Volume 37 Number 3

LAWN

INSTITUTE

THE HABVEST MIN

When we read in a large newspaper that turf is an enemy, it is time for everyone in the Turfgrass Industry to do more than sit up and take notice. It is time for each person and each company to seriously spread the word to every level of every community just how important lawns and sports turf are to the environment and to individuals health. You will be interested in "Answers to Questions Asked The Lawn Institute About the Landscape Environment".

October 1990

ests

Grasscycling is one positive movement underway from the Professional Lawn Care Association of America which is of interest to every community.

Threshing the Journals includes articles on Warm Season Grasses, Natural Compounds as Potential Pesticides, Tissue Culture, and Seed Production.

Miscellaneous articles round out this issue.

ANSWERS TO QUESTIONS ASKED

THE LAWN INSTITUTE ABOUT

be removed and replaced with immeture plants, the galf THE LANDSCAPE ENVIRONMENT

by Eliot C Roberts, PhD Director

The Lawn Institute Pleasant Hill, Tennessee [decomposition or rotting]. In the latter instance, microorganisms are involved in processes that ultimately form human that enriches the soil.

For the past several months, reports of municipalities in the more densely populated parts of the country considering landscape restrictions and ordinances have become more common. To some degree, this is related to increasing interest in Xeriscape which emphasizes use of native vegetation with proposed reductions in water use and energy inputs for maintenance. A back to nature or natural practices philosophy has appeal, particularly in densely populated regions where in recent years much of nature's value has been, at the very least, tarnished by pollution of various sorts.



Of the many questions concerning these matters asked The Lawn Institute, seven are key to an improved understanding of landscape quality and environmental relationships. These are:

- I Which are better, trees or grass in taking carbon dioxide out of the taking carbon dioxide out of the atmosphere and in the return of oxygen ?
- II -What does landscape sustainability have to do with landscape value ?
 - III -What is really the goal of most new landscape ordinances ?
 - How can we deal with landscape plans, regulations and specifications ? IV -
 - Are expenditures of energy V unreasonable in landscape maintenance ?
 - VI -How much idealism is behind demands for current landscape charge ?
 - Why do we so often read in newsprint VII that turfgrasses are an enemy ?

ANSWERS TO QUESTIONS ASKED CONTINUED

Answers to these questions should help to clarify some important issues.

- Q We hear a lot about photosynthesis using carbon dioxide out of the atmosphere and in the process oxygen being released. What does it all amount to ? Which are better doing this, trees or grass ?
- A This type of comparative data is always interesting. It makes woody plants look good and turfgrasses look poor, but it doesn't present the whole picture. <u>All</u> carbon fixed in organic matter [biomass] is in time subject to oxidation. This may be in an accelerated form, such as burning, or as slow biodegradation [decomposition or rotting]. In the latter instance, microorganisms are involved in processes that ultimately form humus that enriches the soil.
 - With woody plants, a lot of carbon accumulates in wood that may maintain its structural integrity for years before the plant dies and decomposes, or is harvested for wood used for construction or pulp or fuel. Ultimately, virtually all of this carbon ends up back in the earth's atmosphere and there is very little net gain in oxygen.

- With turfgrass, decomposition of clippings takes place at or close to the soil surface on a continuing basis - day in and day out as long as temperatures are warm and the soil is moist for microbial activity. This continuing process enriches the soil and improves its structure so that moisture infiltration is improved and soil erosion by water and wind is reduced. This benefit is far more important than the so-called balance of carbon-dioxide and oxygen often referred to.



- When considering a closed system where wood may be removed and replaced regularly with immature plants, the gain in oxygen cited for woody plants may be expected. In an open system, charactéristic of the real world, biodegradation of wood and wood products continually takes place so that atmospheric gains in oxygen are not realized. The liability of turfgrass not accumulating more carbon over time becomes an asset in the provision of carbon energy for some 45,000,000,000,000 [guadrillion] microbes living in every 1,000 square feet of turfgrass root zone. These soil building organisms require carbon as a source of energy for natural humus forming processes.
- Since terrestrial plants that fix carbon through photosynthesis are all subject to biodegradation that consumes oxygen and releases carbon dioxide back to the atmosphere, where has our atmospheric oxygen come from ? The 20 percent oxygen found in the atmosphere is quite stable. Much more or less than this amount would make life hazardous for both plants and animals. The biotic origin of oxygen is aquatic, or at least plants and animals that have their final resting place under water where anaerobic decomposition is prevalent. Deposits of carbon containing coal, oil and natural gas have all formed under these anaerobic conditions.
- Thus, our fossil fuels of stored carbon, which originally came from carbon dioxide in the atmosphere, are only now being oxidized [burned] to heat our homes, run our automobiles, transport goods, power factories and serve as raw material for all sorts of synthetic carbon compounds. Had these sources of carbon not been discovered and used, we would most likely have been limited to burning wood as a source of energy.
- With finite amounts of fossil fuels available, we must now look to use of other sources of energy for the long run. Otherwise we will be limited to production of renewable carbon sources, such as alcohol from certain plants, or wood from trees.
- Providing positive levels of carbon storage and oxygen productivity are the least likely of all landscape benefits to be realized. To be sure, every little bit helps, and we should promote the concept of living plants in the landscape. They are infinitely better than the alternative - dust and dirt, asphalt and concrete.



ANSWERS TO QUESTIONS ASKED CONTINUED

Warvests 3

Q - A new buzzword has come upon the landscape scene. What does landscape sustainability mean ?

A - Catch words, like "sustainability", are technically not very meaningful. Agriculture today is accused of lacking sustainability. The term is not any better understood with reference to agriculture than it is to landscaping. [Reference: <u>Alternative Agriculture -</u> <u>Scientists Review</u>. Special Publication Number 16, Council for Agricultural Science and Technology, Ames, Iowa. July 1990. 182 pages.]

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- Sustainability in agriculture and in the landscape is a complex concept. Most agricultural practices used in so-called conventional farming contribute to a sustainable system. That is, they aid in crop production, promote yields at economic levels and help to conserve soil and water resources. The same holds true for most landscape construction and maintenance practices. Most of these being used today are the result of hundreds of millions of dollars spent over the past fifty years for research. Commercial research dollars and public funding of Land Grant University Agricultural Experiment Stations have supported most of this research. At the present time, the Current Research Information System [CRIS] of the U S Department of Agriculture identifies some 300 research projects on turfgrass alone. These projects represent an investment of several million dollars a year in turfgrass science.

Often the issue of sustainability is linked with use of chemical fertilizers that are alleged to poison the soil and to increase disease and insect problems of plants so that more pesticides are required. The proposed alternative is use of natural organic fertilizers and the elimination of all pesticides. Agricultural Experiment Station research across the country has not demonstrated undue risk from normal use of chemical fertilizers. Nor is there evidence that use of natural organic fertilizers can reduce weed, insect and disease problems to the point where pesticides are no longer needed. Thus, sustainability is now and has been widely accepted in general agriculture and in landscape horticulture. This does not mean that there haven't been over-uses of fertilizers and pesticides in isolated instances. As with all excessive use, risk increases. In other words, it's the dose that makes the poison.

