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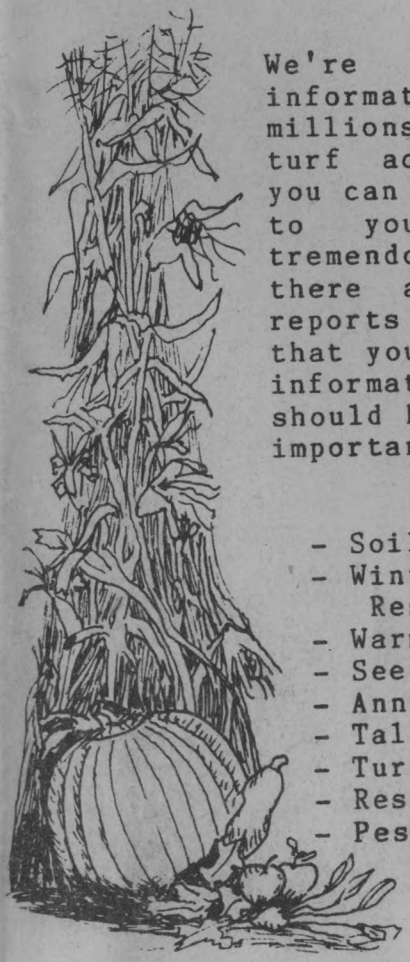
Volume 33 Number 3

THE HARVEST MIX



We're told that the research based information presented in Harvests is worth millions of dollars in better sports and lawn turf across the country. We believe it and you can prove it by applying what we now know to your local conditions. Even with tremendous variation from coast to coast, there are some research results from the 28 reports included in this issue of Harvests that you should know about. Organization of information under the following 9 headings should help you locate items of greatest importance:

- Soil, Fertilizer & Root Research;
- Winter Protection & Cold Tolerance Research;
- Warm Season Grass Research;
- Seeds & Seeding Research;
- Annual Bluegrass Research;
- Tall Fescue Research;
- Turfgrass Cultivar Identification;
- Research Technology;
- Pests & Pest Control Research.

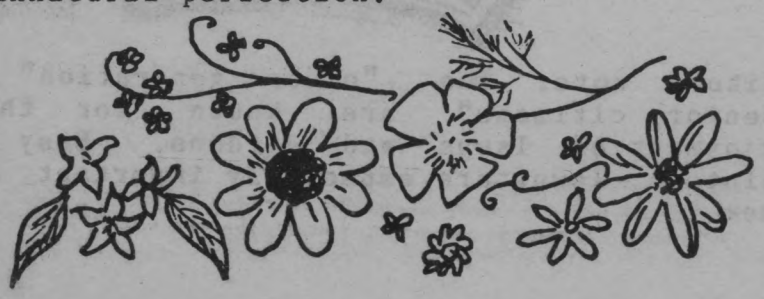
THE NATURAL LOOK ~ SO OLD IT'S NEW

by

Paul N Voykin

Perhaps golfers would be interested in knowing that it was a golf course superintendent from Illinois who helped initiate golf courses to the natural Scottish golf course look, including wild grasses and wildflowers. Some people still think it was the golf course architects Pete Dye and Jack Nichlaus who started the trend toward this Scottish look. Almost everybody now is taking credit and I think that's expected. Famous people always bring highlights to whatever they are doing. Their influence certainly has promoted what I helped start and brought to attention with a controversial speech about 15 years ago in New York at the August USGA meeting entitled Overgrooming is Over-Spending. Since that eventful presentation, I have given the same speech more than a dozen times across the country and in Canada. Golf Digest published my story and the prestigious industry magazine Public Works gave me much credit for pioneering golf course perimeters into wild grass and flower meadows and allowing some areas to grow natural like St Andrews and other old country courses.

In essence my presentation was simply that we superintendents should not overgroom the whole golf course so meticulously. Yes, concentrate even more on greens, fairways, and tee management, but don't carry out the ridiculous wall-to-wall manicuring and overgrooming to such a steep degree that we are pricing ourselves out of golf course business. Leave some golf land for wild animals, birds, and flowers. Make the golf game more challenging and enjoyable, the way it was meant to be by the founders and architects of this wonderful game, and not this present-day look of synthetically manicured and expensive backyards clipped to an unnatural perfection.



Whenever I gave that overgrooming talk to my fellow superintendents and others, or wrote about it, or was quoted in articles and magazines, the reaction by some was that I had lost my marbles. Most of the others didn't take me seriously. Some even wrote strongly against my "natural look" concept. But then, something happened. The high cost of maintaining country clubs drastically accelerated in the 70's and rose each year at a relentless pace and everything changed. Concern set in about the high cost of maintaining golf courses, and slowly my idea of wildflowers and the natural look suddenly didn't sound so looney, because it saved money. The elite golf course architects were the first to begin shouting its virtues whenever they broke expensive land for a new golf course. Something else happened, also. People began to be deeply concerned about our ecology and environment. Scientists who had been warning us for years about old Mother Earth and the dangers facing it due to too much technology and poisonous emissions began to be closely heeded. A little old lady from Texas began planting wildflowers along our highways and roads. The natural look was now definitely in !

