APRIL 1988

LAWN INSTITUTE

Harvests

Volume 35 Number 1

THE HARVEST MIX

This issue of Harvests contains 32 Threshing the Journal research reports in five sections: six on seed research; two on other research topics; six on tall fescues; eleven on weed control and growth regulation in cool season turfgrasses and seven on weed research on warm season turfgrasses. These present new information which we hope will be of value. Also, a short article on Breaking New Ground in the Market Place is presented.

Interest in lawn and sports turf continues to grow making new research results even more important. As many answers to important questions are found, there are still challanges to be met in order to meet the public's demand for beautiful and durable turf.

THRESHING THE JOURNALS

(Published research results)

Seed Research

SEX EXPRESSION IN BUFFALOGRASS UNDER DIFFERENT ENVIRONMENTS

D R Huff and Lin Wu
Crop Science
Volume 27 Number 4
Pages 623-626
1987

Buffalograss is a perennial grass species native to the shortgrass prairies of the western United States. In the early American west, buffalograss sustained immense herds of American buffalo and supplied the raw material for early western pioneers' sod homes. Although buffalograss is still used mainly for forage on western rangelands, its potential for use as a low maintenance turfgrass is increasingly being emphasized. It is drought tolerant, has low nutritional requirements and a short stature.

Generally buffalograss has a dioecious breeding mechanism. The structural differences of inflorescences between male and female plants are so striking that originally plants of each sex were allotted to different genera. They are now recognized as two different sexes of a single species. However, buffalograss populations may contain monoecious plants. In addition, hermaphroditic flowers are occasionally found on inflorescences of monoecious plants.

Seed is available as cultivars or harvests from natural stands, but seed supply has been limited by its inferior agronomic characteristics, such as extremely short female inflorescences, seed shattering, seed burrs containing an oil that inhibits seed germination and low seed yield. Buffalograss cultivar development has emphasized the selection of populations with better seed set and with female-biased sex ratios. The selection for predominantly female monoecious plants has been used to achieve a female-biased sex ratio. However, sex expression in this species may vary between years and locations. Therefore, the nature of sex expression in buffalograss needs to be determined to a greater extent in order to provide a more predictable pattern of sex expression for genetic studies and breeding purposes.

Research at The University of California-Davis has had the objective of examining the distribution of sex forms in buffalograss populations and studying sex expression under different environmental conditions.

Results of this research include:

- Frequency of monoecious plants was higher in Colorado common buffalograss than in Texas native buffalograss.
- The sex expression of male and female plants remained constant over all environmental treatments including warm and cool temperatures, high and low light conditions and high and low nitrogen fertilization levels.
- The trends of sex expression for monoecious sex forms showed that conditions of warm temperature, high light and low nitrogen were favorable for female sex expression.
- Conditions of cool temperature, low light and high nitrogen were favorable for male sex expression.
- A significant effect on sex expression was only produced by the nitrogen treatment for predominately female monoecious sex form.
- Sex expression was different between genotypes within monoecious sex forms. This conclusion suggests that the stability of sex expression in buffalograss is genotype dependent.

THREADING THE JOURNALS continued

EFFECTS OF NONIONIC SURFACTANTS, TEMPERATURE AND LIGHT ON GERMINATION OF WEED SEEDS

W Hurtt and R H Hodgson
Weed Science
Volume 35 Number 1
Pages 52-57
1987

Weed seed dormancy is an important factor for the survival of many weeds under various cropping conditions. Estimates of numbers of viable weed seeds in the soil profile vary widely with millions per acre [hectare] often cited. As many as 2,470,000,000 weed seeds per acre have been reported [about 400 per square inch of soil profile]. Weed seeds might be made more vulnerable to conventional weed control practices by chemically modifying their dormancy. Various chemicals promote germination, such as azide and nitrate, which is effective on some seeds having a light or alternating temperature requirement. Surfactant effects on weed seed germination have not been systematically investigated.

Research at USDA-ARS, Fort Detrick, Maryland has been conducted to test the hypothesis that nonionic surfactants could alter germination of seeds of several weed species exposed to light and temperature environments similar to those that might occur in the field.

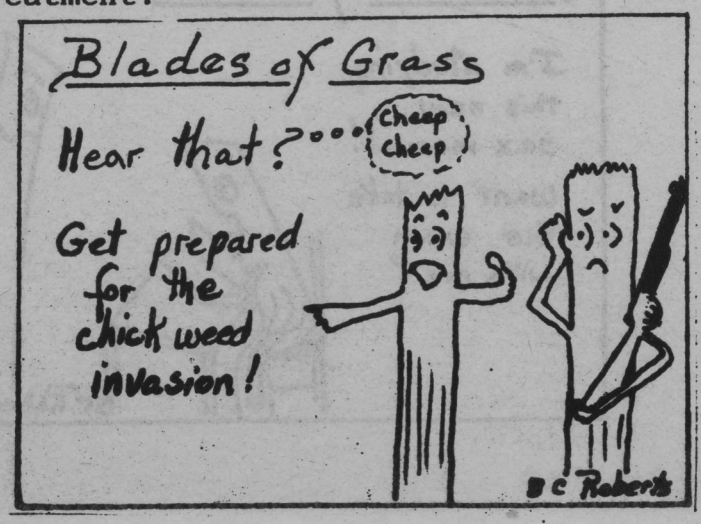
The following results are of interest.

- The nonionic surfactants Tween 20 and Tween 80 at concentrations of 0.05, 0.1, 0.2 and 0.4 percent volume/volume stimulated germination of barnyardgrass seeds in petri dishes.

- Germination of redroot pigweed seeds was inhibited by Tween 80 and Tween 20 under some conditions.

- Germination of tumble pigweed seeds was inhibited by both surfactants in the high temperature regime whether or not light was supplied.

- Common purslane seed were insensitive to treatment.



BEHAVIOR OF WEED SEED IN SOIL CLODS

Rinse Terpstra
Weed Science
Volume 34 Number 6
Pages 889-895
1986

Soil is generally considered a continuous and homogeneous medium. However, the tilled layer of many soils consists of more or less distinct clods or peds. Consequently in clod-forming soils, most weed seeds are inside the clods. Under field conditions the relationship between weed growth and clods is quite clear; fewer weeds are found when the soil is cloddy. More weeds are likely when seedbeds are made finer. Knowledge of the environmental influence on germination should ultimately result in an understanding and if possible a prediction of the field behavior of troublesome weeds. Cloddiness or the lack of it is obviously an environmental factor controlling weed seed behavior. Weed seed incorporated into soil structural units will be exposed to high moisture and low oxygen levels which are more conducive to seed dormancy than germination. Aggregate size and the rate of moisture loss may determine when and if these seed germinate. On the other hand, it seems reasonable to suspect that in the majority of buried seed, dormancy is enforced primarily by lack of light, although many successful weeds of arable land and pasture may start germination in darkness under the influence of fluctuating temperatures. The influence of seed size on germination and emergence of weeds is certainly important. Also, dense soil often yields fewer seedlings but more remaining viable seed than loose soil, while seed buried deeper in soil maintains higher viability because of continued dormancy. Moreover, tillage operations, by changing the size distribution and stability of soil aggregates and mechanically incorporating weed seed into soil aggregates, may modify the type, number and characteristics of seed-soil microsites.

Research conducted at The Wageningen Agricultural University in The Netherlands had as its main objective the study of factors causing germination in and emergence of weeds from soil clods in relation to clod size. An experiment was conducted with artificial clods made of sterilized soil mixed with weed seed. Germination, emergence and dormancy of five weed species in relation to clod size and hardness, as well as the influence of light were studied.

THRESHING THE JOURNALS continued

The following results are of interest.

- Higher germination occurred with larger seed- corn poppy, shepherdspurse, smooth crabgrass, common lambsquarters and Canada thistle, listed by increasing size of seed.

- Higher germination resulted in fewer dormant weed seed remaining in the clods.

- Germination decreased [13 percent] in the larger soft and hard clods with the smaller seed sizes. This lower germination was associated with more dormant seed remaining in the clod.

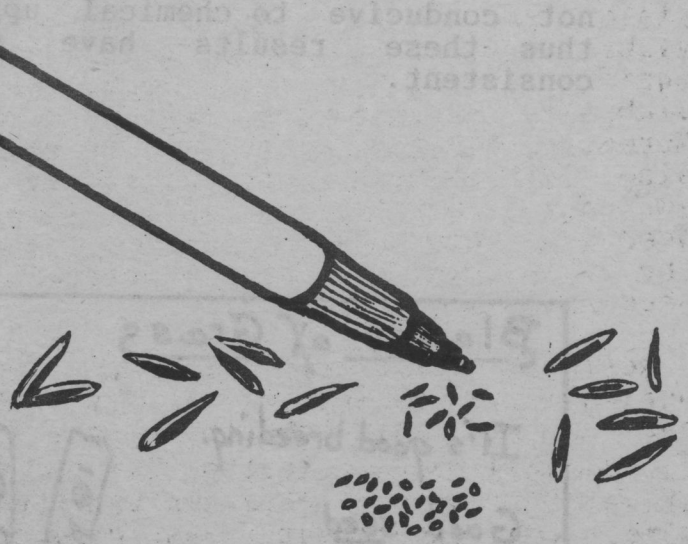
- Germination of the two larger seed decreased [23 percent] only in the larger soft clods.