- A sustainable landscape does now and will continue to promote practices that conserve, recycle and reuse the resources which are invested in these landscapes.

of a the comparison of a second term class a con-

 All landscapes should be designed and maintained to incorporate organic soil management practices. This must not proceed to the exclusion of inorganic fertilizers, herbicides and pesticides. When these are required, they must be available for use. When properly used, risk to people, animals, plants and environment are not unreasonably increased.

- It will be interesting to speculate how effective programs to educate the public about ideas and benefits of sustainable landscapes will be when accurate technical information is so scarce. Perhaps it will be a matter of diseducation.

"What is there that is not a poison ?... Only the dose makes a substance not a poison."

- Paracelsus 1493-1541 AD

ANSWERS TO QUESTIONS ASKED

Q - What is really the goal of most new landscape ordinances ?

CONTINUED

A - It's really difficult to understand what meaning is associated with the goals of many new and proposed landscape ordinances. The bottom line often seems to involve use of water, fuel for equipment, fertilizers, pesticides and labor in landscape construction and maintenance. Some group must feel that there are excesses in one or more of these inputs and that changes should be made. If this is so, then landscape professionals should make recommendations for change. If this matter of policies and guidelines is left to the political system, the landscape quality of the community will surely suffer.

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improvement in the functional and aesthetic environment. Cost/benefit studies may show some landscapes more costly than others, but what does this have to do with success as long as someone is willing to pay ? Some people drive Lincolns, others Fords. The landscape creates and/or modifies space. In so doing it makes better places to live, work and play. Remove it and the inert environment of the central city is left. Now, some people prefer this environment and live in areas devoid of interiorscapes or external landscaping. Most residential development favors a well planned landscape. If a certain landscape imposes environmental costs, such as pollution, then it is an ill conceived landscape. It is not enhancing the functional environment, although it may be aesthetically appealing. These landscapes require modification such that the functional environment is improved. Often this means sound soil-plant management and not the elimination of water, fertilizer, pesticides, fuels or labor. Many criteria for landscape success give the impression that the community plans to "throw out the baby with the bath water". Statements, such as "this ordinance must involve and combine larger issues if the environmental foundation for landscape development is to be integrated into cultural, political, aesthetic and economic factors of positive urban development" are worth emphasizing.

The criteria for landscape success are

- As the landscape enhances the aesthetic and functional environment, people, animals and plants benefit as well as the quality of the environment that provides living space for all life forms. This is environmental health. However, there are limits. At high population density [people], the landscape may fight a losing battle in terms of maintaining environmental quality. The use of accounting procedures to measure the magnitude of decisions and practices is valid. Interpretation of data must be handled with care. Performance standards are difficult to come by for living entities, even landscape plants. It's a good objective, but must be administered by technically well qualified horticulturists and agronomists.

ANSWERS TO QUESTIONS ASKED CONTINUED

- Q Landscape plans, regulations and specifications seem to stand in the way of successful development. How can we deal with this ?
- A Development plans and permits are entirely appropriate in the regulation of land use. Dealing with engineering and construction specifications for soil and building materials is one thing. Landscape specifications cannot be so tightly administered without the ultimate demise of the intended plant material. Each site and case are going to be different. Guidelines are the answer.

- The formulation of rules, procedures and interpretations related to biological systems probably will have limited constructive value and more likely enormous negative value. With biological systems, there are more exceptions to the rule than there are rules. This is simply a biological "fact of life". A " Sustainable Landscaping Guideline Manual" must place emphasis on the word "Guideline". It's interesting to note that in an alternate title "Sustainable Landscape Design Manual" suggested by one community, the term "Guideline" had already been deleted. This does not indicate a move in the right direction. Compliance statements indicate little flexibility and forecast ultimate failure in the use of such a document.

- Landscapes designed with associations of plants which have similar climate, water, soil, sun exposure and maintenance needs are, for the most part, natural landscapes. They are desirable but very limiting in terms of landscape benefits which can be obtained from use of diverse plant materials.
- To design and maintain landscapes with reduced levels of turfgrass greatly restricts both functional and aesthetic aspects of many landscapes. When such reductions are implemented, a non-living mulch is often substituted for a living mulch [turfgrass]. The net result lowers environmental quality and aesthetic value.





A - Energy costs for landscape maintenance are interesting from the standpoint of alleged waste. In the first place, the value of the landscape in creating habitats of highest quality is well worth the cost. Secondly, hundreds of thousands of professionals make a living from landscape construction and maintenance and other do-it-yourselfers gain much personal satisfaction and exercise from gardening. The agribusiness impact of lawns and sports turf is judged to be in excess of 25 billion dollars a year. This represents a lot of jobs manufacturing and distributing products and providing services all across the country. As in all industry, energy is expended in the production process. Turf and landscape products are not more energy demanding than other products used about the home and in pursuit of recreation.

In parts of the country where atmospheric pollution and water shortages are increasingly severe, it is necessary to recognize the cause in terms of population density. If quality of life is not to be sacrificed, reductions in population through relocation must be brought about. Major changes that limit the living landscape will lead to the spread of concrete canyons with well recognized quality of life limitations. These include increased pollution of ground and water that has limited exposure to the living roots of landscape plants.

ANSWERS TO QUESTIONS ASKED

CONTINUED



- For those that understand the natural functioning of grass plants in the soil building process, the statement: "the primary goal of urban landscapes is to build upon the functioning and momentum inherent in natural systems" is meaningful.
- There is no need to have by-products of landscape maintenance efforts result in pollution and stockpiles of unused waste. If this is assumed to be necessary, then there is a grave misunderstanding concerning the inputs and outputs of landscape construction and maintenance.
- There is nothing noble about ugly if one has an appreciation for visual scenery. If ugly is noble, then that's a value judgement that should not be fostered on a neighborhood, town, city, county or state.
- Increases in capital, resource use and manpower are all part of a capitalist society. If this should be changed, then we should say so. Most Americans will not agree.





- Q Given the fact that our life styles influence our appreciation for different landscapes, how much idealism is involved in current demands for change?
- A How idealized our lifestyles are is pretty much dependent on who is making the evaluation. Certainly the issue of the landscape can be complex, but millions of people across the country come up with scores that are favorable in terms of cost/benefit ratios. I would doubt that people in one part of the country are all that much different from people in other parts of the country. After all, many of us have migrated from one part of the country to another.
 - To say that "much of the urban ornamental landscape can be deemed to be an illusion of value and benefit that is unfounded in environmental terms" is not supported by data from Land Grant University and Agricultural Experiment Station research. Even with almost overwhelming gloom and doom forecasts from the media and a variety of activists and extremists, interest in and support of quality landscapes increases yearly across the country. The environmentalist who has a knowledge of ecology, hydrology and the soil and atmospheric sciences does not have difficulty making choices based on clear quantitative measurements and qualitative goals. Those who do not have these qualifications will continue to be mislead.

