to 30-ft^2 plots of dichondra on August 20, 1980, using an air-pressurized sprayer at an equivalent rate of 100 gal liquid per 1000 ft^2.

Each treatment and a check plot were replicated 4 times in a randomized complete block design. Plots were watered thoroughly after the application of pre-emergence herbicide, then the post-emergence herbicide sethoxydim (Poast) was applied.

Plots were visually rated 1 month later on September 20,198O. The phytotoxicity of these herbicides on dichondra and the degree of post-emergence control of weeds are summarized in the accompanying table. Plots also were rated after 5 months, on January 20, 1981, for effects on annual bluegrass germination. Results of this rating are also summarized in the table. None of the herbicides caused phyotoxicity on dichondra, regardless of their application rate. The post-emergence effectiveness of the herbicides was negligible with the exceptions: monuron on prostrate pigweed, and sethoxydim (at 2 lb ai/A) on crabgrass, both resulted in at least 50 percent reduction of those weeds. Annual bluegrass germination and infestation were much higher in check plots than in plots treated with herbicides. The highest levels of pre-emergence control of annual bluegrass were achieved with both application rates of napropamide, the higher application rate of diphenamid, and with monuron.

Effect of One Post-Emergence and Three Pre-Emergence Herbicides on DIchondra and Weeds

		Visual Ratings'				
			Post-emergence[b]			Pre-emergence
Herbicide	lb ai/A	Phytotoxicity[a]	Prostrate Pigweed	Fleabane	Crabgras	Annual Bluegrass
Napropameide	4.0	0	-	0.5		8.7
Napropamide	16.0	0	2 0**	0	0	9.7
Diphenamid	4.0	0	0**	0	0"	4.7
Diphenamid	16.0	0	–	0	1.0	8.5
sethoxydim	0.5	0	1.3"'	0	1.3***	5.5
Sethoxydim	2.0	0	1.0**	0	6.5**	4.2
Monuron	1.0	0.5	5 0***	0	0.5	8.0
Check	–	0	0	0	0	2.5

"Visual ratings are mean values from 4 replications and are based on a sale of O-IO. with 10 being
a. The highest phytotoxicty on dichondra
b. The highest post-emergence effect on weeds
c. No presence (complete control) of annual bluegrass
**Based on two replications rating.
***Based on three replictions rating.
-Not applicable No weeds on these plots to be treat&rated.

[1]Farm advisor, Alameda/Contra Costa/Santa Clara counties; Weed Scientist, Cooperative Extension, University of California, Davis, respectively. (The authors wish to thank the Northern California Turfgrass Council for its financial support of this experiment.)

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Cool Season Turfgrass Variety Performance

Victor A. Gibeault, Ali Harivandi, and Richard Autio[1]

The cool season turfgrass varieties that are reported here were established in 1978 at the UC South Coast Field Station in Irvine and the UC Deciduous Fruit Field Station in San Jose as part of a uniform variety study. The same varieties were established in Washington, Idaho, Colorado, and Nebraska. It was the objective of these studies to uniformly plant, maintain, and evaluate selected cultivars of Kentucky bluegrass, perennial ryegrass, and fine fescues under a uniform system in an attempt to determine comparative turfgrass variety performance for use in home lawns, golf courses, parks, cemeteries, schools, and other turf areas in the western United States.

All grasses listed in Tables 1,2, and 3 (note: fine fescues only at South Coast Field Station) were seeded to $2m^2$ plots with each grass replicated three times. Following establishment, all varieties were mowed at 13/4 in, fertilized with 4 lb of nitrogen per 1000 ft^2 per year, and phosphorus and potassium to maintain adequate levels, and irrigated at 100 percent of calculated evapo-transpiration for cool season turfgrasses.

Plots were visually evaluated monthly using a turf appearance rating scale of 1 to 9, with 9 representing an ideal sward of turfgrass and 1 representing a dead stand of grass. Factors such as color, density, texture, uniformity, and pest resistance/susceptibility were included in the visual rating, called a turf score. The data were averaged across varieties and months, and are presented as yearly averages. The averages were ranked from highest to lowest with those grasses having the same turfscore being given the same ranking. The grasses were considered mature throughout the rating periods, 1980 and 1981.

Appreciation: Appreciation is extended to the Southern California Turfgrass Council and the Lloyd Foundation for financial support for this project. Also, the statistical work of Lori Yates and Carol Adams, UC Riverside, is recognized.