- Nonemerged seedlings increased with larger clods and was most conspicuous with the three large seed in the hard clods. There were none with the three large seed in the soft clods.

- On the average, 70 percent of the germinated seed emerged.

- Differences in germination, as well as in nonemerged seedlings, caused decreased emergence on larger clods.

- Clod influence in germination and emergence was explained by the volumes of the clod layers involved and in some comparable aspects corresponded with volumes [depths] of soil layers.



ANNUAL BLUEGRASS AND CREEPING BENTGRASS GERMINATION RESPONSE TO FLURPRIMIDOL

R E Gaussoin and B E Branham
HortScience
Volume 22 Number 3
Pages 441-442
1987

Annual bluegrass invades close-cut irrigated intensively managed cool season turfs and within 3 to 5 years may dominate the stand. This weedy grass may invade desired species, filling voids left by mismanagement, disease, traffic, cultivation and other stresses. Annual bluegrass may reestablish these areas vegetatively or from seed in the soil.

Control programs are based on the removal of annual bluegrass over a number of years while managing the turf for the desired species, or reestablishment of the desired species after annual bluegrass eradication. One management approach would be to employ a plant growth regulator to inhibit selectively the growth of annual bluegrass and encourage the desired species, allowing a gradual transition from annual bluegrass dominance while maintaining turfgrass aesthetic and functional qualities.

Flurprimidol applied to annual bluegrass and creeping bentgrass polystands exhibits selectivity for annual bluegrass growth suppression, indicating a potential for use in the conversion process. If the annual bluegrass population in a mixed stand is very high, overseeding with creeping bentgrass is sometimes implemented. This research conducted at Michigan State University had the objective to determine if flurprimidol applications influenced germination of annual bluegrass and creeping bentgrass seed.

Results were reported as follows.

- Flurprimidol rates greater than 1/2 pound per acre [0.56 kilograms per hectare] decreased germination of both species.

- There would be no advantage in using flurprimidol in an overseeding program in terms of reducing the competition from germinating annual bluegrass.

- Use of flurprimidol at rates greater than 1/2 pound per acre should not be practiced at or near the time of bentgrass overseeding.

- Since only one biotype of annual bluegrass was evaluated in this research, and since there is extreme variability exhibited by this species, caution is suggested when extending these results to all annual bluegrass biotypes.

THRESHING THE JOURNALS continued

ROOT GROWTH, SEEDHEAD PRODUCTION AND QUALITY OF ANNUAL BLUEGRASS AS AFFECTED BY MEFLUIDIDE AND A WETTING AGENT

R J Cooper, P R Henderlong, J R Street & K J Karnok

Agronomy Journal
Volume 79 Number 5
Pages 929-934
1987

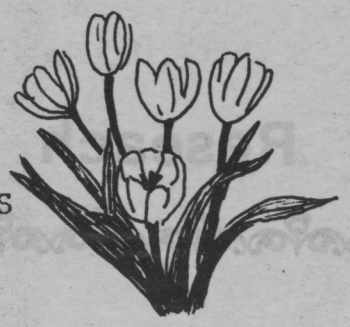
Annual bluegrass often comprises a large portion of the turfgrass sward on golf courses in cool humid climates and has been characterized as having an inherently shallow and poorly developed root system. Rhizotron studies have revealed that the root growth of creeping bentgrass is threefold greater than that of annual bluegrass throughout much of the growing season. Except for the first 20 weeks of establishment, annual bluegrass is often the most shallow-rooted grass around. The shallow-rooted reputation of annual bluegrass may be related to its growth under compacted soil conditions, since it is successful in colonizing highly compacted turf areas where more desirable turfgrass cannot persist. Regardless of the reason for the shallow root system, annual bluegrass does exhibit restricted rooting under typical golf course conditions, which often limits its stress tolerance and turfgrass quality.

In addition to its shallow root systems, extensive spring seedhead production is a major factor limiting the quality of annual bluegrass turf. Annual bluegrass is a prolific seed producer, with virtually every mature tiller producing an inflorescence. There is good reason to believe that the restricted rooting of annual bluegrass may be due, at least in part, to the monopolization of assimilates by developing seedheads during the spring season. Reduced root growth following flowering and seed production has been noted with other grasses.

Research at Ohio State University has concerned the evaluation of the plant growth regulator mefluidide and the wetting agent Aqua-Gro as agents to suppress seedhead development. In addition, studies have been made to determine if higher quality turf with a better developed root system would result from these treatments.

Results are reported as follows.

- Root elongation of mefluidide-treated annual bluegrass was superior to the control for 2 to 4 weeks following application.
- Maximum rooting depth of mefluidide-treated turf was greater than that of Aqua-Gro-treated or untreated turf during a test period in May.
- Mefluidide applied at 0.06 or 0.12 pounds per acre [0.07 or 0.14 kilograms per hectare] prevented seedhead emergence throughout the entire seedhead production period [approximately 8 weeks] when applied under environmental conditions favoring uptake. Leaf tip yellowing occurred 3 to 4 weeks following mefluidide application. Mefluidide treated turf, however, exhibited quality superior to untreated turf for approximately 6 weeks following discoloration.
- Aqua-Gro provided little seedhead suppression and reduced quality for about 10 days following application.
- Environmental conditions are at times not conducive to chemical uptake and thus these results have not been consistent.



DIFFERENTIAL GROWTH RESPONSES OF FRACTIONATED TURFGRASS SEED LEACHATES

J G Buta, D W Spaulding & A N Reed
HortScience
Volume 22 Number 6
Pages 1317-1319
1987

Water extracts of seeds, shoots or roots of many plants have been reported to inhibit seed germination and early seedling development and have been considered to be allelopathic. Seeds of tall fescue, Kentucky bluegrass and annual ryegrass have been leached with water and single concentrations of these solutions used to study the germination and development of various grass and legume seeds. Only seed leachates of annual ryegrass strongly inhibited the germination and early seedling growth of alfalfa, lespedeza, white clover and crownvetch. No inhibitory effects on grass seeds have been found in assays using the grass seed leachates.

Field plot experiments have been performed to determine whether cultivars and differing seeding percentage mixtures of Kentucky bluegrass and perennial ryegrass were important in the establishment of the turfgrass and its relative composition. If original mixtures contained at least 20 percent ryegrass seeds, very little bluegrass has been found in some resulting turf. It is not known whether germination and early seedling growth of these grass mixtures were affected by substances leached from the seed during germination.

Research at the USDA-ARS in Beltsville, Maryland was undertaken in part to examine whether the seed leachates of several species and cultivars of turfgrasses contain differing levels of inhibitory substances that might affect germination and early seedling development.

The following results have been reported.

- When seed leachates of Kentucky 31 and Rebel tall fescue, Citation and Manhattan perennial ryegrass and Mystic and Victa Kentucky bluegrass were evaluated for inhibition of lettuce [a widely used bioassay for allelopathic effects] germination and seedling growth, different degrees of inhibition were noted - Rebel > Kentucky 31 fescue; Victa > Mystic Kentucky bluegrass; Citation = Manhattan perennial ryegrass.

- When grass seed leachates were separated into organic and inorganic fractions, the organic fractions were inhibitory to lettuce seedling growth.

- Inorganic fractions were also inhibitory to lettuce seedling growth at high concentrations but were stimulatory at low concentrations.

- Results of these experiments indicate that both the inorganic and organic fractions of grass seed leachates contain inhibitory substances and that growth effects in the bioassay selected are dependent on concentrations of the leachate solutions obtained from various cultivars of the species tested.

Other Reseach Topics

SNOWMOBILE TRAFFIC RELATIONSHIPS ON TURFGRASSES

W J Eaton and J B Beard
HortScience
Volume 21 Number 3
Pages 531-532
1986

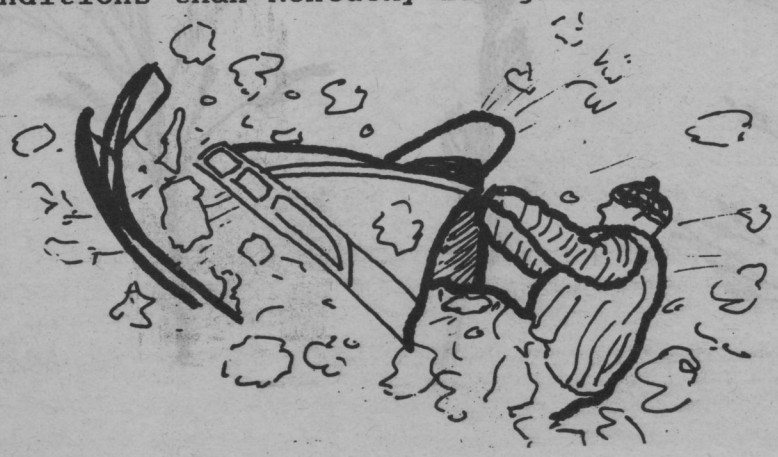
Snowmobiles are used increasingly as recreational vehicles on winter dormant turfgrass covered with snow. Parts or sections of parks and golf courses are being set aside for winter snowmobile use. In some situations, serious damage to turfgrasses occur. This study assessed the effects of 6 intensities of snowmobile traffic on 2 winter dormant turfgrasses covered with 5 different depths of snow. Soil conditions and cultural practices used on turf prior to these investigations were favorable for turfgrass growth and persistence.

