TURFGRASS SOD RESEARCH UPDATE

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Sod production has become a highly sophisticated technology due to the development of better equipment, pesticides, turfgrass varieties, and production and handling techniques. However, many problems continue to plague sod growers including various weed species, diseases and other factors that reduce the quality and marketability of sod. The purpose of this paper is to explore several of these major problems and to report results from recent research at the University of Illinois on the production and subsequent use of sod.

ANNUAL BLUEGRASS CONTROL DURING ESTABLISHMENT

Annual bluegrass is a serious weed problem on some sod production sites. It germinates rapidly and is extremely vigorous and competitive with Kentucky bluegrass during cool seasons. Since preemergence herbicides that are effective in preventing annual bluegrass development from seed cannot be used safely in conjunction with seeding Kentucky bluegrass, studies were undertaken to evaluate their use with vegetative plantings. Results showed that application of a new herbicide - oxadiazon (Rhodia's Ronstar) - immediately after planting plugs of A-20 Kentucky bluegrass effectively controlled annual bluegrass and other annual weeds while allowing fairly rapid development of turf. However, tests employing 48 Kentucky bluegrasses showed that some varieties were highly susceptible to injury from oxadiazon while others were quite tolerant of this herbicide (Table 1). Results from other field studies showed that close plug spacing (ca. 6 in), moderate mowing heights (1.5 - 3.0 in), and adequate fertilization (0.5 - 1.0 lb Nitrogen/1000 sq ft/month) were important factors for encouraging rapid turfgrass establishment from plugs.

YELLOW NUTSEDGE CONTROL

Yellow nutsedge (Cyperus esculentus L.) is a perennial sedge that reproduces by seed, rhizomes and tubers. One surviving tuber can give rise to several nutsedge plants which, in turn can spread rapidly through lateral growth and development of rhizomes. Extensive formation of tubers at rhizome terminals can ensure regeneration of nutsedge plants in subsequent years. Results from research at the University of Illinois have shown that the success of yellow nutsedge as a weed in some turfs is inversely related to the competition from Kentucky bluegrass. Important factors for restricting the spread of nutsedge included: adequate fertilization (0.5 to 1.0 lb N/1000 sq ft/month), moderate mowing heights (1.5 to 3.0 in), adequate moisture to sustain growth of Kentucky bluegrass during extended drought periods, and avoidance of summer disease in the turf. Chemical control of yellow nutsedge was highly variable; the best control from cyperquat and MAMA occurred on sites where intensive irrigation was practiced. This was believed to be due to the relationship between moisture and the absorption of the applied herbicides by the leaves. Plants sustained under high moisture have relatively thin cuticles with continuous channels of water through the pores of the cuticle. Herbicide movement is facilitated by the water continuum between the spray droplet and the inside of the leaf. In contrast, plants subject to drought typically have thicker cuticles with air-filled pores. Herbicide absorption is restricted in these plants and, consequently, efficacy is reduced.

PERENNIAL WEEDY GRASSES

Quackgrass, bentgrass, tall fescue and nimblewill are perennial grasses that disrupt turfgrass quality and reduce the marketability of sod. Since there are no selective chemical controls for these weeds, nonselective herbicides have been used for spot-treating clumps and patches of undesirable perennial grasses. Dalapon and amitrole have been used for several years for this purpose; however, weed control has not always been satisfactory and the residual activity of these herbicides delays turfgrass recovery into treated areas. Recently, glyphosate (Monsanto's Roundup) has been shown to be effective in controlling perennial grasses while the lack of any residual activity following its use allows for rapid turfgrass growth into treated areas. Results from research have shown that treated sites can be reseeded soon after application of glyphosate. However, sufficient time should be allowed between chemical treatment and disc seeding to facilitate translocation of the herbicide within the plant; otherwise, the mechanical severing of stolons or rhizomes that accompanies disc seeding may interfere with herbicide translocation and, hence, control of the weed species.

SELECTION OF KENTUCKY BLUEGRASS VARIETIES

The intraspecific variability of Kentucky bluegrass has allowed the development of many varieties and experimental selections that differ widely in their color, texture, density, environmental adaptation, disease susceptibility, and other factors. The basis for these breeding efforts is that improvements in the characteristics and adaptation of a turfgrass reduce its dependency on cultural practices designed to compensate for specific weaknesses. Thus, turfgrass management is made simpler and higher turfgrass quality is obtainable with the use of improved varieties.