Table 1. Turf scores for Kentucky bluegrass varieties at South Coast Field Station and the Deciduous Fruit Field Station, 1980 and 1981. The rating scale is l-9, with 9 being the ideal grass in terms of density, texture, uniformity, and overall appearance.

	South Coast Field Station				Deciduous Fruit Field Station			
	1980		1981		1980		1981	
Variety	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
A-20-6	5.97	15	5.69	9	6.21	21	5.42	20
A-34	6.36	6	5.31	17	6.49	15	6.03	7
Adelphi	6.19	11	5.78	7	6.24	23	5.36	21
America	6.44	4	5.25	19				
Aquila	5.25	32	5.25	19	6.41	16	6.31	2
Baron	5.81	19	5.38	14	6.55	11	5.67	15
BF B-35	6.17	12	5.33	16				
Birka	5.78	20	4.08	37	6.22	24	5.47	19
Bluebell	5.47	28	4.19	36				
Bonnieblue	6.28	9	5.14	20	6.29	20	4.67	29
Bristol	6.08	14	5.14	20	6.10	27	4.89	24
Brunswick	5.81	19	4.94	25	6.62	9	5.56	17
Cello	5.69	22	4.97	24	5.61	33	3.00	37
Charlotte	5.61	25	3.81	40				
Cheri	6.89	1	5.97	5	6.49	15	6.28	3
Cleopatra	4.97	38	4.28	33				
Columbia	6.75	2	6.47	1	6.84	2	6.17	4
Dormie	4.97	38	4.63	31	5.86	32	4.69	28
Enaldo	5.50	27	4.89	26	6.34	19	5.67	15
Enmundi	6.14	13	5.47	13	6.38	17	5.92	9
Enoble	5.06	36	3.14	42	5.97	31	4.39	33
Entensa	6.14	13	5.39	14				
Entopper	5.33	30	3.94	39	6.63	8	6.17	4
Fylking	5.67	23	5.08	22	6.16	25	4.50	31
Geronimo	6.19	11	5.36	15	6.22	24	5.75	13
Glade	5.81	19	5.58	11	6.71	5	5.81	12
Golden West	5.78	20	4.94	25	6.24	23	5.25	22
H-l	5.42	29	5.31	17	6.09	28	5.64	16
Haga	5.89	17	5.28	18	6.54	12	6.33	1
Harmony	5.92	16	4.56	30				
Hekla	5.53	26	4.75	27				
Holiday	6.31	8	4.69	29	6.52	14	4.92	23
ISU 28	5.64	24	5.33	16	6.68	6	6.17	4
Kimono	4.89	39	4.28	33	6.14	26	4.63	30
Majestic	6.53	3	6.33	2	6.61	10	5.69	14
Merion	4.81	40	4.36	31	5.51	34	3.67	3
Merit	6.14	13	5.50	12	6.99	1	6.17	4
Mosa	5.50	27	4.22	35	6.22	24	4.25	34
Obelisk	5.72	21	4.25	34	6.53	13	4.83	25
Orna	5.14	34	3.72	41				
Parade	6.39	5	5.75	8	6.63	7	5.83	11
Pion	6.75		6.19	3				
Plush	5.28	3:	4.25	34	6.03	30	4.81	26
P-164	5.00	37	4.05	38	6.05	29	3.89	35
Ram I	5.17	33	4.72	28	6.84	2	5.86	10
Rugby	6.36	6	5.92	6	6.82	3	6.14	5
Scenic	5.83	18	5.03	23	6.03	30	4.47	32
Sherpa	5.06	36	3.94	39				
Sving	4.89	39	4.33	32				
Sydsport	6.14	13	5.33	16	6.71	5	6.06	6
Touchdown	5.11	35	4.06	38	5.40	35	4.78	27
Trenton	6.08	14	6.12	4	6.82	4	5.94	8
Vanessa	5.69	22	4.36	31	6.38	18	4.53	30
Victa	6.25	10	5.25	19	6.25	22	5.67	15
Welcome	5.42	29	5.11	21				
WW Ag 480	6.33	7	5.61	10				

[1]Extension Environmental Horticulturist, UC Riverside; Farm Advisor, Alameda county; Staff Research Associate, UC Cooperative Extension, UC Riverside, respectively.

Table 2. Turf scores for perennial ryegrass varieties at South Coast Field Station and Deciduous Fruit Field Station, 1980 and 1981. The rating scale is 1-9, with 9 being the ideal grass in terms of density, texture, uniformity and overall appearance.