The following results were recorded:

- No injury to either Penncross creeping bentgrass or to Merion Kentucky bluegrass was noted - even after 80 passes of the snowmobile over the shallow snow depth of about 1 inch [3 centimeters].

- Some areas outside the test area where the snowmobile turned were injured. When the machine track came in contact with the dormant turf, injury was noted.

- When snowmobiles are used on melting slushy snow, the slush is likely to be compacted. Subsequent low temperatures can freeze the hydrated plant crowns. From this kill of leaves, crowns and rhizomes of Kentucky bluegrass has been noted. Creeping bentgrass has greater resistance to injury under these conditions than Kentucky bluegrass.



- Grasses most susceptible to injury of this type [crown hydration followed by severe freeze] are:
  * ryegrasses
  * tall fescues
  * annual bluegrass
  * fine leaved fescues
  * Kentucky bluegrass

  in that order.

- Creeping bentgrass, rough bluegrass and colonial bentgrass are least susceptible to direct low-temperature kill.

GRASS INTERPLANTING IN HORTICULTURAL CROPPING SYSTEMS

J D Butler
HortScience
Volume 21 Number 3
Pages 394-397
1986

Some 5,000 grass species have been identified worldwide. More than 1,400 of these are found in the United States. The potential benefits of interplantings in horticultural crops justifies the effort to identify the most appropriate grasses for this practice. What do grass interplantings do ?

- reduce erosion;
- increase water infiltration into the soil;
- improve traffic-carrying ability;
- improve soil structure;
- limit weed invasion;
- moderate soil temperatures;
- reduce soil contamination.

There are some disadvantages:

- increased competition for water and nutrients;
- harborage of pests;
- expensive to establish and maintain.

Desired characteristics of grasses for horticultural interplantings include:

- low growth;
- fast germination;
- rapid cover;
- dense and weed resistant cover;
- drought tolerance;
- shade tolerance;
- wear resistance.

Cool-season grasses for use as interplantings:

- Kentucky bluegrass;
- fine fescue;
- tall fescue.

Warm-season grasses for use as interplantings:

- bermudagrass;
- zoysiagrass.

According to Dr Butler, the following points are important for consideration:

- Days necessary for germination:
  * perennial ryegrass - 5-6 days;
  * annual ryegrass - 5-8 days;
  * red fescue - 5-12 days;
  * tall fescue - 6-12 days;
  * Kentucky bluegrass - 6-30 days.
- Characteristic seedhead heights for unmown grass:
  * buffalograss - 4-8 inches [10-20 centimeters];
  * bermudagrass - 6-12 inches [15-30 centimeters];
  * Kentucky bluegrass - 8-30 inches [20-75 centimeters];
  * fine fescue - 18-36 inches [45-90 centimeters];
  * perennial ryegrass, annual ryegrass, fairway wheatgrass - 24-36 inches [60-90 centimeters];
  * tall fescue - 24-48 inches [60-120 centimeters].

Generally the new turf types, such as Rebel, Falcon, Olympic and Mustang, would be preferred over the coarse-textured open and tall-growing cultivars such as Alta, Kentucky 31 or Fawn.

- Water use and drought tolerance:
  * Evapotranspiration rates are usually higher for cool season grasses than for warm season types.
  * Tifway bermudagrass and buffalograss use about 20 percent less water than Merion Kentucky bluegrass and Rebel tall fescue. In Colorado, the total water use for 4 cool-season grasses was in the order from most to least: tall fescue, Kentucky bluegrass, perennial ryegrass and fine fescue.
  * Bermudagrass, blue grama and buffalograss may become more commonly used for interplantings in the drier parts of the United States.
  * Among the cultivars that performed well under drought conditions at Fort Collins were:
    - Kentucky bluegrasses:
      Majestic
      America
    - Perennial ryegrasses:
      Aristocrat
      Bellatrix
      Citation
      Yorktown.
- Heat hardiness:
  * Most heat hardy grasses are zoysiagrass, bermudagrass, carpetgrass, bahiagrass and buffalograss.
- Cold hardiness:
  * Most cold hardy grasses are creeping bentgrass, Kentucky bluegrass.

Tall Fescues

ESTABLISHMENT CLIPPING OF TALL FESCUE AND COMPANION ANNUAL RYEGRASS

A D Brede and J L Brede
Agronomy Journal
Volume 80 Number 1
Pages 27-30
1988

Annual ryegrass use in lawn establishment has been discouraged by turf scientists because of its undesirable qualities [coarse texture, pale color and annual growth cycle]. It is used sometimes for soil stabilization because seedlings of annual ryegrass are extremely vigorous and emerge rapidly.

Tall fescue is a desirable turfgrass species because of its stress tolerance and wide adaptation, particularly in the southern United States. Unfortunately, tall fescue is slow to establish, especially under high temperature conditions. When annual ryegrass is used as a companion crop with tall fescue as a means of stabilizing the soil during establishment, the highly competitive nature of the ryegrass creates an early dominance over the fescue. Much of this is caused by vigorous root competition by the ryegrass. Annual ryegrass also has a high shoot growth rate and competes effectively for light in the seedling stage.

Research was conducted at Oklahoma State University to develop a clipping treatment that would allow annual ryegrass to effectively stabilize the soil in a mixture with tall fescue but that would reduce the dominance of annual ryegrass in the maturing turf. Results have been reported as follows:

- From 22 to 50 percent of the variability in shoot and root growth in turf 60 days old is attributed to initial clipping treatments, including clipping heights, weeks from emergence to first clip and clipping repetitions.

- On the first day of emergence, 90 percent of ryegrass seedlings had emerged while only 50 percent of the tall fescue seedlings had emerged. This suggests a potential for managing species dominance by clipping.

- With a 4:1 fescue/ryegrass mixture, waiting 6 weeks before initially cutting the turf favored annual ryegrass. Tall fescue was generally favored by a single clipping at 1/4 inch height [7 millimeters] some 3 days after annual ryegrass emergence.

- Initial clipping treatments reduced ryegrass ground cover at 60 days from 82 percent to as little as 46 percent.

- Improvements in mulch materials in recent years have nearly eliminated the need for companion crop planting of turfgrasses. However, if highly erosive or adverse conditions necessitate a companion species, close clipping should be practiced as soon after emergence as feasible.

THATCH ACCUMULATION IN TALL FESCUE TURFS

R C Shearman, B E Anderson, D M Kopec
and T P Riordan
HortScience
Volume 21 Number 5
Page 1164
1986

Differences in species, cultivars and cultural practices influence thatch accumulation. Tall fescue turfs typically are not troubled by thatch build-up. Under the right conditions, thatch accumulation can be anticipated with any species or cultivar.

Research conducted at the University of Nebraska has produced the following results:

- Thatch accumulation was greater in turf-types than forage types.

- Thatch accumulation was directly related to verdure and total cell wall production.

- Cellulose, hemicellulose and lignin are primary constituents of thatch. Cultivars with high total cell wall production per unit area represent high thatch accumulation potential, particularly under conditions that favor organic matter production over decomposition.

QUANTIFICATION OF ACREMONIUM COENOPHIALUM IN TALL FESCUE SEED USING NEAR INFRARED REFLECTANCE SPECTROSCOPY

N S Hill, J C Petersen, R A Shelby, L W Dalrymple and F E Barton II
Crop Science
Volume 27 Number 6
Pages 1291-1295
1987

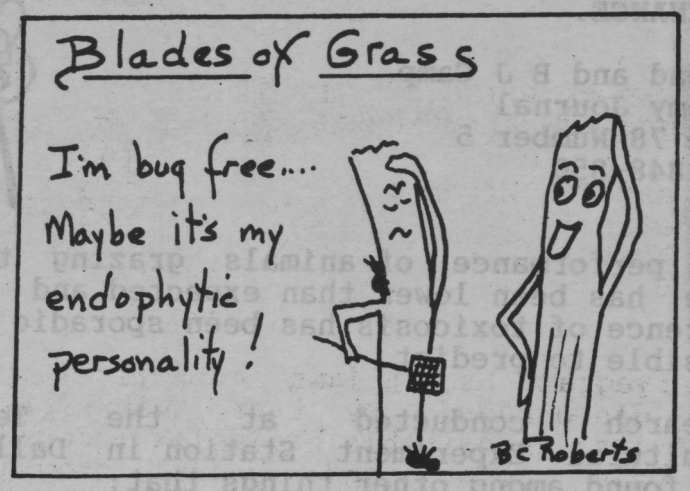
Routine testing of seed for endophyte is conducted in some state laboratories. Two procedures, mycelium staining and enzyme-linked immunosorbent assay have been investigated for use in identifying the endophyte in tall fescue seed. Commonly, microscopic identification of stained mycelium is used for routine analysis of seed lots because the enzyme-linked immunosorbent assay gives false results on uninfected samples. Both procedures are laborious and development of a more reliable and rapid technique is needed.