The diseases of principal importance have been Helminthosporium leaf spot, Sclerotinia dollar spot and Fusarium blight (Table 2). Those varieties showing the least injury from these diseases were: A-20, A-34, Adelphi, Baron, Bonnieblue, EVB-282, EVB-391, Galaxy, Glade, K1-131, K1-132, K1-143, K1-155, Majestic, Cheri, Monopoly, P-59, P-140, Parade, PSU-150, Sodco, Touchdown, Victa and Windsor. The summer quality data reflect both disease incidence and summer stress tolerance. Thatch development varied from 0.71 to 1.91 cm thick, depending upon variety. There is reason to believe that thatch has an important effect on summer stress tolerance since Nugget typically declines as summer temperatures rise while, at the Belleville site in southern Illinois, the absence of thatch in Nugget is associated with substantially better summer quality.

The blends reflect disease and quality levels that represent compromises between the two component varieties. Considering the fact that no variety is perfect, blending superior varieties allows for incorporating the desirable features of each component while reducing the impact of a specific weakness on general turfgrass quality. The Kentucky bluegrass (Fylking)- fine fescue mixtures have not been good turfs due to the poor adaptation and high disease susceptibility of the fescues. The Fylking-Pennfine (perennial ryegrass) mixture is predominantly perennial ryegrass and its quality through the season is similar to that of Pennfine alone.

SOIL-LESS (WASHED) SOD

A new and potentially important development by Warren's Turf Nursery is "soil-less" sod. Recently harvested sod is washed free of soil with a device that employs a steel conveyer belt, a series of water jets for washing, and a roller assembly to squeeze excess water from the sod. The resulting sod is lighter, easier to handle, and less costly to transport. Research results have shown that, under moderate climatic conditions, soil-less sod roots faster than conventional sod. Also, soil removal does not significantly reduce sod strength since the strength of a sod section is primarily due to the interlocking system of roots or rhizomes that remains with the washed sod. Another potential advantage of soil-less sod is the avoidance of an interface effect due to differences between soil types occurring at the sod production and transplant sites. One obvious concern with soil-less sod is the higher desiccation potential after planting, especially during stress conditions. Also, the nutrient requirement of soil-less soil that has been planted on very sandy media are higher than for conventional sod since little or no nutrients are carried with the sod after soil removal.

PROCESSED TURFGRASS CLIPPINGS

Mowing is one of the primary cultural practices necessary for sustaining turf. Clippings resulting from regular mowing are either picked up and discarded, or returned to the turf where they decompose. In view of the traditional use of grasses for forage, it is likely that turfgrass clippings could be successfully employed for feeding livestock and other animals. As turfgrass cultivars and cultural practices are substantially different from those employed in forage production, investigations were initiated this year to determine the relationship of turfgrass species, cultivars, mowing and fertilization to the nutritive value of clippings from these turfs. Lutein, a non-epoxide xanthophyll important as a pigmenting agent in poultry feeds, was found to occur in large quantities in Kentucky bluegrass clippings from sod farms in California. Clippings were collected from 20 Kentucky bluegrasses, four perennial ryegrasses and K-31 tall fescue in May and analyzed for lutein using an acetone extraction and thin-layer chromatographic separation of the pigments. Colorimetric determination of lutein was made from extracts from the TLC plates. Lutein levels ranged from a low of 72 mg/kg fr. wt. in Vantage Kentucky bluegrass to a high of 358 mg/kg in Adelphi Kentucky bluegrass (Table 3). Thus, selection of a particular turfgrass cultivar substantially affects the lutein yield from the clippings. Clippings were also collected from Kentucky bluegrass fertilized with 0, 0.25, 0.5 or 1.0 kg N/are/mo. Results showed that lutein increases significantly from increasing nitrogen fertilization, but the increases were of a relatively low magnitude.

Turfgrass clippings offer a potentially important source of protein in animal feeds, especially for ruminants (sheep, cattle, etc.) which can digest the cellulose within the plant tissue. Crude protein levels were determined in dried clippings by Kjeldahl analysis for total nitrogen (X 6.25) in 53 Kentucky bluegrasses and 8 perennial ryegrasses. Within the Kentucky bluegrasses, crude protein levels ranged from 22 to nearly 33 percent depending upon cultivar (Table 4). The perennial ryegrasses ranged from 26.3 to 30.2 percent crude protein.

The dynamic nature of turfgrass technology and sod marketing conditions requires that sod growers keep abreast of new information from on-going research. Expanded results from scientific investigations provide important guides for selecting varieties and blends at planting, incorporating pesticides and other materials into production techniques, and modifying sod handling methods. The sod grower can no longer assume that what is considered satisfactory today will be adequate for tomorrow. At the same time, the challenges and opportunities that exist today can yield substantial gains for the sod grower who makes wise choices in light of new technical developments.