	South Coast Field Station				Deciduous Fruit Field Station			
	1980		1981		1980		1981	
Variety	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Acclaim	6.11	6	5.25	17	6.47	21	6.00	8
Aristocrat	5.83	13	5.92	7	6.44	22	6.00	8
Arno	6.08	7	6.11	4	6.75	8	6.11	6
Bellatrix	5.56	16	5.69	12	6.59	13	5.67	16
Birdie	6.36	2	6.00	6	6.58	14	5.69	15
Blazer	6.08	7	6.14	3	6.77	7	5.94	9
Caravelle	5.31	20	3.92	32	6.47	20	5.25	19
Citation	5.28	21	4.31	27	5.86	24	4.94	21
Common	5.36	19	4.53	25	4.91	26	3.19	22
compas	5.03	24	4.50	26	6.92	5	5.67	16
Dasher	6.14	5	6.03	5				
Derby	5.89	12	5.08	19	6.79	6	6.11	6
Diplomat	5.97	10	6.00	6	7.14	1	6.14	5
Elka	5.92	11	5.72	11	6.62	11	6.00	8
Ensporta	5.08	23	4.17	28	6.57	18	5.64	17
Fiesta	6.19	4	5.81	8	6.72	9	6.22	2
Hunter	4.86	26	4.97	29	6.51	17	6.03	7
KS-92	5.92	11	5.75	10	5.83	25	5.33	18
Loretta	6.14	5	6.25	2	6.61	12	6.11	6
Manhattan	6.00	9	5.51	13	6.52	16	5.83	12
Mom LP 20	5.44	17	5.33	16				
Omega	5.89	12	5.47	14	6.33	23	5.89	10
Pennant	6.44	1	6.67	1	6.49	19	5.72	14
Pennfine	6.22	3	5.81	8	6.94	4	6.19	3
Pippin	5.36	19	5.14	18				
Player	5.44	17	4.92	22	7.01	3	6.44	1
Regal	5.81	14	5.36	15	5.83	25	5.17	20
Runner	5.75	15	5.78	9	6.68	10	5.86	11
Score	4.94	25	3.67	33				
Servo	4.08	27	4.14	29				
Sportiva	5.03	24	4.11	30	6.56	15	5.83	12
Sprinter	5.19	22	4.78	23				
Venlona	5.39	18	4.61	24	6.47	20	6.17	4
Yorktown	5.31	20	4.53	25	6.25	8	5.81	13
Yorktown II	6.03	8	5.81	8	7.04	2	6.14	5
ZW 42-80	5.28	21	5.03	20				
ZW 42-81	5.08	23	4.08	31				

Table 3. Turf scores for fine fescue varieties at South Coast Field Station, 1980 and 1981. The rating scale is l-9, with 9 being the ideal grass in terms of density, texture, uniformity and overall appearance.

	1980		1981	
Variety	Mean	Rank	Mean	Rank
Agram	3.33	16	2.86	5
Balmoral	3.17	19	1.70	25
Bingo	3.28	18	2.28	13
Dawson	3.50	12	2.14	17
Engina	3.78	7	1.78	23
Envira	3.33	16	2.08	18
Enzet	2.89	23	1.83	21
Ensylva	3.94	4	3.19	
Fortress	4.25		2.47	10
Grelo	3.53	11	2.28	13
Jade	3.14	20	2.25	14
Jamestown	3.97	3	1.86	20
Luster	3.08	21	2.25	14
Menuet	3.69	9	2.88	4
Monocorde	3.39	14	1.69	25
Oase	3.28	18	1.94	19
Parita	3.75	8	2.83	6
Pernille	4.00	2	2.86	5
Polar	3.39	14	2.31	12
Rolax	3.50	12	2.64	9
Satin	3.61	10	2.36	11
Sonnet	3.17	19	2.31	12
Starlight	2.89	23	1.72	24
Tamara	3.69	9	3.00	2
Tatjana	2.64	24	1.83	21
Waldorf	3.36	15	2.17	16
Wilton	3.89	6	2.19	15
Adonis	3.92	5	2.94	3
Atlanta	3.44	13	2.25	14
Banner	3.36	15	2.75	
Checker	3.28	18	1.86	20
Highlight	3.03	22	1.64	26
Koket	3.31	17	2.72	8
Wintergreen	3.14	20	2.08	18
Biljart	3.37	15	1.81	22
Scaldis	4.00	2	1.81	22
Tournament	3.33	16	1.58	27

UC Turf Corner

*Forrest Cress**

UC Turf Corner contains summaries of recently reported research results, abstracts of certain conference presentations, and announcements of new turf management publications. The source of each summary is given for the purpose of further reference.