Research at the University of Georgia has been conducted to determine a suitable procedure to calibrate near infrared reflectance spectroscopy for routine analysis of endophyte in tall fescue seed. The following results have been obtained.

- Once accurately calibrated, near infrared reflectance spectroscopy can be used to rapidly and precisely determine major chemical constituents of plant material as related to quality. Minor organic and inorganic constituents can be determined.

- Laboratory procedures currently used to analyze for endophyte are neither precise nor accurate enough to provide reliable data to calibrate near infrared reflectance spectroscopy.

- This lack of accuracy, especially at low infection rates, necessitates development of a more accurate endophyte assay from which near infrared reflectance spectroscopy can be calibrated.



TOLERANCE OF WEED COMPETITION ASSOCIATED WITH HIGH LEAF-AREA EXPANSION RATE IN TALL FESCUE

F Forcella
Crop Science
Volume 27 Number 1
Pages 146-147
1987

With various crop cultivars [not necessarily turfgrass] a high rate of leaf-area expansion is considered a trait that allows some weeds to compete and proliferate relative to closely related uncompetitive species that have low leaf area expansion rates.

Research conducted at the North Central Conservation Research Laboratory in Morris, Minnesota with non-turf type cultivars has produced results as follows:

- Tall fescue plants that possess genes that code for and express high rates of leaf area expansion can tolerate weed interference more effectively than fescue plants lacking such genes.

- These genes may be valuable additions to crop breeding programs because cultivars with the associated traits may better tolerate interference from weeds that escape chemical and/or cultural control.

- Such genes could also reduce currently necessary levels of chemical and cultural weed control.

THRESHING THE JOURNALS continued

THE EFFECT OF THE FUNGAL ENDOPHYTE ACREMONIUM COENOPHIALUM IN TALL FESCUE ON ANIMAL PERFORMANCE, TOXICITY AND STAND MAINTENANCE.

J C Read and B J Camp
Agronomy Journal
Volume 78 Number 5
Pages 848-850
1986

The performance of animals grazing tall fescue has been lower than expected and the occurrence of toxicosis has been sporadic and impossible to predict.

Research conducted at the Texas Agricultural Experiment Station in Dallas, Texas found among other things that:

- Forage production was low and there was a loss of stand in pastures with low levels of the endophyte [Acremonium coenophialum].

FUNGAL ENDOPHYTE INFECTION - LOLINE DERIVATIVE ALKALOID CONCENTRATION OF GRAZED TALL FESCUE

D P Belesky, J D Robbins, J A Stuedemann, S R Wilkinson and O J Devine
Agronomy Journal
Volume 79 Number 2
pages 217-220
1987

Impaired animal performance on tall fescue pasture has been associated with the presence of a fungal endophyte [Acremonium coenophialum]. [Editors note: Endophytes are also associated with persistance of turf stands of tall fescue].

A number of alkaloids occur in endophyte infected tall fescue. A study has been conducted at the USDA-ARS Southern Piedmont Conservation Research Center in Watkinsville, Georgia to examine the influence of nitrogen fertilization and season on endophyte infection and alkaloid concentration of grazed tall fescue. The following results have been noted:

- Endophyte infection frequency was not affected by nitrogen.
- Endophyte infection frequency did not vary within a growing season.
- Loline derivative alkaloid concentration was directly related to endophyte infection frequency in each growing season.

An Obeisance to Grass

Of all that lives and grows
  Most humble is the grass.
High pride is in the rose
  And vanities that pass
    Are clothed in arrogance.
But grass is meek. The strong
  Need pride nor arrogance.
As blood is in the heart,
As strength is in the sea,
  So grass is in the earth,
And sings as bright a song -
  As pure and humble mirth -
As sings in blood the heart,
  As sings in strength the sea.

For grass is sea and sun,
  Is dust of earth in song,
Is blood in vein and gone
  Most humble and most strong.

- John Howland Beaumont

Weed Control & Growth Regulation

Cool Season Grasses

CONTROLLED-RELEASE PREEMERGENCE HERBICIDE FORMULATIONS FOR ANNUAL GRASS CONTROL IN KENTUCKY BLUEGRASS TURF

D R Chalmers, H J Hopen & A J Turgeon
Weed Science
Volume 35 Number 4
Pages 533-540
1987

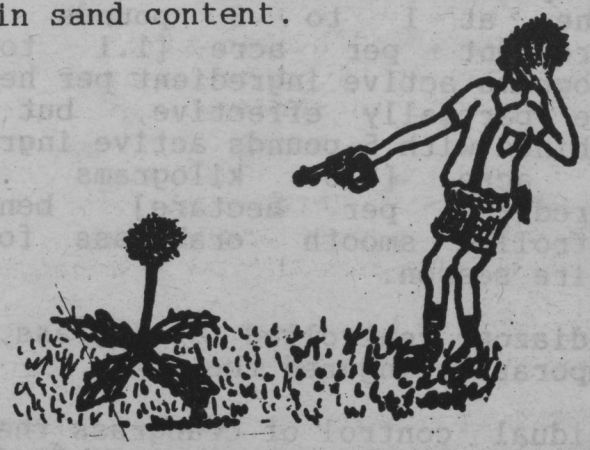
Preemergence herbicides are applied to control annual grass weeds in established turf. However, control can vary with herbicide, location and application date. Turfgrass injury can result from their use. Application rates are usually above those needed for control but below a level that causes turf injury. The effective period of control can depend on how readily an herbicide is depleted through volatilization, leaching, sorption by organic matter, adsorption by plants, or chemical, photo chemical and microbial degradation.

The dinitroaniline class of herbicides is characterized as being relatively immobile in soil, of low water solubility and subject to varying degrees of loss through volatilization and photodecomposition. Benefin, a dinitroaniline is widely used as a preemergence turf herbicide. It is less effective for smooth crabgrass control than other preemergence herbicides. Shortened residual activity of benefin reduces smooth crabgrass control from early spring applications. This shortened effective period of control from single benefin applications can be offset by increased application rates or by repeat applications. Split applications of other preemergence herbicides have been reported to be effective in control of annual grasses with reduced turfgrass injury.

An alternate method of extending the effective period of control and reducing the potential for nontarget injury is to regulate the bioavailability of the active ingredient through the use of controlled-release formulations, such as starch xanthide and sludge polymer. Herbicide starch xanthide formulations have demonstrated controlled-release properties in comparisons with conventional formulations.

Research at The University of Illinois was conducted to evaluate the performance of starch xanthide and sludge polymer formulations of preemergence herbicides for annual grass control in Kentucky bluegrass turf. Phytotoxicity to Kentucky bluegrass turf; control of large crabgrass; persistence in crabgrass control; and characterization of benefin release from starch xanthide granules were emphasized. The following results have been reported.

- Turf injury was greatest with sludge polymer oxadiazon and prosulfalin formulations.
- Starch xanthide formulations of oxadiazon and prosulfalin caused decreased and/or delayed injury and provided control comparable to conventional formulations.
- Coarse starch xanthide granules containing prosulfalin caused less turf injury than fine granules, while the opposite effect was noted at times with starch xanthide oxadiazon.
- The starch xanthide matrix restricts herbicide availability which results in a safening effect, without reducing large crabgrass control.
- Starch xanthide performance in field situations appears to be influenced most by granule size and not by cross-linking agent or degree of substitution.
- The greenhouse comparisons suggest that selection of cross-linking agent can influence herbicide release from starch xanthide granules applied to soils high in sand content.



SMOOTH CRABGRASS CONTROL IN KENTUCKY BLUEGRASS TURF WITH HERBICIDES APPLIED PREEMERGENCE

P C Bhowmik
Weed Technology
Volume 1 Number 2
Pages 145-148
1987

Crabgrass, a C4 summer annual, is among the most difficult weeds to control in turf. Seeds of crabgrass begin to germinate in late May to early June, depending upon the region, and continue to germinate throughout the summer. To maintain good quality turf, crabgrass control is essential. The selective control of crabgrass can be achieved with preemergence herbicides.

Effective preemergence application of herbicides must provide season-long control for later emerging crabgrass. Variation in performance of herbicides may be attributed to formulation, to rate and timing of herbicide application and to differences in environmental conditions.

DCPA, Bensulide and Napropamide generally provide excellent crabgrass control. Limited information is available on the performance of combinations of bensulide and napropamide.

Research at The University of Massachusetts has been conducted to determine the most desirable rates of herbicide combinations for annual preemergence application; to assess any potential injury to the turfgrass and to evaluate the effectiveness of herbicide combinations in the year following application. The following results have been listed.

- In field experiments, preemergence applications of bensulide or DCPA at 10 pounds active ingredient per acre [11.2 kilograms active ingredient per hectare] controlled smooth crabgrass selectively in turf.

- Granular and liquid formulations of bensulide performed similarly.

- Napropamide granules, when applied alone, at 1 to 3 pounds active ingredient per acre [1.1 to 3.4 kilograms active ingredient per hectare] were partially effective, but when combined with 5 pounds active ingredient per acre [5.6 kilograms active ingredient per hectare] bensulide controlled smooth crabgrass for the entire season.