Today I am happy to say thousands of golf courses have set aside natural areas to prosper and spread. Many golf courses enhance these restful areas even more [like I have] with beautiful native flowers and grasses. And, of course, golf course architects continue to build courses with that "Scottish look". The great Walter Hagen whose poignant quote, "Be sure to stop and smell the flowers as you go by" makes it easier for all of us now to do so. I am glad I had a part in providing this opportunity.

TRIVIA

Some Facts About an Expanding Population Segment

Time Trivia

Methuselah lived 900 years. Will you do as well ? Check out some of these amazing facts about aging. Maybe you can tack a few more years onto your lifespan.

- There are 49,000 people in the United States over 100-36,000 are women, 13,000 men. By the year 2020, the number of 100-plussers in the U S will increase by more than 700 percent. [U S Census Bureau and Statistics from the Administration on Aging].
- Nuns live longer than other women.
- Chemists live three years longer than composers and military commanders [69 vs 66].
- The death rate is twice as high for men and three times as high for women who are friendless [Dr Lester Breslow, UCLA, New York Times, October 2,1984].
- As you get older you may become less sensitive to pain.
- Pierre Bonnard reached the pinnacle of his painting career in his 70s [The Crown of Life by Hugo Munsterberg].
- The older you get the fewer colds you get [New York Times, April 7,1974].
- People do not die of old age. They die from disease. Working to keep your immune system more efficient and taking advantage of the various vaccines available today can help to keep you healthy for many years.
- Personality doesn't change with age. If you're energetic and a risk-taker at 30, you'll be the same at 80 [Ladies' Home Journal, January 1986].

- Frances Sheridan Goulart

Here's the Real Scoop on Aging

Statistics should shock, amuse, outrage, inform or otherwise confound you. Look at these facts on aging, for example:

- 210 Americans reach age 100 each week.
- 56,000 people past age 65 get married every year; 10,000 get divorced.
- One of six elders has children age 65 or over.
- The world's 60-plus population was 376 million in 1980. In 40 years it will top 1 billion.
- At the turn of the century, the average male spent 3 percent of his lifetime in retirement; in this decade he is spending 20 percent.
- Almost two-thirds of all workers retire before age 65.
- Over half of the oldest-old [85 plus] report no physical disability whatsoever.

Modern Maturity August-September 1986

Editors note: The "older generation" or "senior citizens" are known for their enjoyment of lawns and gardens. Easy to maintain lawns are especially important for them.

THRESHING THE JOURNALS

Warvests 3

(REVIEW OF CURRENT TURFGRASS RESEARCH LITERATURE)

Soil, Fertilizer and Root Research

RHIZOSHEATHS ON MESOPHYTIC GRASSES

R W Duell and G R Peacock

Crop Science 1985 Volume 25 Number 5
pages 880-883

Rhizosheaths are coatings of sand grains surrounding roots of certain grass species, usually associated with desert environments. Research conducted in New Jersey has described the occurrence of rhizosheaths on grasses grown under more humid conditions and in various substrates. These grasses have both root hairs and mucigel, an adhesive agent, that bind sand grains to form a sheath. This tube-like structure is largely impermeable to water and has been thought to protect roots against moisture loss. The development of a microenvironment in proximity to grass roots favorable for soil microorganisms may be mutually advantageous.

As seedlings develop several tillers, rhizosheaths are found on nodal roots but not on seminal roots. Seminal roots quickly become fibrous and no rhizosheaths are detectable. Rhizosheaths of cool season grasses persist through cycles of freezing and thawing during the winter and are more prominent in spring than in fall. Root systems of old plants are fibrous and devoid of rhizosheaths. Rhizosheaths are never found on grass in dense sod perhaps because roots tend to strip each other of the ensheathing soil during excavation. Rhizosheaths deteriorate in some grass species as seed development occurs, while in others, rhizosheaths remain intact.

Rhizosheaths have been found on both annual and perennial grasses, as well as on cool and warm season species. These include perennial ryegrass and tall fescue. Rhizosheaths are found only occasionally on fine fescues and Kentucky bluegrasses. No rhizosheaths have been found on other species of bluegrass or on bentgrass.

EFFECT OF IRRIGATION INTERVAL ON ST AUGUSTINEGRASS ROOTING

C H Peacock and A E Dudeck

Agronomy Journal 1985 Volume 77 Number 5
pages 813-815

Short-term turfgrass water stress is experienced diurnally or between scheduled irrigations and can be recognized by a folding of leaf blades, blue-gray coloration of foliage or foot printing on turf that lacks turgor. Grasses normally maintain a deep extensive root system in proportion to canopy size. When grown without water stress, 49 percent of ryegrass assimilate fixed during a normal photoperiod is translocated to plant parts underground. Rooting can affect plant water status by limiting soil water availability. Plant water deficits create reduced rooting and can result from limited carbohydrate availability under low mowing heights. In addition, soil water stress can increase root distribution deeper in the soil profile. Greater rooting depth during soil water stress is a drought avoidance mechanism. Roots grow within a limited soil water potential range. Soil water stress alters shoot to root ratios and this occurs because of lack of turgor for leaf expansion causing redistribution of assimilates to roots for growth there.