ANSWERS TO QUESTIONS ASKED CUNI

CONTINUED

- Q When the environmental benefits of lawns and sports turf are so obvious and so well supported by science, why do we read in newsprint that turfgrass is an enemy ?
- Δ Danica Kirka states in the April 9,1990 issue of the Los Angeles Times that the City of Irvine has a new enemy - turfgrass that is in the same classification with chlorofluorocarbons. In fact, CFC's are not believed to be the only contributor to ozone changes in the upper atmosphere - perhaps not even the gravest cause for concern. Now it appears that another scapegoat may have been identified. Do city governments really need to spend this amount of time, energy and dollars to try to disprove the value of landscape features that have done so much to enhance the functional and aesthetic environment over the years ? Is the need for causes so much a driving force in government today that activists and extremists espousing change command the attention of reasonable officials in the name of unreasonable causes ? Often all that is required is the identification environment with some aspect of environment with of agriculture or landscape horticulture to instill suspicion or fear or even panic on the part of many people. At a time when we should be enjoying the benefits of science and technology as never before, we are subject to accusations that make science the enemy rather than the cure.
 - The real issue in all densely populated parts of the country is population density. The problems allegedly faced by many metropolitan areas are not those common in rural America. And, they are not likely to be solved by landscape ordinances that identify turfgrass as the new enemy.





Warvests

Professional Lawn Care Association of America

The Professional Lawn Care Association of America [PLCAA] has announced a national public awareness campaign to encourage the recycling of grass clippings. The campaign, GRASSCYCLING: TODAY'S TURF - TOMORROW'S EARTH, will help to eliminate tons of grass clippings currently taking up valuable space in the nation's landfills.

Grasscycling is the natural recycling of grass clippings by simply leaving them on the lawn after mowing. Homeowners avoid the inconvenience of collecting, bagging, and disposing of clippings.

TAKING THE ENVIRONMENTAL INITIATIVE

In this "green decade", the decade of the environment, Americans are demanding environmental improvements and environmental responsibility. The simple fact is that a better environment begins with <u>individuals</u> willing to act. We must begin with ourselves.

Each of us should make an individual commitment to changing our behavior towards the environment. We must become wise consumers, practice conservation, and recycle. Our individual efforts in partnership with the efforts of government and industry can accomplish extraordinary goals. And, it can start in our own backyards. GRASSCYCLING is a simple and effective opportunity to make a contribution to the protection of our environment, while saving time, work and money.

PLCAA MAKES COMMITMENT TO ENVIRONMENT

PLCAA is making a commitment by sponsoring the GRASSCYCLING campaign to address one of our nation's most pressing environmental issues, solid waste disposal. This public education program provides a practical solution for eliminating millions of tons of grass clippings taking up valuable space in our municipal landfills. Today, local governments are facing a trash disposal crisis. at least ten states have less than five years of landfill capacity and 14 others have less than 10 years of useable landfill space. Approximately 20 % of all municipal landfill space is taken up by landscape waste, i.e., leaves, grass clippings and tree and shrub debris. In recent studies, it has been found that grass clippings may be responsible for more than 50 % of the total volume of landscape waste. Many states recognize the problem and are passing legislation to ban landscape waste from landfills.

It's In The Trash WHAT'S IN THAT 150 MILLION TONS OF SOLID WASTE AMERI-CANS CURRENTLY BURY IN LANDFILLS EVERY YEAR







CONTINUED

Professional Lawn Care Association of America

GRASSCYCLING IS THE ANSWER

Grasscycling is a term created by PLCAA which describes the natural recycling of grass clippings by simply leaving them on the lawn when mowing. The grass plant's nutrients are then recycled to the soil with the added benefit of helping lawns become healthier.

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encouraging grasscycling, we have the By potential to save more than 10 % of the total municipal landfill space. This is a tremendous achievement when we consider that only paper at 35.6% takes up more landfill space than landscape waste.

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LAWN CARE ENTHUSIASTS SHOULD TAKE LEADERSHIP

More than 60 million households participate in some type of lawn care. If these lawn enthusiasts practiced GRASSCYCLING, the life of a landfill could be drastically extended.

PLCAA COINS NEW WORD!

Grasscycling: a definition according to PLCAA's Glossary of Lawn Care Terminology

grass.cy.cling \ 'gras-'si-K (2-) lij\ vb. (1990) often attrib [Me gras; LL cyclus, fr. GK kyklos circle, wheel, cycle; PLCAA fr. environmental practice] 1: to naturally recycle grass clippings by leaving them on the lawn when mowing 2: responsible environmental practice 3: lazy man's lawn recycling program 4: a program designed by PLCAA to help solve America's landfill problems. -grass.cy .der (n)

grass cy cle \'gras-'s i-kel \ n.(1990) the process of grasscycling.

MOWING TIPS:

Proper mowing is essential to a healthy lawn. Keep your mower sharp. Cut when the grass is dry. Set your mower to cut at the proper height. Mow often enough so you never remove more than one-third of the lawn height each cut. You may have to mow every 5 days when your lawn is growing fast, but once every 10 days may be sufficient when turf is growing slowly.

MOWING HEIGHT:

Mowing heights depend upon the type of grass in the lawn:

Kentucky bluegrass 3.0"
Fescues and ryegrasses 3.0"
Bentgrass 1.0"
Bermudagrass 1.0" - 1.5"
Zoysia 1.0" - 1.5"
St Augustine 3.0"
Bahiagrass 3.0"
Centipedegrass

10 REASONS TO GRASSCYCLE:

- 1. Grasscycling improves lawn quality.
- 2. Grasscycling saves time and money.
- 3. Clippings do not cause thatch.
- Grass clippings won't damage lawns.
 Doesn't spread lawn diseases.
- 6. Clippings are too wet to incinerate.
- 7. Lawn care services recommend grasscycling.
- 8. All lawn mowers can grasscycle.
- 9. Collecting clippings is becoming more expensive.
- 10. Grasscycling is a responsible environmental practice.

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THRESHING THE JOURNALS

Warm

Season Grasses

ATT SMARTIN

EVALUATION OF SLOW-RELEASE NITROGEN CARRIERS ON CENTIPEDEGRASS

R N Carrow and B J Johnson HortScience Volume 24 Number 2 Pages 277-279 1989

Common centipedegrass is a popular lowmaintenance turfgrass in the South. At annual nitrogen levels of 25 to 100 kilogram per hectare [22 and 88 pound per acre], centipedegrass can maintain good shoot density, but it often is light green. To achieve a sufficiently dark green turf, annual applications of about 200 kilogram nitrogen per hectare [176 pound nitrogen per acre] have been recommended. Long-term studies, however, demonstrated that 100 kilogram nitrogen per hectare [88 pound nitrogen per acre] was the maximum annual nitrogen level without promoting "centipede decline". Centipede decline, a serious problem on centipedegrass is a term used to describe slow spring greenup or a chlorotic appearance and sudden die-back after initial greenup.

The objective of this study conducted at the University of Georgia was to evaluate the influence of several slow-release nitrogen carriers vs a water-soluble nitrogen source on common centipedegrass. Several slowrelease nitrogen sources, applied as single spring treatments at 98 kilograms nitrogen per hectare [88 pounds nitrogen per acre] were compared to a single application of water soluble nitrogen in April at 98 kilogram nitrogen per hectare [88 pounds nitrogen per acre] or 49 kilogram nitrogen per hectare [44 pounds nitrogen per acre] applied in April and repeated in June to evaluate their effect on centipedegrass performance.