- Oxadiazon controlled crabgrass, but temporarily injured the turf.

- Residual control of crabgrass the year after treatment was unacceptable for all treatments.

MEFLUIDIDE APPLICATIONS FOR ANNUAL BLUEGRASS SEEDHEAD SUPPRESSION BASED ON DEGREE-DAY ACCUMULATION

T K Danneberger, B E Branham & J M Vargas,Jr
Agronomy Journal
Volume 79 Number 1
Pages 69-71
1987

Annual bluegrass is the predominant turfgrass species on a number of golf course fairways and greens found in the northern United States and Canada. Maintained under intensive culture, annual bluegrass forms a dense uniform turf. A major limitation in the use of annual bluegrass is its prolific seed production in the spring. Seedhead production reduces the aesthetic quality, disrupts the uniformity and reduces potential root growth of annual bluegrass turf.

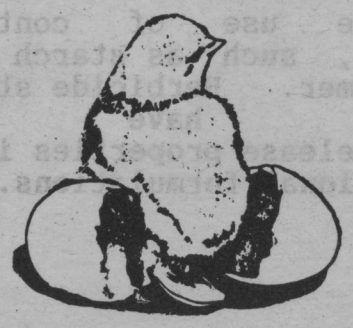
Mefluidide is a plant growth regulator capable of suppressing seedhead production in annual bluegrass and other cool season grasses. The timing of a mefluidide application is a critical factor in the degree of seedhead suppression achieved. Due to natural climatic patterns, the optimum time for mefluidide application will vary from year to year and from location to location. Rates of mefluidide application are also critical as this chemical can be phytotoxic.

Research at Ohio State University and Michigan State University has been conducted to determine if mefluidide applications could be timed to give optimum seed head control based on a seedhead emergence model. Results indicate the following.

- Mefluidide applied between 15 and 30 growing degree days at 0.125 pounds per acre [0.140 kilograms per hectare] gave excellent seedhead suppression.

- Mefluidide applied between 15 and 30 growing degree days at 0.06 pounds per acre [0.070 kilograms per hectare] gave moderate seedhead suppression.

- Applications of mefluidide at 45 growing degree days or at 0.03 pounds per acre [0.035 kilograms per hectare] rate were unacceptable.



THRESHING THE JOURNALS continued

EFFECTS OF TURF CULTIVATION PRACTICES ON THE EFFICACY OF PREEMERGENCE GRASS HERBICIDES

B E Branham and P E Rieke
Agronomy Journal
Volume 78 Number 6
Pages 1089-1091
1986

Cultivation is an important practice used on intensely trafficked turfgrass sites to relieve compaction and improve rooting. Because cultivation practices usually result in some turf injury and potential for desiccation damage, cultivation is usually timed so the turf is not under drought or heat stress immediately following cultivation. Thus, in the cool, humid portion of the United States, the prefeered times of cultivation are spring or fall when temperatures are moderate and roots are growing rapidly. On many turf sites, summer annual weeds, such as large crabgrass and goosegrass, are serious problems. Preemergence herbicide labels instruct the user not to perform a cultivation operation after herbicide application so as not to lessen annual grass control.

Research conducted at Michigan State University has examined the effect of three cultivation operations performed at the time of herbicide application or 4 weeks after herbicide application on the activity of three commonly used preemergent annual grass control herbicides on an annual bluegrass turf, the predominate species found on golf course fairways in the northeast region of the United States. The following results have been reported.

- Neither cultivation nor time of cultivation had an effect on the degree of crabgrass control afforded by benefin, bensulide or DCPA.

- The only difference occurred when comparing the herbicide treated plots with an untreated control.

- These data indicate that cultivation operations can be safely performed in the spring without disrupting the preemergence herbicide barrier. This study was conducted on a turf maintained as a fairway with a very high turf density. Whether the results would be the same on turfs maintained at higher mowing heights with less density was not determined.

CHLORSULFURON ACTIVITY ON SEVEN COOL SEASON GRASSES

B M Maloy and N E Christians
HortScience
Volume 21 Number 4
Pages 1012-1014
1986

Perennial cool-season grasses are often the most serious weed problem in Kentucky bluegrass because of their physiological similarities to that species. The only methods of control for these perennial grass weeds are mechanical digging or the use of nonselective herbicides.

Chlorsulfuron is a new herbicide that is 10 to 100 times more active than most herbicides and currently is labeled for selective control of both broadleaf and grass weeds in cereal crops. It has some selectivity among cool-season grasses and has been shown to have little effect on Kentucky bluegrass.

Research at Iowa State University has been conducted to determine the effects of chlorsulfuron on 7 cool-season grass species often found in a Kentucky bluegrass turf. The following results have been noted.

- Tall fescue and perennial ryegrass are very sensitive to chlorsulfuron.

- Creeping bentgrass, hard fescue, quackgrass and smooth bromegrass are more tolerant of chlorsulfuron treatments.

- Annual bluegrass sensitivity to chlorsulfuron has been inconsistent.

- Application rates for chlorsulfuron ranged from 0.125 to 0.250 pounds active ingredient per acre [141 to 282 grams active ingredient per hectare].

FENOXAPROP-ETHYL FOR POSTEMERGENCE CRABGRASS CONTROL IN KENTUCKY BLUEGRASS

P C Bhowmik
HortScience
Volume 21 Number 3
Pages 457-458
1986

Crabgrass is a serious weed in home lawns, golf courses and other turf grass areas. Selective crabgrass control can be achieved with preemergence herbicides. Effectiveness of these herbicides varies considerably year to year and region to region.

Postemergence control of crabgrass has been obtained with arsenicals, such as MSMA. Control failures that had related turfgrass discoloration involved application number and environmental conditions conducive to herbicide phytotoxicity. In addition, timing of herbicide application with respect to crabgrass development is key to its effective control.

Fenoxaprop-ethyl, a new herbicide, provides excellent postemergence control of several annual grasses. Research at The University of Massachusetts has been conducted to evaluate effectiveness of this herbicide for crabgrass control; to determine optimum stage of crabgrass growth for postemergence control and to assess any possible chemical injury to the turf. Results have been noted as follows.

- Fenoxaprop-ethyl applied at rates of 0.08 to 0.25 pounds per acre [0.09 to 0.28 kilograms per hectare] provided effective smooth crabgrass control with minor injury to Baron Kentucky bluegrass.
- Optimum timing for application was the 4-leaf to 5-tiller stage of crabgrass growth. At this stage of growth, fenoxaprop-ethyl applied at 0.18, 0.25 or 0.34 pounds per acre [0.20, 0.28 or 0.38 kilograms per hectare] provided excellent [90 percent or better] season-long crabgrass control.
- Fenoxaprop-ethyl at 0.08 pounds per acre [0.09 kilograms per hectare] was an effective crabgrass control treatment at 2 to 4 leaf stage when combined with DCPA at 10.5 pounds per acre [11.76 kilograms per hectare].
- Split applications of fenoxaprop-ethyl in June and July at both 0.125 plus 0.125 and 0.25 plus 0.25 pounds per acre [0.14 plus 0.14 and 0.28 plus 0.28 kilograms per hectare] also provided season-long crabgrass control.

KENTUCKY BLUEGRASS AND ANNUAL BLUEGRASS RESPONSES TO ETHOFUMESATE

R C Shearman
HortScience
Volume 21 Number 5
Pages 1157-1159
1986

Annual bluegrass is a pest in many intensely used sports turfs that are well irrigated and receive ample nitrogen. Ethofumesate controls annual bluegrass in perennial ryegrass with little or no detrimental effects on the desirable turf.

Research has been conducted at The University of Nebraska to compare ethofumesate with bensulide for annual bluegrass efficacy and potential injury to Kentucky bluegrass. The following results are noted.

- Ethofumesate applied at 1 to 3 pounds per acre [1.1 to 3.3 kilograms per hectare] reduced verdure and clipping yields of Park and Touchdown Kentucky bluegrass, but gave significant annual bluegrass control.
- Bensulide applied at 12 pounds per acre [13.6 kilograms per hectare] caused no injury but unsatisfactory annual bluegrass control.
- In other tests, ethofumesate caused injury at 7 and 15 days after treatment, but only the repeat treatments had significant injury at 60 days after treatment. No injury was detectable at 260 days after treatment. Excellent annual bluegrass control was obtained at 2 pounds per acre [2.2 kilograms per hectare] and 2 plus 1 pound per acre [2.2 plus 1.1 kilogram per hectare].
- Good annual bluegrass reduction was noted for other treatments with the exception of bensulide which only reduced the pest population by 50 percent.
- Lateral spread of Touchdown Kentucky bluegrass increased with ethofumesate treatment when compared to the untreated control. This was related to reduced annual bluegrass competition.

NITROGEN AND PHOSPHORUS NUTRITIONAL INFLUENCE ON BENTGRASS-ANNUAL BLUEGRASS COMMUNITY COMPOSITION

W M Dest and K Guillard
Journal American Society for Horticultural Science
Volume 112 Number 5
Pages 769-773
1987

Much of the plant population in a turfgrass community that is frequently irrigated and closely and frequently mowed, such as that found in a golf course fairway, may be comprised of annual bluegrass. Overseeding with other grass species, particularly creeping bentgrass and colonial bentgrass cultivars, has been employed to reduce annual bluegrass populations to manageable levels.