Table 1. Relative phytotoxicity from oxadiazon to field-planted plugs of Kentucky bluegrass varieties.

Phytotoxicity	Variety
Low	A-20, A-34, Ba 62-55, Baron, Brunswick, EVB-282, EVB-307, Galaxy, Geronimo, Glade, K1-131, K1-132, K1-133, K1-143, Majestic, Plush, PSU-150, PSU-169, PSU-197, RAM #1, RAM #2, Sodco, Vantage, Victa, Windsor.
Moderate	Adelphi, Ba 61-91, Bonnieblue, EVB-391, Fylking, K1-138, K1-155, Kenblue, Cheri, Monopoly, Nugget, P-140, PSU-190, Sydsport, Touchdown.
High	Campina, EVB-305, K1-157, Merion, P-59, Parade, Park, Pennstar.

Table 2. Performance of Kentucky bluegrass varieties, blends and mixtures in 1975.

Variety	Spring Green-up[1]	Leaf Spot Disease[2]	Fusarium Blight[2]	Dollar Spot Disease	Thatch Depth, cm.	Quality[1] 7/11/75	Quality[1] 8/15/75	Quality[1] 10/9/75
A-20 (seeded)	3.3	2.0	1.0	1.0	1.39	2.7	2.0	3.7
A-20 (veg)	4.0	2.0	1.0	1.0	1.24	3.7	2.3	2.7
A-34	3.0	2.7	1.3	1.0	1.11	5.0	2.3	3.0
A-20-6	4.0	2.0	1.0	1.0	0.99	2.7	2.0	2.0
Adelphi	2.7	2.0	1.0	1.0	1.25	4.0	2.3	3.0
Ba 61-91	4.3	2.7	2.0	1.3	1.05	3.7	3.7	4.7
Ba 62-55	4.0	2.3	1.3	2.0	1.50	3.3	3.3	3.3
Baron	5.3	2.7	1.3	1.0	1.37	3.7	3.0	3.0
Bonnieblue	3.0	2.3	1.3	1.0	1.01	3.7	2.3	3.3
Brunswick	2.0	3.0	2.3	1.7	1.54	2.3	3.7	4.7
Campina	2.3	7.0	1.0	1.3	1.06	4.0	3.3	3.3
Delft	2.3	3.7	5.0	1.0	1.04	3.7	5.7	6.3
EVB-282	3.3	3.0	1.0	1.0	1.14	2.7	2.7	3.0
EVB-305	4.7	2.0	4.3	1.3	1.52	5.3	4.3	5.7
EVB-307	3.7	2.0	2.0	1.7	1.19	4.0	4.0	4.3
EVB-391	5.7	2.7	1.3	1.0	1.26	4.0	3.0	3.0
Fylking	4.3	2.3	2.3	1.3	1.30	3.3	3.3	4.7
Galaxy	3.7	2.0	1.3	1.0	1.17	3.7	2.3	3.3
Geronimo	3.0	3.3	2.0	2.0	1.25	3.3	4.0	4.3
Glade	3.7	2.7	1.0	1.7	1.54	3.7	3.3	3.0
K1-131	3.3	2.7	1.3	1.0	1.41	3.3	2.7	3.3
K1-132	3.3	3.0	1.0	1.0	1.27	3.3	3.0	3.0
K1-133	3.0	2.7	1.7	1.0	1.20	3.0	3.0	4.0
K1-138	3.0	4.0	5.7	1.0	1.21	3.7	6.3	5.7
K1-143	3.0	2.7	1.0	1.3	1.32	3.0	2.3	3.0
K1-155	2.7	2.0	1.3	1.0	1.21	4.0	2.7	3.3
K1-157	2.3	5.3	3.0	1.0	1.13	3.7	3.3	5.0
K1-158	2.0	5.3	1.7	1.0	1.22	3.0	1.7	2.7
K1-187	3.0	2.7	2.0	1.0	1.45	3.0	3.3	4.7