In spring, Escote 100, IBDU [fine], sulfur coated urea and sulfur coated urea plus ammonium nitrate provided color equal to ammonium nitrate, but only treatments containing sulfur coated urea produced turfgrass quality equal to ammonium nitrate. During the summer, all slow-release nitrogen carrier treatments provided turfgrass quality and color that was equal to or better than that provided by ammonium nitrate. Ureaform resulted in better late fall color than did ammonium nitrate, but fall quality ratings were similar regardless of nitrogen source. Thatch accumulation was similar for all treatments and no centipede decline was observed. Leaf nitrogen content was not markedly influenced by treatment and no consistent trend in relative growth rate among nitrogen sources was apparent. Thus, while no single slow-release nitrogen source provided a season-long advantage over ammonium nitrate applied in April, all could be used effectively on centipedegrass.



BERMUDAGRASS RESPONSE TO CHILLING TEMPERATURES AS INFLUENCED BY IRON AND BENZYLADENINE

R H White and R E Schmidt Crop Science Volume 29 Number 3 Pages 768-773 1989

Bermudagrass, a warm-season perennial, produces little growth and is discolored by exposure to chilling temperatures. Chilling stress occurs in grasses of tropical and subtropical origin at temperatures of 10 to 15 degrees Centigrade [50 to 59 degrees Fahrenheit] down to 0 degrees Centigrade [32 degrees Fahrenheit]. Prolonged chilling results in alteration of plant physiological functions, loss of green pigmentation, and the plant eventually enters a state of dormancy. The slow growth rate is associated with decreased photosynthetic activity and carbohydrate metabolism at chilling temperatures. Species, as well as cultivars within species, vary with respect to photosynthetic sensitivity to chilling temperatures.





This study was conducted at Virginia Polytechnic Institute and State University to determine the effects of chilling temperatures on the carbon dioxide exchange rate, total nonstructural carbohydrate content, amylolytic enzyme activity, chlorophyll content and turf color of two bermudagrasses and to determine the effects of foliar pretreatment with iron and benzyladenine upon the same parameters. Grasses were grown on a silt loam soil at pH 5.7 with 4.8 grams per square meter [1 pound per 1000 square feet] nitrogen per month.

Day time carbon dioxide exchange rate of Midiron and Tifgreen declined 71 and 82 percent and nighttime carbon dioxide exchange rate declined 55 and 52 percent, respectively, during 4 days at chilling 10/7 degrees Centigrade [50/45 degrees Fahrenheit] day/night temperatures. Midiron carbon dioxide exchange rate was 70 percent of the original daytime rate at 30 degree Centigrade [86 degree Fahrenheit] but Tifgreen returned to within only 27 percent when returned to 30 degree Centigrade [86 degree Fahrenheit] for 2 hours after chilling treatment. In contrast, nighttime carbon dioxide exchange rate fully recovered.

Tifgreen's low daytime carbon dioxide exchange rate was associated with a 25 percent decrease in chlorophyll content, 60 percent decrease in amylolytic enzyme activity and 160 percent increase in leaf total nonstructural carbohydrate during chilling. Midiron chlorophyll content was unchanged, amylolytic enzyme activity decreased 30 percent and leaf total nonstructural carbohydrate increased 88 percent during chilling.

iron treatments had similar prechill The daytime carbon dioxide exchange rates. However, 120 milligram iron per square meter [6.4 ounces per 1000 square feet] as FeDTPA maintained a 23 percent higher average daytime carbon dioxide exchange rate than the 0 iron treatment after chilling and following recovery from chilling. Nighttime carbon dioxide exchange rate before and after the chilling regime was not affected by iron. Average nighttime carbon dioxide exchange rate was 28 percent higher for the 120 than the 0 milligram per square meter [6.4 than the 0 ounce per 1000 square feet] iron treatment after the recovery period. Leaf total nonstructural carbohydrate accumulation was similar for the iron treatments. Darker green turf color was observed for 120 than for 0 milligram per square meter [6.4 than for 0 ounce per 1000 square feet] iron after the chilling period although no difference in chlorophyll content occurred.



Daytime and nighttime carbon dioxide exchange rate, chlorophyll content, total nonstructural carbohydrate and color scores for the 0 and 12.4 milligram per square meter [0 and 0.6 ounce per 1000 square feet] benzyladenine treatments were similar at each treatment regime.

Although chlorophyll loss and total nonstructural carbohydrate accumulation in leaves are associated with photosynthetic inactivity in chill-sensitive bermudagrasses, disruption of carbon partitioning and utilization probably contribute to reduced growth and turf quality of bermudagrasses at chilling temperature. Foliarly applied iron may facilitate the maintenance of physiological activity and more desirable turf quality of bermudagrass exposed to chilling temperatures.

Midiron and Tifgreen bermudagrasses should be classified as chill tolerant and chill sensitive, respectively, based on physiological responses to chilling temperatures. The greater ability to assimilate carbon during and after exposure to chilling temperatures may allow Midiron to grow more rapidly than Tifgreen. Thus, Midiron may provide turf superior to Tifgreen after exposure to chilling temperatures.

Photosynthesis may be permanently impaired, but respiration only reversibly inhibited by short term exposure of bermudagrass to chilling temperatures. In chill-sensitive cultivars, rapid chlorophyll loss and leaf nonstructural carbohydrate accumulation at chilling temperatures may contribute to a reduction in photosynthetic activity. The disruption of carbohydrate partitioning and utilization at chilling temperatures may be of equal or greater importance to maintenance of high bermudagrass turf quality than photosynthetic inactivity.

Iron maintained the aesthetic quality of both bermudagrasses after the chilling period and stimulated recovery of daytime and nighttime carbon dioxide exchange rate as well. Thus, foliar applications of iron should be beneficial for maintenance of more desirable bermudagrass turf quality levels during exposure to chilling temperatures.



FALL PERFORMANCE AND POST-DORMANCY GROWTH OF MIDIRON BERMUDAGRASS IN RESPONSE TO NITROGEN, IRON AND BENZYLADENINE

R H White and R E Schmidt Journal American Society of Horticultural Science Volume 115 Number 1 Pages 57-61 1990

Bermudagrass ceases growth and becomes discolored when exposed to chilling temperatures. Chilling stress occurs in grasses of tropical and subtropical origin at temperatures of 15 to 0 degrees Centigrade [59 to 32 degrees Fahrenheit]. Chilling injury of bermudagrass is characterized by the

presence of necrotic lesions, chlorophyll loss, and subsequent leaf discoloration, and cessation of growth. Disruption of photosynthesis, respiration, and carbohydrate partitioning at chilling temperatures contribute to reduced bermudagrass growth.

The objective of this study at Virginia Polytechnic Institute and State University was to evaluate the effect of late-summer and fall foliar applications of iron and benzyladenine in conjunction with summer nitrogen fertilization on bermudagrass performance during fall and on post-dormancy recovery in spring. The effects of nitrogen, iron and benzyladenine on nonstructural carbohydrate accumulation in bermudagrass storage tissues were also studied.



Fall green color retention and Midiron bermudagrass turf quality were superior for 48 than for 24 kilogram per hectare [42 than for 21 pound per acre] nitrogen per month. Nitrogen level did not affect post-dormancy recovery or nonstructural carbohydrate levels in stolons and rhizomes measured in September and November 1983 and 1984. Iron level did not influence turf color and quality during summer months. Biweekly application of 0.6 kilogram per hectare [0.5 pound per acre] iron produced better retention of greenness and turf quality during fall 1983 and 1984 and superior turf color in spring 1985 than the no iron treatment. Better green turf coverage was obtained with the biweekly than the monthly iron treatment at 1.2 kilogram per hectare [1.0 pound per acre] during fall 1983. In contrast, monthly iron produced color and turf quality similar to that of the biweekly iron treatment during fall 1984.