Bentgrasses and annual bluegrass thrive on close mowing and frequent irrigation, practices that must be maintained to obtain a turf that meets playing requirements on golf courses. Therefore, it is difficult to manipulate these two cultural practices so as to shift the plant community to the population levels of bentgrass often desired by the turf manager. However, controlling nitrogen and phosphorus fertilization can be useful if the influence of these two elements on the botanical composition of the bentgrass-annual bluegrass community is known.

Research at The University of Connecticut has been conducted to evaluate the effect of nitrogen and phosphorus fertilization on the change in species composition of a bentgrass and annual bluegrass turf. Results are reported as follows.

- Bentgrass population increased in those areas from which nitrogen was withheld for 3 years compared to areas that were fertilized with nitrogen.

- Phosphorus fertilizer treatments had no effect on species composition.

- Except for one of the three ratings made in 1982, turf quality was not reduced by withholding nitrogen. Quality began to improve in 1984 on the no-nitrogen plots compared to the nitrogen-fertilized plots. This change was associated with increased bentgrass population.

- Although the nitrogen content of the leaf tissue was greater in the bentgrass tissue compared with annual bluegrass, leaf tissue concentrations were within or above the sufficiency range for grasses.

This study has shown that withholding nitrogen fertilization in some years under certain conditions gives bentgrass a competitive advantage over annual bluegrass without lessening turf quality.

TOLERANCE OF PERENNIAL RYEGRASS AND TALL FESCUE SEEDLINGS TO FENOXAPROP

P H Dernoeden
Agronomy Journal
Volume 79 Number 6
Pages 1035-1037
1987

Fenoxaprop is an effective postemergence herbicide for summer annual grass weed control in cool-season turfgrasses. Fenoxaprop has been reported to stunt and discolor Kentucky bluegrass, particularly when applied in spring. Creeping bentgrass may be severely injured by fenoxaprop applied at recommended labeled rates. Little if any injury, however, has been associated with fenoxaprop use on perennial ryegrass and tall fescue turf. However, little is known regarding the sensitivity of seedlings to this herbicide.

Research at The University of Maryland has been conducted to determine the tolerance of seedlings and immature plants of perennial ryegrass and tall fescue to fenoxaprop and to assess establishment of these species in the presence of competition from smooth crabgrass and fenoxaprop treatments. The following results have been reported.

- Fenoxaprop caused seedling yellowing of Citation and Palmer perennial ryegrass and Olympic and Houndog tall fescue on one of six application dates over a two year period.

- No stand reduction or other adverse visual effects from any fenoxaprop treatment - 0.08 to 0.25 pound per acre [0.09 to 0.28 kilogram per hectare] were observed.

- Fenoxaprop applied at 0.08 pound per acre [0.09 kilogram per hectare] effectively controlled [greater than 90 percent] one to three-leaf stage smooth crabgrass.

- But, 0.25 pound per acre [0.28 kilogram per hectare] of fenoxaprop was required to effectively control two to four tiller stage smooth crabgrass.

- Single applications of fenoxaprop at all rates and dates of application were sufficient to reduce smooth crabgrass competition and insure good [89 percent] to excellent [99 percent] turfgrass cover.

EFFECT OF TEMPERATURE, MOISTURE, AND SOIL TEXTURE ON DCPA DEGRADATION

J S Choi, T W Fermanian, D J Wehner and L A Spomer
Agronomy Journal
Volume 80 Number 1
Pages 108-113
1988

The chemical control of annual grasses is regarded as one of the most important procedures in turfgrass maintenance. The use of preemergence herbicides has been very effective for the short-term control of this group of weeds. To maintain a sufficient concentration of herbicide in the soil for continued control of grass weeds from early spring through mid-summer, it is necessary to apply the herbicide in concentrations above that required for initial control.

Turf managers sometimes experience poor or early loss of control of targeted weeds even when the herbicides are applied at recommended rates. This may be attributed to herbicide concentration dropping below the threshold level for control before the weed season is over.

The ability to predict preemergence herbicide degradation in turf is essential for herbicide optimal use. In this way, excessive pesticide applications would be avoided, a benefit from the standpoint of both economics and environmental quality. DCPA was chosen as a representative turfgrass herbicide for this study because it is used widely in turfgrass management operations and the methodology for its analysis in soil has been demonstrated.

Research at The University of Illinois has been conducted to investigate the effects of soil temperature, soil moisture and soil texture on DCPA persistence applied at the labeled usage rate. The following results have been obtained.

- Soil temperature, soil moisture and soil texture each influenced the persistence of DCPA.

- Soil temperature influenced the rate of DCPA degradation in the following order: 50<<59<<68<77=86>95 degrees Fahrenheit [10<<15<<20<25=30>35 degrees Centigrade].

- The average half-life ranged from 92 days at 50 degrees Fahrenheit [10 degrees Centigrade] to 18 days at 86 degrees Fahrenheit [30 degrees Centigrade].

- Soil moisture content influenced the rate of degradation in the following order: low - 0.22 pounds of water per 2.2 pounds of soil [0.1 kilogram water per kilogram of soil] < medium - 0.44 pounds of water per 2.2 pounds of soil [0.2 kilogram water per kilogram soil] = high - 0.88 pound of water per 2.2 pounds of soil [0.4 kilogram water per kilogram soil].

- The average half-life values for DCPA were 49, 33 and 31 days for the low, medium and high soil moisture levels, respectively.

- When an optimum environment for breakdown was provided - 77 to 86 degrees Fahrenheit [25 to 30 degrees Centigrade] - plus medium soil moisture, very fast degradation was observed [half-life of 11 days], while 105 days was estimated for the loss of half the initial concentration under unfavorable conditions of 50 degrees Fahrenheit [10 degrees Centigrade] and low soil moisture.

- Since the soil environment varies greatly throughout the year and over different locations, the period of effective DCPA concentration in the soil will not be constant. This might be an explanation for the inconsistency of weed control by DCPA in the soil.

- Soil environmental factors should be considered in determining the timing of second or subsequent applications when necessary, rather than following a fixed application schedule.

THRESHING THE JOURNALS continued

SELECTIVE CONTROL OF ANNUAL BLUEGRASS IN COOL SEASON TURFS WITH FENARIMOL AND CHLORSULFURON

M C Gaul and N E Christians
Agronomy Journal
Volume 80 Number 1
Pages 120-125
1988

Annual bluegrass is widely distributed throughout the world as a weed in both cool-season and warm-season turfs. In cool-season regions, annual bluegrass presents the biggest problems on golf course putting greens, fairways and tees, where many environmental and cultural factors place the desired turfgrass stands under stress, allowing for rapid establishment of annual bluegrass.

Research at Iowa State University has investigated the use of chlorsulfuron and fenarimol as postemergence selective controls for annual bluegrass; and has evaluated appropriate use-rates of both chemicals; has evaluated phytotoxic effects from these application rates on Kentucky bluegrass and creeping bentgrass; and has noted any differential effects of high single application rates of fenarimol on the two species grown under greenhouse conditions. Results have been reported as follows:

- Fenarimol was not effective in controlling annual bluegrass in the field or greenhouse and caused discoloration of creeping bentgrass in the field with rates of application accumulation above 4.4 pounds per acre [4.9 kilograms per hectare].

- Chlorsulfuron was effective in controlling all three annual bluegrass biotypes in the greenhouse and had no detrimental effects on creeping bentgrass or Kentucky bluegrass.

- In the field, chlorsulfuron was effective in controlling annual bluegrass at one of two testing sites. Chlorsulfuron was applied in the field at single application rates of 0.016, 0.032, 0.064, 0.128, and 0.256 pounds per acre [18, 35, 70, 140 and 280 grams per hectare] and in the greenhouse at single application rates of 0.064, 0.128, 0.187 and 0.256 pounds per acre [70, 140, 210 and 280 grams per hectare].

GRASS

by

Carl Sandburg

Pile the bodies high at Austerlitz and Waterloo.
Shovel them under and let me work -
I am the grass; I cover all.

And pile them high at Gettysburg
And pile them high at Ypres and Verdun.
Shovel them under and let me work.
Two years, ten years, and passengers ask the conductor:
What place is this ?
Where are we now ?

I am the grass.
Let me work.

- From Cornhuskers 1918

Weed Control – Warm Season Grasses

TOLERANCE OF OVERSEEDED PERENNIAL RYEGRASS TO SELECTED TRICALCIUM ARSENATE TREATMENTS

B J Johnson
HortScience
Volume 22 Number 5
Pages 886-888
1987

Annual bluegrass is one of the most common winter weeds that invade turfgrass areas throughout the United States. However, this weed can be controlled in nonoverseeded bermudagrass with either preemergence or postemergence herbicides. Annual bluegrass becomes more difficult to control when bermudagrasses are overseeded with a cool season grass. In most instances, preemergence herbicides must be applied at least 30 to 60 days prior to planting of the cool-season grass to avoid severe injury and stand loss. However, herbicides applied this early often allow germination and survival of the annual bluegrass.