Dull Mower Blades Reduce Turfgrass Quality

Findings from a University of Nebraska study substantiate the hypothesis that repeated mowing with a dull mower blade reduces the quality and increases the disease susceptibility of turfgrass.

Results from the Nebraska research also contradict the generally accepted premise that dull mower blade injury of turfgrass leaf tissue increases water use.

The study was aimed at determining the effects of repeated mowing with a dull or sharp rotary mower blade on turfs of Park and Baron-Glade-Adelphi Kentucky bluegrass.

The effects of mower blade sharpness on turfgrass quality, leaf spot, thatch accumulation, water-use rate, and mower fuel consumption were measured in field experiments of the Kentucky bluegrasses growing on a Sharpsburg, silty-clay loam.

Turfgrass quality was reduced by dull mower treatment for both the Park and the blend bluegrasses. Leafspot incidence increased in Park turfs mowed with the dull mower but not on the blended turf which was leafspot resistant.

Thatch accumulation wasn't significantly influenced by mower blade sharpness. Water-use rates under field conditions for Park and the Baron-Glade-Adelphi turfs were 1.3 and 1.2 times greater, respectively, for turfs mowed with the sharp mower blade than with the dull one. The reduced water-use rate associated with dull mower treatments was positively correlated to reduced shoot density ($r=0.88$) and verdure ($r=0.93$).

Gasoline use was 22 percent higher with dull mower blade treatments than with sharp ones.

(See "Mower Blade Sharpness Effects on Turf," by D.H. Steinegger, R.C. Shearman, T.P. Riordan, and E.J. Kinbacher, Agronomy *Journal,* Vol. 75, No. 3, May-June 1983.)

St. Augustinegrass Turf Canopy Resistances to Evapotranspiration

Results from a controlled environment study of evapotranspiration from St. Augustinegrass at Texas A&M University refute the hypothesis that stomata control the flux of water vapor from an adequately watered turfgrass canopy.

Findings from this research, according to its investigators, imply that alteration of stomata1 aperture, such as by stomata1 inhibitor, cannot be expected to result in a substantial decrease of evapotranspiration from an adequately watered turf. Nor would manipulation of stomata1 size or frequency be a propitious avenue of research in a breeding program designed to develop water conserving turfgrasses, they add.

Their study was designed to determine the extent to which flux of water vapor from a turfgrass canopy is controlled by stomata, or internal resistance, even under adequately watered conditions (i.e., field conditions). The study was conducted in a controlled environment chamber so that different humidity and air temperature regimes could be imposed on the turf. Mowing height of the turf was varied in an attempt to vary internal resistance. Wind speed and light were held constant throughout the study.

The Texas researchers found that under adequately watered conditions evapotranspiration from St. Augustinegrass was influenced to a greater extent by environmental factors external to the plants than by the disposition of leaf stomata. Internal resistance was found to be only one-fourth to one-half the external resistance. Under wind speed conditions of 0.6m/sec, actual evapotranspiration rates of St. Augustinegrass were only slightly lower than potential evapotranspiration rates. The Texas scientists concluded from their study that chemical or genetic control of stomata1 resistance would not result in appreciable savings of irrigation water.

(See "Resistances to Evapotranspiration from a St. Augustinegrass Turf Canopy," by D. Johns, J.B. Beard, and C.H.M. van gavel, Agronomy *Journal,* Vol. 75, No. 3, May-June 1983.)

Effects of Soil Compaction on Ryegrass Growth Studied

Results from a Kansas State University greenhouse study reflect the adverse effects that soil compaction can have on turfgrass growth and irrigation management.

Soil compaction was examined for its effects on turfgrass growth, water use, and soil aeration using a Chase silt loam soil. The perennial ryegrass, Derby, was subjected to three compaction levels: (1) no compaction; (2) moderate compaction-360 joules energy; (3) heavy compaction-720 joules energy.

The soil was compacted by dropping a 11.5-kg weight from a height of 65 cm. When tensiometers read -0.65 bar, 5 cm of water was applied. Soil compaction increased bulk density; reduced aeration porosity, visual quality and shoot density; altered root distribution; reduced root density in the 10 to 25 cm zone. But it had slight effect on verdure and individual shoot weight, according to the Kansas researchers.