Nonstructural carbohydrates were similar among iron levels in 1983 and 1984. The effects of iron on turf color and quality were similar at each level of nitrogen and benzyladenine. Benzyladenine level did not consistently influence turf color or quality and did not affect storage carbohydrate levels. When used in conjunction with moderate summer nitrogen fertilization, foliar-applied iron can extend bermudagrass quality during fall without adversely affecting post-dormancy recovery.

NITROGEN FERTILIZATION X GENOTYPE INTERACTIONS INFLUENCE BERMUDAGRASS TURF QUALITY CHARACTERISTICS

B D McCaslin, M R Hughes and A A Baltensperger Journal American Society of Horticulture Science Volume 114 Number 1 Pages 65-68 1989

Recommended levels of nitrogen fertilization for bermudagrass range from 24 to 73 kilogram nitrogen per hectare [21 to 65 pounds nitrogen per acre] per month during the growing season, with 48 kilogram per hectare [42 pound per acre] nitrogen per month most often cited for maintenance of adequate turf quality. Management alternatives would increase if cultivars could be chosen for specific quality factors at less nitrogen fertilizer. For example, in many instances high shoot density is desired, but the degree of greenness may be relatively unimportant for a low maintenance turfgrass.

Increased levels of nitrogen have long been known to increase the clipping yield of grasses, but high clipping yield is not considered to be a desired turf quality. Yield of forage is a waste in turf. While high clipping yield is undesirable in turf, a certain amount of growth is necessary to ensure recovery from stress and injury. Turf type bermudagrass responds in color and density to increasing levels of nitrogen. Cultivars are also evaluated at optimum levels of nitrogen fertility. Information is needed comparing cultivars or genotypes for their various quality characteristics over nitrogen response curves.

The objective of this research conducted at New Mexico State University was to determine if the turf quality of bermudagrass was influenced by an interaction of genotype and nitrogen fertilization. The response of 10 bermudagrass genotypes:

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were evaluated at nitrogen levels of 0, 16, 33 and 48 kilogram per hectare [0, 14, 29 and 42 pounds per acre] per month during the growing season. Color, density and clipping yield responses of the genotypes differed for the four nitrogen fertility levels. Texturf 10 had the highest overall ranking at 48 kilogram per hectare [42 pound per acre] nitrogen per month and Ormond had the highest ranking at 32 and 16 kilogram per hectare [29 and 14 pound per acre] nitrogen per month.

Thus, cultivar selection must be considered in arriving at precision nitrogen fertilization of bermudagrass turf.



MECHANISM OF DORMANCY IN PENSACOLA BAHIAGRASS

S H West and F Marousky Crop Science Volume 29 Number 3 Pages 787-791 1989

Bahiagrass is a popular turf and forage grass in the southern United States and throughout the tropical and semi-tropical world. It is planted from seed on millions of acres of pastures, roadsides, lawns and golf and recreational areas. Recommended seeding rates are high and stand achievement is often in doubt as with many warm season forage grasses. The seeds are routinely and mechanically scarified during processing, but germination is not improved significantly. Twenty eight days are recommended for final germination count in bahiagrass seed tests. Under field conditions, germination can be even slower. The seed are small and should be planted near the soil surface, making them vulnerable to wind and water erosion, drought, excessive heat, insects, fungi, birds and rodents.

In general, when viable seed fail to germinate under optimum environmental conditions, dormancy factors are involved. These factors vary with plant species but a list would include immature embryos, chemical inhibitors, seedcoats that are impermeable to water and/or oxygen, and requirements for heat or cold treatments. Likewise, no consistent dormancy factor has been found among the various grasses studied. Furthermore, there is diversity of dormancy factors even within a genus.

The objective of this research at the University of Florida was to investigate the factors that may contribute to dormancy in bahiagrass seed. Several dormancy releasing treatments were ineffective on Pensacola bahiagrass. The importance of the lemma was established by excising parts of the seed covers. Removing the second glume and sterile lemma did not reduce dormancy. Removing the palea resulted in significantly improved germination but still not as rapid nor as complete as removing the lemma.

Germination was observed to occur by the coleorhiza protruding through an opening in the lemma caused by the separation of fibers immediately above the embryo. Aging the seed increased germination and the number of seed with visible, separated fibers. A dormancy mechanism is proposed in which water uptake and the expansion of the embryo are restricted until an opening occurs in the lemma.



Natural Compounds as Potential Pesticides

NATURAL COMPOUNDS AS POTENTIAL HERBICIDES

S O Duke Weed Technology Volume 2 Page 509 1988

Plants and microorganisms produce hundreds of thousands of secondary compounds. Many of these compounds are phytotoxic and have potential as herbicides or as templates for new herbicide classes.

As traditional methods of herbicide discovery produce diminishing returns, interest in natural products as sources of new herbicide chemistries increases. The following reports cover a spectrum of both microbial and plant products with potential herbicidal activity. These are only a sampling of a broad, untapped chemical reservoir that offers tremendous potential for future pesticide development.

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POTENTIAL NEW HERBICIDES - PHYTOTOXINS FROM PLANT PATHOGENS

D Kenfield, G Bunkers, G A Strobel and F Sugawara Weed Technology Volume 2 Pages 519-524 1988

The desire for selective, less persistent herbicides has generated interest in phytotoxins as potential chemicals with applicability as agri-chemicals. Phytotoxins are natural compounds which have a deleterious effect on plants. Of particular interest are those toxins produced by microbes, usually pathogens, which live on weedy plants. These pathogens are first noticed because they cause symptoms such as necrosis, chlorosis or wilt in their hosts.

Attempts are being made to isolate and to identify toxic chemicals produced by the pathogens in hopes of establishing molecular leads for the herbicide industry. One spinoff of such studies is the elucidation of intriguing, often novel chemicals which perturb the normal physiological processes of plants in ways not found in the usual approach of organic synthesis followed by screening. Numerous phytotoxins have been identified in recent decades.

For example, curvulin and maculosin-1 are readily synthesized and represent both nonselective and extremely selective possibilities for direct application. More complex organics, like the eremophilanes, resorcylide, triticones and ophiobolins, are useful both as tools for understanding biochemical and physiological processes in plants and as selective biorational agrichemicals.



PERSPECTIVES ON DISCOVERY OF MICROBIAL, PHYTOTOXINS WITH HERBICIDAL ACTIVITY

H G Cutler Weed Technology Volume 2 Pages 525-532 1988

Over 30 years ago, a small sample bottle arrived for testing at the Boyce Thompson Institute for Plant Research, then located in Yonkers, New York. It had been shipped from J Lambrech, a chemist at Union Carbide to L J King for screening in various assays in plants, plant pathogens and insects. The material, labeled 7744, was requested by King, who in reading the literature, had conceived the idea that carbamates might be used as herbicides. He asked Lambrech to make half a dozen novelty carbamates and suggested possible structures based on plant growth regulator templates.