Research at The University of Georgia on Tifway bermudagrass overseeded with Medalist VI perennial ryegrass and treated with variable rates and frequencies of 26 percent [flowable] tricalcium arsenate has produced the following results.

- Ryegrass was severely injured when tricalcium arsenate was applied in mid- to late fall, after it had fully germinated.
- Injury to ryegrass was not as severe when applied prior to or during germination.
- Timing of chemical application had more effect on injury than rate of application.
- Unseasonably cool weather in early fall can result in unacceptable injury in some years to the overseeded grass.
- Bermudagrass was not affected by any of the tricalcium arsenate treatments.

TURFGRASS SPECIES RESPONSE TO HERBICIDES APPLIED POSTEMERGENCE

B J Johnson
Weed Technology
Volume 1 Number 4
Pages 305-311
1987

A mixture of grass species in the same area often results in a poor quality turf because the leaf texture and color of the different species are incompatible. For example, professional turf managers would not want the fine leaf texture of hybrid bermudagrass and the coarse leaf texture of centipedegrass. Converting mixed turf into a uniform stand usually requires a complete renovation with a non-selective postemergence herbicide, such as glyphosate. However, controlling all of the grasses in the area, especially if the undesirable grass makes up only a small percentage of the total grass cover, may be undesirable.

In the southern United States, bermudagrass often contaminates other lawn grass species. Preferably an herbicide either should control or should retard bermudagrass enough for the desired grass species to compete and gradually to replace the bermudagrass. However, to be effective, an herbicide must suppress or must control bermudagrass without injuring the desired grass species.

Research has been conducted at The University of Georgia with sethoxydim applied at 0.3 pound active ingredient per acre [0.34 kilogram active ingredient per hectare], fluazifop at 0.11 pound of active ingredient per acre [0.13 kilogram active ingredient per hectare] and SC-1084 at 0.25 pound active ingredient per acre [0.28 kilogram active ingredient per hectare]. Results are reported as follows:

- All three herbicides controlled Tifway bermudagrass nearly 100 percent when applied for 2 consecutive years.

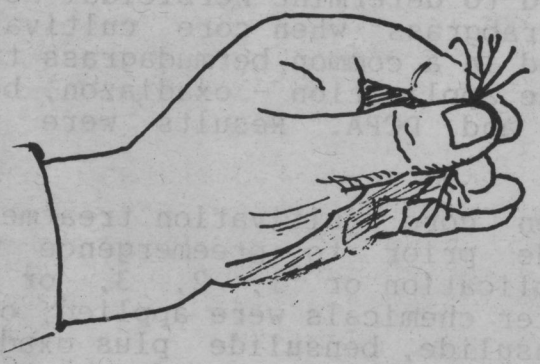
- Tall fescue tolerated fluazifop and SC-1087 at 1/4 to full strength.

- Centipedegrass and Emerald zoysiagrass did not tolerate these treatments.

- Centipedegrass tolerated sethoxydim, zoysiagrass tolerance was intermediate and tall fescue was injured severely.

- Sethoxydim applied at 0.2 pound per acre [0.22 kilogram per hectare] discolored leaves of zoysiagrass, but the turf recovered fully.

- Thus bermudagrass when mixed with either tall fescue, centipedegrass or zoysiagrass, can be controlled selectively with herbicides applied postemergence.



PURPLE NUTSEDGE CONTROL WITH IMAZAQUIN IN WARM-SEASON TURFGRASSES

G E Coats, R F Munoz, D H Anderson, D C Heering and J W Scruggs
Weed Science
Volume 35 Number 5
Pages 691-694
1987

Purple nutsedge is among the most difficult weeds to control in warm season turfgrasses. Methyl bromide, metham and glyphosate are available for controlling purple nutsedge before turfgrass establishment. However, no herbicides are presently available that selectively control purple nutsedge in major warm-season turfgrasses, such as bermudagrass, zoysiagrass, St Augustinegrass and centipedegrass.

Research at Mississippi State University has been conducted to evaluate the efficacy of imazaquin for purple nutsedge control under varying turf management practices. An additional objective was to determine tolerance of several warm-season turfgrasses to imazaquin. The following results have been obtained.

- Postemergence applications of imazaquin controlled higher levels of purple nutsedge in common bermudagrass and Tifgreen and Tifdwarf bermudagrasses than MSMA.

- Control was better at 0.5 or 0.75 pounds active ingredient per acre [560 or 840 grams active ingredient per hectare] of imazaquin than at lower rates.

- Postemergence applications of imazaquin plus 2 pounds active ingredient per acre [2240 grams active ingredient per hectare] of MSMA controlled more purple nutsedge than equivalent rates of imazaquin alone.

- Preemergence applications of imazaquin were not effective.

- Bermudagrass discoloration was observed in some experiments on turfs mowed at a height of 1/2 inch [1.3 centimeters] or less but usually disappeared within 2 to 3 weeks, especially when MSMA was used in combination with imazaquin.

- No injury was observed on bermudagrass, zoysiagrass, Raleigh St Augustinegrass and centipedegrass maintained at mowing heights above 1/2 inch [1.3 centimeters].

- Applications of imazaquin generally gave significant levels of purple nutsedge control for 7 to 9 weeks, whereas purple nutsedge regrowth following MSMA treatment was observed after 1 to 2 weeks.

CENTIPEDEGRASS TOLERANCE TO POSTEMERGENCE GRASS HERBICIDES

L B McCarty, J M Higgins, L C Miller and T Whitwell
HortScience
Volume 21 Number 6
Pages 1405-1407
1986

Centipedegrass is a warm-season perennial grass often used in the southeastern United States for limited wear areas such as lawns, industrial sites and along roadsides. Desirable characteristics of centipedegrass include reduced fertilizer requirements, pH range adaptability and reduced mowing frequency. Centipedegrass is established by seeds or vegetatively and due to its slow, stoloniferous growth habit, weeds often invade these areas. Postemergence control of weeds, such as bermudagrass, dallisgrass, crabgrass and goosegrass in centipedegrass is difficult to achieve without injury.

Research at Clemson University has involved phytotoxicity of single and sequential treatments of sethoxydim and fluazifop applied at 0.1, 0.2 and 0.3 pounds per acre [0.1, 0.2 and 0.3 kilograms per hectare]; haloxyfop, xylafop, fenoxaprop and SC-1084 at 0.07, 0.15, and 0.3 pounds per acre [0.07, 0.15 and 0.3 kilograms per hectare] on centipedegrass. The following results are worthy of note.

- Turf color generally was unaffected by sethoxydim application except for a slight discoloration at 14 days after treatment with the high rate. Recovery was evident from all rates of sethoxydim by 28 days after treatment. Turf density was similar to untreated control at 42 days after treatment.

- Single applications of fenoxaprop and SC-1084 at the low rate initially caused severe discoloration; however, recovery was evident by 42 days after treatment. Density also was unaffected at this time.

- Unacceptable turf color and density were observed with single and sequential applications of fluazifop, haloxyfop, xylafop and with sequential application of SC-1084 and fenoxaprop.

- Inconsistent responses with fenoxaprop indicate that further investigations using various rates and application under different environmental conditions are needed before usage on centipedegrass is accepted.

EFFECT OF CORE CULTIVATION ON PREEMERGENCE HERBICIDE ACTIVITY IN BERMUDAGRASS

B J Johnson
HortScience
Volume 22 Number 3
Pages 440-441
1987

Crabgrass is a common summer annual weed that invades turfgrasses throughout the United States. Many studies have shown that preemergence herbicide applications to turf in spring effectively control crabgrass, both smooth and large.

Core cultivation is used commonly on turfgrass sites in the spring and summer to improve wetting of dry spots, to stimulate root and shoot growth, to alleviate soil compaction and to control thatch. Core cultivation also has resulted in openings in the turf that favor weed seed germination and development. Therefore, coring is usually not performed after preemergence herbicide application to prevent disruption of the herbicide barrier. This restriction greatly limits the usefulness of core cultivation in many turf situations.

Research at The University of Georgia was conducted to determine herbicidal activity on large crabgrass when core cultivation was performed in a common bermudagrass turf after herbicide application - oxadiazon, bensulide, benefin and DCPA. Results were noted as follows.

- When core cultivation treatments were made prior to preemergence herbicide application or 1, 2, 3, or 4 months after chemicals were applied, oxadiazon, bensulide, bensulide plus oxadiazon and benefin, the timing of core cultivation had no influence on preemergence crabgrass control. These herbicides were applied at the following rates: 4.0 pounds per acre [4.4 kilograms per hectare], 10 pounds per acre [11.2 kilograms per hectare], 6.0 plus 1.5 pounds per acre [6.7 plus 1.7 kilograms per hectare] and 3.0 pounds per acre [3.4 kilograms per hectare], respectively.

- DCPA applied at 12.5 pounds per acre [14.0 kilograms per hectare] was ineffective in controlling large crabgrass, regardless of core cultivation.