Kenblue	3.0	5.0	2.0	1.3	0.96	3.7	3.3	4.0
1L-3817	4.3	2.3	2.7	1.3	1.13	4.3	4.3	4.3
Majestic	2.7	2.0	1.0	1.0	1.41	4.0	2.3	2.7
Merion	3.0	2.0	1.7	1.3	1.02	2.3	3.0	4.0
MLM 18001	3.3	3.0	1.3	1.0	1.58	3.7	2.7	2.7
Monopoly	2.7	2.7	1.0	1.0	1.06	2.3	2.0	2.7
Nugget	7.7	1.0	2.7	3.3	1.52	4.7	5.3	5.3
P-59	2.0	2.3	1.0	1.0	1.33	4.7	2.7	2.7
P-140	2.3	2.7	1.0	1.7	1.76	2.3	2.3	2.7
Parade	2.3	2.3	1.3	1.7	1.01	4.3	3.0	2.7
Park	2.3	5.3	2.0	1.0	0.71	2.7	3.3	5.0
Pennstar	4.0	2.0	2.0	1.0	1.22	3.3	3.3	4.0
Plush	3.7	3.0	1.7	1.0	1.33	2.3	2.3	3.7
PSU-150	3.3	2.0	1.0	1.0	1.17	3.0	3.3	3.7
PSU-169	3.0	2.3	1.7	1.0	1.13	4.3	3.3	4.0
PSU-190	3.7	2.7	1.7	1.0	1.29	3.0	3.3	4.0
PSU-197	3.7	2.7	2.7	1.0	0.97	3.0	4.0	5.3
RAM #1	4.3	2.7	1.3	2.7	1.68	3.7	3.7	3.7
RAM #2	3.0	2.7	3.0	1.3	1.37	3.7	4.3	4.3
Sodco	3.0	3.0	1.0	1.0	1.37	3.0	2.7	2.3
Sydsport	4.0	2.0	1.7	1.0	1.22	5.0	3.0	3.0
Touchdown	3.3	2.3	1.0	1.0	1.91	4.3	3.0	2.7
Vantage	3.0	3.7	1.7	1.0	1.02	2.7	2.7	3.3
Victa	5.0	2.7	1.0	1.0	1.47	3.0	3.0	3.3
Windsor	3.0	3.0	1.0	1.0	1.22	2.7	2.0	3.0
..............................Blends..............................								
Merion + Kenblue	3.0	3.0	1.7	1.0	1.22	3.0	3.3	4.3
Merion + Pennstar	2.3	2.0	1.0	1.0	1.19	2.3	3.0	4.0
Merion + Baron	3.3	2.3	2.0	1.0	1.30	3.7	3.3	4.0
Nugget + Pennstar	7.0	1.3	2.0	1.0	1.28	4.3	4.0	4.3
Nugget + Park	3.0	2.3	3.7	1.0	1.10	3.7	5.0	6.0
Nugget + Glade	4.7	2.0	1.3	1.0	1.42	3.7	2.7	3.7

Nugget + Adelphi	4.3	1.7	1.3	1.0	1.27	4.3	2.7	3.3
Victa + Vantage	3.7	2.7	1.7	1.0	1.40	3.3	3.0	3.3
P-59 + Brunswick	2.3	2.7	3.3	1.0	1.41	3.3	4.3	5.3
Blend 38	3.3	3.0	1.7	1.0	1.51	3.3	3.0	3.3
............................Mixtures............................								
Fylking + Jamestown (RF)	4.0	2.3	5.0	1.0	1.36	4.7	4.3	6.0
Fylking + Pennlawn (RF)	3.3	2.3	5.3	1.0	1.24	3.7	5.7	6.0
Fylking + C-26 (HF)	3.7	2.0	3.3	1.3	1.31	3.7	4.3	5.7
Fylking + Pennfine (PR)	1.0	2.0	1.0	1.3	0.72	2.7	3.3	2.7

[1] Spring green-up and quality ratings were made using a scale of 1 through 9 with 1 representing best quality and 9 representing poorest quality.

[2] Disease ratings were made using a scale of 1 through 9 with 1 representing no disease and 9 representing complete blighting of the turf.

Table 3. Lutein content in fresh clippings of various turfgrasses.

Lutein	Cultivars
mg/kg fr wt	
360-300	Adelphi, A-34, Pennfine PR
299-250	Baron, Majestic, Pennstar, Merion Fylking, Kenblue, Sydsport, Brunswick, Common PR, Manhattan PR, K-31 TF
249-200	Park, Windsor, A-20, Victa, Parade, Glade, Bonnieblue, NK-200 PR
199-150	Nugget, Touchdown
99-50	Vantage

Table 4. Crude protein content in dried clippings of various turfgrasses.

Protein	Cultivars
%	
35-30	Campina, Windsor, Majestic, Sodco, NK-101 PR
29-25	A-20, Parade, Adelphi, Bonnieblue, Brunswick, Merion, Plush, Vantage, Sydsport, Galaxy, Delft, Baron, Kenblue, Park, A-34, Nugget, Glade, Pennstar, Victa, Monopoly, NK-200 PR, Manhattan PR, NK-100 PR, Pennfine PR, Common PR
24-20	Fylking, Geronimo, Touchdown