Total clipping weights were reduced by 38 and 53 percent for the moderate and heavy compaction treatments, respectively. Clipping yield decreased immediately after compaction treat. ment, while root changes were not apparent until after 12 weeks.

During the study, water use was reduced by 21 and 49 percent for the moderate and heavy compaction treatments, respectively. With heavy compaction, oxygen diffusion rates (ODR) were below 20 x 10^{-8} g cm^{-2} min^{-1} for at least 53 hours after irrigation. The noncompacted soil achieved acceptable ODR within 5 hours.

The combined effects of compaction-reducing rooting, slowing shoot growth, and increasing moisture retention-caused the compacted soil to remain at a reduced aeration status longer than the noncompacted soil after irrigation.

(See "Perennial Ryegrass Growth, Water Use, and Soil Aeration Status under Soil Compaction," by K.J. O'Neil and R.N. Carrow, ***Agronomy Journal,*** Vol. 75, No. 2, March-April 1983.)

Controlled Environment System Developed for Turfgrass Research

A controlled environment system for conducting research on turfgrass swards has been developed at Ohio State University.

The system consists of three basic components:

(1) a 1000 cm^2 sward of turf;

(2) a four-sided, glass, root observation cell;

(3) an open gas exchange system with accompanying instrumentation.

The system reportedly has the capability of controlled light intensity, light quality, day length, diurnal air temperature, soil temperature, and relative humidity. The design of the facility, its developers report, allows continuous and concurrent monitoring of both morphological (shoots and roots) and physiological (photosynthesis, dark respiration, and evapotranspiration) responses of turfgrasses to a variety of laboratory-simulated environmental conditions.

(See "A Controlled Environment System for Turfgrass Research," by B.J. Augustin and K.J. Karnok, ***Agronomy*** Journal, Vol. 75, No. 2, March-April 1983.)

Control of Anthracnose on Annual Bluegrass

Field study results from Ohio show that moderate levels of nitrogen (1.46 kg/acre/year) applied monthly from June through November was the most effective nitrogen fertilization program tested for reducing annual bluegrass damage due to anthracnose. Combining this nitrogen program with fungicide applications effectively controlled the disease.

Researchers from Michigan State University and Ohio State University jointly conducted the study.

Three nitrogen carriers – isobutylidene diurea, sulfur-coated urea, and urea – were applied at two rates (1.46 kg/N/acre/year and 2.92 kg/N/acre/year) and two timings, starting in spring or summer, with or without triademefon fungicide treatments. The fungicide treatments gave the most effective anthracnose control. Fungicide-treated plots averaged 1.9 and 1.7 percent infected area for the first and second years of the study, whereas plots not treated were 29.6 and 30.6 percent infected, respectively. The type of nitrogen applied had no effect on anthracnose development, according to the scientists who conducted the work. Moderate nitrogen levels (1.46 kg/acre/year) were associated with less disease incidence than the higher level of nitrogen (2.92 kg/acre/year). Also, the nitrogen applications that began in June resulted in less disease than those started in April.

(See Anthracnose development on Annual Bluegrass in Response to Nitrogen Carriers and Fungicide Application," by T.K. Danneberger, J.M. Vargas, Jr., P.E. Rieke, and J.R. Street, Agronomy Journal, Vol. 75, No. 1, January-February 1983.)

WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendation's given on the container label. Store all chemicals in their original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Recommendations are based on the best Information currently available, and treatments based on them should not leave residues exceeding the tolerance established for any particular chemical. Confine chemicals to the area being treated. THE GROWER IS LEGALLY RESPONSIBLE for residues on his crops as well as for problems caused by drift from his property to other properties or crops.

Consult your County Agricultural Commissioner for correct methods of disposing of leftover spray material and empty containers. Never bum pesticide containers.

PHYTOTOXICITY: Certain chemicals may cause plant injury If used at the wrong stage of plant development or when temperatures are too high. Injury may also result from excessive amounts or the wrong formulation or from mixing incompatible materials. Inert ingredients, such as wetters, spreaders, emulsifiers, diluents, and solvents, can cause plant injury. Since formulations are often changed by manufacturers, it is possible that plant injury may occur, even though no injury was noted in previous seasons.

NOTE: Progress reports give experimental data that should not be considered as recommendations for use. Until the products and the uses given appear on a registered pesticide label or other legal, supplementary direction for use, it is illegal to use the chemicals as described.

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