Thus, 7744 [1-naphthalenol methylcarbamate] came into being, but as it turned out, the material did not possess herbicidal properties but insecticidal ones, and so, 7744, nick-named Sevin, became one of the most successful insecticides of all times. With an LD50 of 500 to 700 milligrams per kilogram, it also was considered very safe. Later, other synthetic carbamates which had herbicidal utility came on the market. While synthetic work was being undertaken on the carbamates, no one could have foreseen that carbamate derivatives would be discovered as microbial natural products.

Thus, biologically active natural products of microbial origin have become attractive candidates for possible use in agriculture. They may be obtained by fermentation, used in their natural state, or subjected to synthetic modification for specific uses. These natural products are characterized by high specific activity and high selectivity and they are biodegradable. The structures are extremely diverse and represent many classes of compounds ranging from very complex to simple.

Cyclocarbamide A and B from Streptoverticillium have marked pre-emergence herbicidal activity.

Nigerazine A and B from Aspergillus niger also inhibit root growth in certain plants. Citreoviridin from Penicillium charlesii preferentially controls the growth of monocotyledonous plants as does a synthetic derivative of cladosporin from Aspergillus repens, which bleaches chloroplasts.

The 12-membered fungal macrolides also inhibit root growth in many test plants and offer templates for further synthetic work.

Herbicidins from Streptomyces saganonensis are particularly effective against barnyard grass, goosegrass, tufted mannagrass and green panicum.

The macrocyclic trichothecenes are a significant class of natural products that tend to concentrate against a gradient in seeds of certain plants, which resist these microbially derived metabolites thereby producing seed with "built-in" natural herbicides.

MITOTIC DISRUPTERS FROM HIGHER PLANTS AND THEIR POTENTIAL USES AS HERBICIDES

M A Vaughan and K C Vaughn Weed Technology Volume 2 Pages 533-539 1988

Many of today's herbicides have as a primary or secondary mode of action the disruption of mitosis. These herbicides include: the dinitroaniline, carbamate and phosphoric amide groups, as well as others, such as DCPA [dimethyl 2,3,5,6-tetrachloro-1,4benzenedicarboxylate]. However, the most highly studied chemicals that disrupt mitosis in both plant and animal cells are compounds which are produced by plants.

The plant-derived compounds have counterparts among herbicides with respect to cellular effects and, in some cases, mode of action. Cellular effects in common are arrested prometaphases [colchicine, dinitroanilines], multipolar divisions [Vinca alkaloids, carbamates] and production of binucleate cells [caffeine, dichlobenil].

The potential of these natural compounds, either directly or as the basis of new chemistries for herbicides, has remained largely untapped.



Citreovirigin from Penicillium charlesi preferentially controls the growth of monocotyledonons plants as does a synthetic derivative of cladospotin from Appenditue repeas which bleaches chloroplasts.

ALLELOCHEMICAL FROM PLANTS AS HERBICIDES

A R Putnam Weed Technology Volume 2 Pages 510-518 1988

More research is being focused on the chemical mechanism of plant interference which is called allelopathy. Allelopathy is characterized by a reduction in plant emergence or growth reducing performance of at least some individuals in the association. Chemicals that impose allelopathic influences are called allelochemicals or allelochemics. If present in low enough concentrations, they may stimulate rather than inhibit growth.

Chemicals with allelopathic potential are present [usually in conjugated form] in virtually all plants and in many tissues, including leaves, flowers, fruits, buds, seeds, stems and roots. Under certain conditions, these compounds may be released into the environment [atmosphere or rhizosphere] in sufficient quantitites and with enough persistence to affect a neighboring or successional plant.

Natural product chemists isolate and identify hundreds of new compounds from higher plants and microbes each year. Just because a chemical can be extracted from a plant, does not imply that it is released from the plant naturally. Rigorous proofs are required to demonstrate allelopathy. On the other hand, natural products may lead to new herbicides, even if they are not allelochemicals.

Perhaps the best term to describe the chemical nature of allelochemicals is diversity. They range from simple hydrocarbon, ethylene, to complex polycyclic compounds with molecular weights of several hundred. Almost every class of secondary metabolites has been implicated; and, in some instances, major intermediates, such as organic acids, in plant metabolism also seem to be involved. PERSPECTIVES ON DISCOVERY OF MICROBIAL DUITOTORINS WITH HERBICIDAL ACTIVITY

Allelochemicals, representing numerous chemical groups, have been isolated from over 30 families of terrestrial and aquatic plants. Some of the compounds also have been isolated from soil in quantities sufficient to reduce plant growth. Although selected allelochemicals are believed to influence plant densities and distributions, none isolated from higher plants have been considered active enough for development as commercial herbicidal products.

Almost all herbicidal allelochemicals exist in plants in non-toxic, conjugated forms. The toxic moiety may be released upon exposure to stress concept upon death of the tissue. The most successful use of allelochemicals in weed control has been management of selectively toxic plant residues. For example, rye residues have controlled weeds effectively in a variety of cropping systems.

Blades of g	inass
Now, that's a bumper sticker I like.	
and high selectivity	HONK IF YOU LOVE YOUR LAWN !
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	B C Roberts

TENTOXIN, A CHLOROSIS-INDUCING TOXIN FROM ALTERNARIA AS A POTENTIAL HERBICIDE

A R Lax. H S Shepherd and J V Edwards Weed Technology Volume 2 Pages 540-544 1988

Much interest has centered on the possible exploitation of natural products as safe, selective and cost-effective herbicides. Since many of these compounds are exotic and synthetically impractical for production, these studies may provide the chemical basis for herbicidal analogues of these natural products. Numerous symposia have convened to consider this potential, and several reviews have increased the attention paid to natural products having potential agricultural use. Creation of natural product divisions by the pesticide industry attests to its interest in this potentially fertile area.

The potential for use of compounds isolated form diverse sources, ranging from microbial to high plants, has received increasing attention. These natural products represent a vast array of chemistries and mechanisms of action often having the requisite specificities to be ideal herbicides.

Tentoxin, a cyclic tetrapeptide, has potent chlorosis activity on a variety of weeds of soybean and corn, while not affecting these crops. Investigations into this toxin's mechanism suggest several enzyme target sites for the development of herbicidal analogues, each having the inherent specificity of the parent compound. Structure/activity relationships determined so far may permit a directed synthesis of efficacious analogues. New insights into biosynthesis of the toxin suggest possible means of increasing production to allow economical exploitation of the toxin itself as a herbicide.

Whether tentoxin or its analogues will be developed successfully into commercial herbicides is unknown. Tentoxin though is but one of many phytotoxic natural products in which the inherent selectivity, potent activity, and probable environmental safety combine to provide such potential. Increasing efforts in this area attest to the possibility of natural product development into safe, efficacious herbicides. These efforts should provide intuition into the widespread commercial feasibility of natural product development while continued understanding of present toxins enhances understanding the physiology of both healthy and diseased plants. PHOTODYNAMIC HERBICIDES

G H N Towers and J T Arnason Weed Technology Volume 2 Pages 545-549 1988

Light is an essential component of many important aspects of plant life. The wavelengths causing plant responses include the whole visible range and much of the ultraviolet range of the solar spectrum. Although most terrestrial organisms are dependent on light for some physiological functions, green plants are obligate phototrophs, with light participating in the phenomena of greening, photosynthesis, photoperiodism, and phototropism. Much of the photobiochemistry of plants remains to be elucidated; for example, light activation of enzymes, the significance of photoisomerization of cell wall hydroxycinnamic acids and vitamin D biosynthesis.