THRESHING THE JOURNALS continued

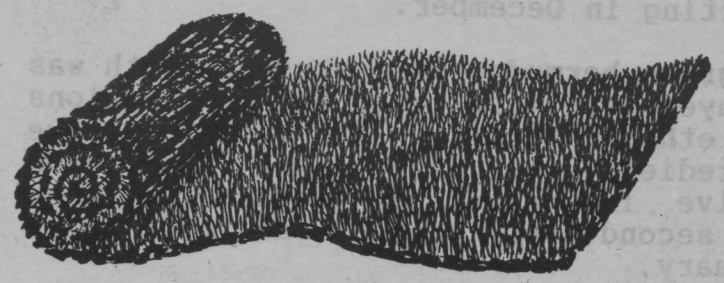
ATRAZINE EFFECTS ON TENSILE STRENGTH OF CENTIPEDEGRASS SOD

D L Turner and R Dickens
Agronomy Journal
Volume 79 Number 1
Pages 39-42
1987

Increased production of centipedegrass sod has emphasized problems with low tensile strength. Centipedegrass sod grown under high management conditions often has lower tensile strength than that harvested from pastures or other lower maintenance areas.

Atrazine is the predominant herbicide used in the production of centipedegrass sod. Atrazine can be applied to established centipedegrass with minimal injury to the above ground portion of the plant, but its effects on sod tensile strength were among the objectives of research conducted at Auburn University. The following results have been reported.

- Visual observations indicated that injury was increased as atrazine rates and application frequencies increased from 0.5 - 2.0 pounds per acre [0.6 - 2.2 kilograms per hectare] and from 2 to 4 week intervals during the growing season.
- Amount of injury varied with year experiment was run.
- Visual injury ratings were not consistent with sod tensile strength measurements.
- Increasing rates of atrazine reduced the tensile strength in a linear fashion.
- Injury was greated with the 2 week application interval.
- Reduction of tensile strength was more evident with sod harvested in September than in May.
- Sod tensile strength of untreated centipedegrass was higher during September than during the following May.



EVALUATION OF ETHOFUMESATE FOR ANNUAL BLUEGRASS AND TURFGRASS TOLERANCE

G E Coats and J V Krans
Weed Science
Volume 34 Number 6
Pages 930-935
1986

Annual bluegrass control in dormant bermudagrass overseeded with cool-season turfgrasses in the fall to provide a green turf during the winter period is a major problem throughout the south. The availability of selective herbicides that cause no injury during establishment of the overseeded cool-season turfgrass species or to the permanent bermudagrass turf is the primary limiting factor.

Paraquat and bensulide have been the most widely used herbicides for annual bluegrass control in dormant bermudagrass greens. Paraquat is used postemergence on non-overseeded greens where as bensulide is used preemergence in overseeded cool-season turfgrasses. Bensulide must be applied several weeks before overseeding, and a rapid establishment of the overseeded turfgrass is essential for effective control of annual bluegrass.

Research at Mississippi State University was conducted to evaluate ethofumesate control of annual bluegrass and phytotoxicity to non-overseeded Tifgreen bermudagrass maintained at putting green height under field conditions; to compare the growth response of actively growing Tifgreen and Tifdwarf bermudagrasses following application of ethofumesate in the greenhouse; and to determine the response of 29 cool-season turfgrasses to ethofumesate in the greenhouse. The following results should be noted.

THRESHING THE JOURNALS continued

- Annual bluegrass control in non-overseeded dormant Tifgreen bermudagrass was 75 percent or greater with at least two ethofumesate applications at monthly intervals starting in December.

- Tifgreen bermudagrass spring growth was delayed with more than two applications of ethofumesate at 1.0 pound active ingredient per acre [1.1 kilograms active ingredient per hectare] or when the second application was made after January.

- Under greenhouse conditions, the growth of both Tifgreen and Tifdwarf bermudagrasses was less when treated with ethofumesate.

- Stand and shoot growth of 29 cultivars of ryegrass, bluegrass, bentgrass and red fescue were reduced by ethofumesate at 1.0 pound per acre [1.1 kilograms per hectare] as a preemergence or split - 0.5 pounds per acre preemergence plus 0.5 pound per acre postemergence [0.5 kilogram per hectare preemergence plus 0.5 kilogram per hectare postemergence] application.

- Postemergence applications were less phytotoxic to cool-season turfgrasses than preemergence applications.

- Perennial ryegrass stands were generally not reduced by postemergence application of ethofumesate at 1.0 pound per acre [1.1 kilograms per hectare]; however, shoot growth was reduced.

CAST RELEASES REPORT ON SAFETY OF HERBICIDE 2,4-D

Each year, millions of acres of farmland, forests, home lawns and golf courses are treated with the herbicide 2,4-D. Public concern over the safety of 2,4-D has focused on whether it causes cancer in humans.

A new report from CAST - The Council for Agricultural Science and Technology - concludes that given current evidence, "as it is generally used, 2,4-D does not represent a significant health threat." However, the report "Perspectives on the Safety of 2,4-D" warms users to handle the herbicide with the caution necessary when applying any chemical that can cause harmful effects. The report also notes that several epidemiologic studies now in progress will provide further data on possible links between cancer and herbicide use.

Written for a lay audience, the report discusses how scientists assess the potential harmful effects on human health of any chemical, and 2,4-D in particular. The recent Kansas Farm Worker study - in which agricultural use of 2,4-D was associated with an increase in one type of cancer - is discussed in detail. Other studies of human exposure to 2,4-D are reviewed, and the use of laboratory animal studies to determine the effects of chemicals on humans is explained.

A ten-member task force of epidemiologists, toxicologists, and agricultural scientists prepared the report. Dr Lawrence J Fischer of the Center for Environmental Toxicology at Michigan State University, East Lansing, chaired the task force.

"Perspectives on the Safety of 2,4-D", a 16-page publication, is available for $2.00 from CAST, 137 Lynn Avenue, Ames, Iowa 50010-7120. For more information, contact Dr William W Marion, Executive Vice President of CAST, [515/292-2125].

Breaking NEW Ground in the Market Place

Youth have been the focus of most marketing strategies during recent years. Those with grey hair were never mentioned in ads. This is changing rapidly with the mid-age group [35-54 years] now representing over a third of the US population. This group controls about 45 % of personal income with 25 % of households in this age bracket earning $50,000 or more as a result of two incomes.

Association Trends, September 4,1987 reported these statistics. During the next 13 years the spending power of this group will grow by 80 %. Households headed by people under 35 will continue to decline and this youth market will account for less than 20 % of all spending by the year 2000.

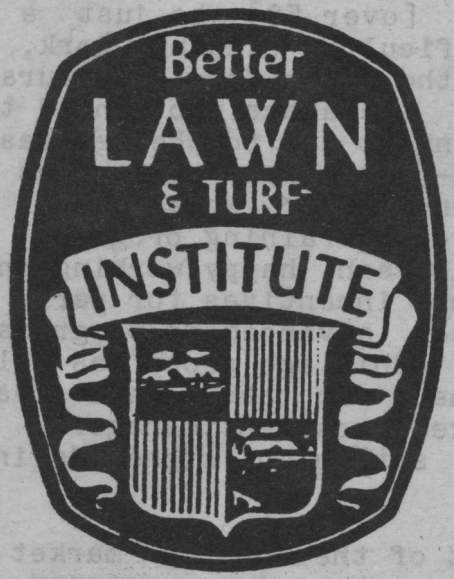
The second largest consumer market is concerned with those households headed by folks over 55. Thirty five percent of all homes are in this group, and control 30 % of all personal income.

Older workers, [over 50] who just a few years ago had difficulty finding work, now are in demand by the fast-food restaurants. The large pool of teenagers who manned these counters is drying up due to the decrease in births in the mid-60s. New strategies are underway to convince older workers to take these jobs. Special training programs, ads showing an older person happy working on his first day, economic incentives for part time workers, and career advancement programs are all under study. This age group has plenty of work experinece so they are easily trainable and make excellent managers. They are reliable and set high standards in the work place.

Another segment of the consumer market that has increased in number is concerned with those people living alone. These people now account for about 1/4 of all households. Chief factors in this trend are increases in numbers of widows, divorces and late marraiges.

Even so, the traditional households of husband-wife families account for 60 % of all homes so these folks should not be discounted in marketing strategies.

Editors Note: These trends are generally favorable for continuing emphasis on lawns and gardens.



THE LAWN INSTITUTE

County Line Road
P. O. Box 108
Pleasant Hill, Tennessee 38578-0108

ADDRESSEE....
HELP US KEEP
YOUR ADDRESS
CORRECT.....
If address is wrong
in any respect, please
correct directly, and
return to us.
THANK YOU

Lawn Institute Harvests is published four times a year by The Better Lawn and Turf Institute. The headquarters office address is P O Box 108, Pleasant Hill, Tennessee 38578-0108. Phone: 615/277-3722. Inquiries concerning all aspects of this publication may be addressed to the headquarters office.

The Better Lawn and Turf Institute is incorporated as a nonprofit business league formed exclusively for educational and research purposes concerned with agronomic, horticultural and landscape concepts.

Lawn Institute Harvests is dedicated to improved communications among turfgrass seed and allied turf industries and other firms, businesses, organizations and individuals with lawngrass research and educational interest and concerns.

Editor: Eliot C Roberts, PhD

Associate Editor: Beverly C Roberts, MA

Printer: Crossville Chronicle (Tennessee)