Many natural and synthetic plant compounds become toxic when irradiated by ultraviolet or visible light. These compounds may be considered for use as herbicides, remembering the requirement for light. Concurrently, methods for blocking metabolic pathways so that phototoxic intermediates accumulate and thus kill the plant also have been studied.

Because plants have an absolute requirement for light to grow, light activated herbicides are a logical application of the emerging phototoxin technology. The advantage of this strategy is that it provides a radically different mechanism of weed control that may be effective against the growing number of weed species resistant to conventional herbicides.







Tissue Culture

EVALUATION OF A NEW IN VITRO CELL SELECTION TECHNIQUE

Maria Tomaso-Peterson and J V Krans Crop Science Volume 30 Number 1 Pages 226-229 1990

In vitro cell selection is a tissue culture technique used to recover disease-resistant plants. The selection agents usually employed in this type of research are phytotoxic extracts. These extracts are incorporated into the suspension or semisolid media used to culture the callus. While successes using phytotoxin extracts as selection agents have been reported, the pathogenicity of plant pathogenic microorganisms is often complex and true resistance is difficult to obtain. Some of the difficulties in obtaining resistance to certain plant pathogenic microorganisms stem from the pathogens producing other factors, such as enzymes that inhibit plant growth and development. These factors are often difficult to isolate and may become pathologically inactive when incorporated in an in vitro cell selection system.

Research at Mississippi State University has been conducted to evaluate the Host-Pathogen Interaction system which permits the simultaneous transfer of toxins from a plant pathogenic microorganism to a callus culture during concurrent growth, while avoiding direct physical contact between the organisms. Results of these studies appear to provide an effective means for exposing calli to a pathogen without the complications associated with direct physical contact between the organisms. This technique is being used to recover desirable variants of Penncross bentgrass with resistance to Rhizoctonia solani.





SOMATIC EMBRYOGENESIS AND PLANT REGENERATION FROM SUSPENSION CULTURES OF RED FESCUE

O M F Zaghmout and W A Torello Crop Science Volume 29 Number 3 Pages 815 - 817 1989

Embryogenic tissue cultures are considered advantageous since high rates of plant regeneration can usually be maintained over prolonged culture periods. In monocots, plants regenerated through somatic embyrogenesis are usually genetically stable compared to plants regenerated through organogenesis, which can typically become sporadic or lost after 3 to 5 subcultures. The capacity for embryogenesis and plant regeneration in red fescue callus cultures has been shown to be stable following prolonged culture periods of up to 4 years. The development of a culture system for embryogenic cell suspensions of red fescue would increase the range of techniques, which could be applied in somatic approaches toward genetic modification.

Research at the University of Massachusetts has developed fast-growing embryogenic cell suspension cultures from Dawson red fescue callus cultures followed by root regeneration.



Seed

Production

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AGRONOMIC AND BOTANICAL COMPONENTS ASSOCIATED WITH SEED PRODUCTIVITY OF KENTUCKY BLUEGRASS

R D Ensign, D O Everson, K K Dickinson and R L Woollen Crop Science

Volume 29 Number 1 Pages 82-86 1989

Kentucky bluegrass is an important perennial forage and turfgrass in the temperate areas of the United States and Europe. It is an aggressive rhizomatous grass with an extensive root system, but is propagated primarily by seed. The species is polyploid with chromosome numbers ranging from 28 to 182 and is classified as having a high degree of facultative apomixis.

Research workers and seed producers have noted considerable variability in seed productivity among Kentucky bluegrass cultivars due to genetic-environmental interactions. The species has wide environmental adaptability and many ecotypes are recognized. The best seed production of Kentucky bluegrass in the Pacific Northwest is favored by complete residue removal through open-field burning after seed harvest, followed by moist soil throughout the Fall to mid-June. Warm, dry periods from preanthesis to seed ripening reduce seed productivity. Seed maturity among cultivars within the locality of this study may vary as much as 15 to 25 days.



Although considerable genetic and phenotypic variation for improved seed productivity does exist among bluegrass cultivars, selection for seed production has been limited because many cultivars are apomictic and vegetative clones are selected primarily on the basis of turf quality characteristics. Additional information is needed on the nature of variation of characteristics of the bluegrass species that contribute to seed productivity. It is important to recognize agronomic and botanical components for seed productivity during the early generations of selection when plant populations are limited.

Biological components, such as number of spikelets per panicle, number of inflorescences per unit area, tillering, seed size, lodging, plant height, maturity, panicle size, spike size and combinations of other traits have been reported to affect seed productivity of various grass species. Most of those studies involved crosspollinated species. Research at the University of Idaho has been conducted to study the agronomic and botanical components of the bluegrass plant and correlate their contributions to seed productivity. Twenty eight agronomic and botanical components were evaluated during a 6 year field experiment. Fifteen diverse cultivars or experimental strains were used in the study.

Seed weight per panicle and seeds per panicle were most highly correlated with seed yields. Components indicating early stages of maturity, vigor at anthesis, leaf blade length, panicle length, spikelets per panicle, number of panicles per plant and harvest date were also highly correlated with seed yields. The magnitude of some correlations varied among years indicating environment-specific associations. Analyses for each of the 3 years showed that full heading date, number of panicles and seed weight per panicle accounted for 65 percent of the variation in a high seed-yielding year. However, for drought stressed years, the model accounted for approximately 90 percent of the variation in seed yield.



SPRING ESTABLISHMENT OF TURF-TYPE TALL FESCUE SEED CROPS WITH CEREAL COMPANION CROPS

T G Chastain and D F Grabe Agronomy Journal Volume 81 Number 3 Pages 488-493 1989

Traditionally, most tall fescue seed in the United States has been produced as a byproduct of forage production. In Oregon, however, specialized management practices have been developed for tall fescue seed production. Spring plantings of tall fescue are reported as best for seed production in the Pacific Northwest. However, exposure to low winter temperatures is needed to promote flowering in tall fescue, and such temperatures are not present during Spring. Thus, tall fescue seed yields are negligible in the year of planting, resulting in the loss of income for one season. The planting of red fescue in the fall with winter wheat increased net income by \$508.00 per hectare [\$206.00 per acre] over a 3-year period. These results suggested the need to evaluate companion cropping for tall fescue seed production.

The recent introduction of turf-type tall fescue cultivars also requires that seed production practices, including stand establishment be re-evaluated. Turf-type tall fescues have been selected for improved turf performance characteristics, including narrower leaf width, greater leaf density, more prostrate growth habit and darker green color than forage types. Companion crops create a microenvironment that could have a significant effect on tall fescue stand establishment and subsequent seed yield.



Research at Oregon State University has involved the feasibility of spring establishment of Bonanza, a turf-type tall fescue, with cereal companion crops in Oregon's Willamette Valley and to investigate the effect of cereals on tall fescue growth seed yield and economic return. Bonanza was interplanted in 45 centimeter [18 inch] rows with Waverly spring wheat, Steptoe spring barley and Cayuse spring oats, in 15 and 30 centimeter [6 and 12 inch] rows. Experiments were run in 1985 and 1986.

Cereals reduced the photosynthetic photon flux density available for tall fescue seedlings, which caused transient increases in chlorophyll content and reduced soil temperature by 1.8 degrees Centigrade [3.2 degrees Fahrenheit]. Soil water content was decreased by competition from cereals, causing greater stomatal resistance and lower transpiration rate. Reduction in photosynthetic photon flux density and soil water by cereals was responsible for low tall fescue tiller and dry matter production.

Following cereal harvest, tall fescue regrowth and new tiller initiation were delayed until Spring as a consequence of competition with cereals, resulting in fewer fertile tillers and a 61 percent reduction in first year [after planting] seed yield compared with no companion crop. Tall fescue growth and seed yield were similar with all cereals, row spacings and combinations of row spacings and cereals. Second-year [after planting] seed yield was 15 percent greater when fescue was established with cereals than when no companion crop was used. Dry conditions caused low grain yield and increased competition by cereals and was partly responsible for poor economic returns; however, fescue planted with spring oats earned \$139.00 per hectare [\$56.00 per acre] more than monoculture over a 3-year period because of compensatory increases in secondyear seed yield. This suggests that turftype tall fescue establishment with cereals could be more profitable in Spring with irrigation or in Fall when water is not limiting.



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Tribute to Grass

"Lying in the sunshine among the buttercups and dandelions of May, scarcely higher in intelligence than the minute tenants of that mimic wilderness, our earliest recollections are of grass, and when the fitful fever is ended and the foolish wrangle of the market and forum is closed, grass heals over the scar which our descent into the bosom of the earth has made, and the carpet of the infant becomes the blanket of the dead. Grass is the forgiveness of nature - her constant benediction. fields trampled with battle, saturated with blood, torn with the ruts of cannon, grow green again with grass, and carnage is forgotten. Streets abandoned by traffic become grass grown like rural lanes and are obliterated. Forests decay, harvests perish, flowers vanish, but grass is immortal. Beleaguered by the sullen hosts of Winter, it withdraws into the impregnable fortress of its subterranean vitality and emerges upon the first solicitation of Spring. Sown by the winds, by wandering birds, propagated by the subtle agriculture of the elements which are its ministers and servants, it softens the outline of the world. It bears no blazonry of bloom to charm the senses with fragrance or splendor, but its homely hue is more enchanting than the lily or the rose. It yields no fruit in earth or air, and yet, should its harvest fail for a single year, famine would depopulate the world."

> - John T Ingalls Senator from Kansas 1873-1891

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CUTTING BACK ON HIGHWAY NOISE

It seems that mounds of earth covered with wildflowers or grass may be the most costeffective devices to reduce traffic noise for residential areas near major roadways, says Sabih Hayek, a professor of engineering science and mechanics.

Hayek, who has studied the problem for nearly thirteen years, says, 'The best noise barriers are earth berms placed on either side of the road. These are even more effective if they are covered with grass or other vegetation, because the carpet of plants absorbs the sound.'

Alternative barriers such as walls of concrete, fiberglass or wood, often seen along European roadways, are also effective, but costly.

'It is possible to cut as much noise as you want,' says Hayek, warning that costs rise drastically with each increased reduction in noise. A typical 15-foot-high wall, for instance, costs between \$200 and \$250 a foot to construct.

Other drawbacks to walls are that they must be carefully designed and constructed and that their performance effectiveness is not always predictable.

Deciduous trees, often considered good sound absorbers by lay people, actually can make noise problems, Hayek says, because sound is reflected off the leaves. Pine trees are somewhat more effective because their needles do absorb sound. But, the researcher points out, the most effective barriers absorb some sound and diffuse the rest.

Hayek's research was sponsored by the US Federal Highway Administration and the National Cooperative Highway Research Program of the Transportation Research Board.

> - <u>Turf and Recreation</u> May 1990 P 13



THE VALUE OF TURF FOR TODAY & THE FUTURE

A video entitled "The Value of Turf for Today and Tomorrow", sponsored by Ciba-Geigy Turf and Ornamental Products, has been released by the PLCAA Education & Research Foundation. This speaks to environmental concerns by showing the value of turf in our environment. The many benefits of turfgrass brings us today and for the future are emphasized. Drs Watschke, Niemczyk and Petrovic speak of their research projects which are important as we consider how to be good conservationists.

The video sells for \$50.00 a copy. Those who pledge \$100/year for the next three years to the PLCAA Education & Research Foundation [non profit corporation] receive a complimentary copy.

MICHIGAN TURFGRASS INDUSTRY REPORT

Contact: Mr Tim Doppel 313/939-3636

The "1988 Michigan Turfgrass Industry Report" studies 10 industry segments of the turfgrass industry. Individual reports on each of the segments as well as the complete report are available.

There were found to be approximately 1 million acres in turf area, not including home lawns, in the state of Michigan. An estimate of 674,420 more acres are in home lawns, but further study is needed in this area. In 1988, 53,700 acres of new turf were established; \$454 million was spent on turf maintenance and \$53.6 million in new maintenance equipment.



HARDWARE AGE

ENVIRONMENTAL

A survey of independent hardware retailers shows they consider the pro-environment movement a permanent trend. Many are carrying products that are supposed to save on energy use, trash build-up or pollution.

Nearly two-thirds of the 3,000 dealers surveyed said customers are asking more environment-related questions about the products they buy, the packaging the goods come in, and opportunities for recycling. Dealers need to be able to answer questions about product side-effects, how to compost or mulch from home and yard wastes, effectiveness of biodegradable products, and higher price of some of the newer products. About half of those surveyed felt they were not very well prepared to address environmental issues raised by their customers. More information from manufacturers and wholesalers to help answer such questions is needed. Retailers would like more in store signage or window-sized posters, and point-of-sale materials to help promote the environmentally oriented products. New "environment-friendly" products can be appealing to the consumer, but there are questions still to be answered about many of these.

One retailer noted that traditional pesticides and fertilizers are still selling well and the organic alternatives are selling well so the overall lawn and garden sales have been boosted.

Hardware retailers had varying opinions about the environmental movement itself: some expressed a positive attitude toward the trend but are skeptical that any real changes are in the works; some fear overregulation, higher taxes and unnecessary paperwork; some are concerned that "extremists" may do more damage in the end than good.

> Hardware Age August 1990

Editor note: Certainly one of the most environmentally sound products sold in hardware stores is grass seed. The benefits of lawns is documented in Lawn and Sports Turf Benefits which would be a good document get into the hands of retailers. to Customers have lawns are real who conservationists environmentalists and because they are helping to promote all of the benefits that lawngrasses give to our planet. They need to know this.

SURVE'



Better THE LAWN Bulk Rate U.S. Postage PAID County Line Road Pleasant Hill TN P. O. Box 108 Permit No. 3 Pleasant Hill, Tennessee 38578-0108 ADDRESSEE er noted that tradition HELP US KEEP nd fertilizers . are still sell YOUR ADDRESS organic alternatives are sell overall lawn and garden saTJARROD If address is wrong in any respect, please correct directly, and de solinions opinions di bas varying return to us. mental movement itself: s THANK YOU hydrate aburtities builtions

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.

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