Research at The University of Florida has been concerned with determinations of optimum irrigation intervals that affect turfgrass rooting and thus help provide better utilization of irrigation water. Floratam St Augustinegrass was evaluated for two years with irrigation intervals of 2,3,4 or 6 days. All treatments supplied the same total volume of water. With the irrigation volume applied, the turf increased root size but not root length regardless of irrigation interval. This afforded an advantage in survivability but not in drought avoidance. St Augustinegrass responded well to the longest irrigation interval and rooting to greater depths in the profile may have been a key factor.

THREADING THE JOURNALS CONTINUED

SOIL COMPACTION AND MOISTURE STRESS PRECONDITIONING IN KENTUCKY BLUEGRASS. I. SOIL AERATION, WATER USE, AND ROOT RESPONSES

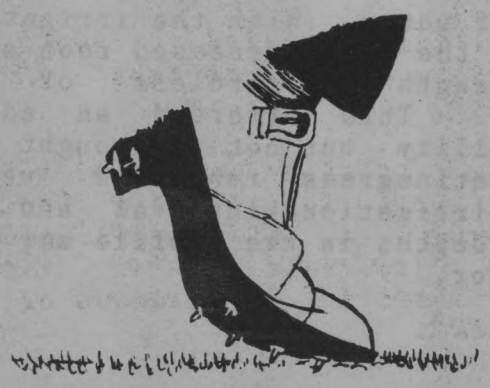
M L Agnew and R N Carrow

Agronomy Journal 1985 Volume 77 Number 6 pages 872-878.

Compaction of turfed soil by vehicular and foot traffic reduces aeration, increases bulk density, increases soil strength and changes pore size distribution. These altered physical properties reduce shoot growth, root growth and overall quality of turfgrasses. Compaction of soil has a major influence on plant water relations and drought stress. A decrease of 21 to 49 percent in evapotranspiration has been attributed to soil compaction.

Soil aeration is of prime importance to the growth of recreational turf subjected to soil compaction. Bulk density and aeration porosities are influenced mainly in the upper inch [3 centimeters]. This upper zone of compaction can limit the diffusion of oxygen into the soil by creating discontinuity of pores and insufficient pore volume for adequate gas exchange. Soil compaction decreases the oxygen diffusion rate below the critical level for plant growth. This may remain below the critical level for up to 53 hours following an irrigation. Under heavy compaction, the oxygen diffusion rates are such that an immediate limit to shoot growth is realized and over time, reductions in root growth are noted.

Plants can acclimate to low oxygen conditions by modification of the roots. This involves an increase in internal oxygen diffusion from the leaves via increased root porosity. Root porosity is a measure of the internal resistance to oxygen diffusion within the plant with an increase in porosity accompanied by an increase in internal plant oxygen concentrations. In addition water-stressed plants extract more water from the deep soil zones than well-watered plants. Compaction influences turf quality more than irrigation level.



Research at Kansas State University evaluated Ram I Kentucky bluegrass under treatments of no soil compaction, long term compaction, short term compaction with turf well irrigated or water stressed. Results emphasized the following.

- Compaction treatments reduced the oxygen diffusion rate.
- Long-term compaction increased root weights in the upper 2 inches [5 centimeters] and decreased root weights in the lower 4 to 8 inch [10 to 20 centimeter] profile.
- Short-term compaction decreased root weights only at 6 to 8 inch [15 to 20 centimeter] depths.
- Root porosity was increased by long term compaction. The greatest increase was noted when long-term compaction was combined with water stress. This produced a root porosity of 23 percent.
- Plants with higher root porosities also exhibited greater water uptake during low soil oxygen conditions.
- Soil compaction reduced total water use and moisture extraction in the deeper zones.

SOIL COMPACTION AND MOISTURE STRESS PRECONDITIONING IN KENTUCKY BLUEGRASS. II. STOMATAL RESISTANCE, LEAF WATER POTENTIAL AND CANOPY TEMPERATURE

M L Agnew and R N Carrow

Agronomy Journal 1985 volume 77 Number 6 pages 878-884

Soil compaction and moisture stress are both serious problems associated with growing recreational turfgrasses. Plant growth and water use are altered such that the turf is predisposed to injury. Plant-soil-water relationships involve leaf water potential and stomatal diffusive resistance. Soil compaction increases canopy temperatures by 2 to 8 degrees Fahrenheit [1 to 4 degrees Centegrade] regardless of soil moisture content. Stomatal closure is induced by low aeration on wet soils and reduced transpiration from poor water uptake on drier soils. In soils subjected to moisture deficits, stomatal closure is often directly related to plant water potential but the stomatal diffusive resistance and leaf water potential relationships under low soil aeration are not clear.

Soil Compaction & Moisture Stress Preconditioning in Kentucky Bluegrass.II. Continued

Research at Kansas State University has involved Ram I Kentucky bluegrass subjected to no compaction, long term compaction and short term compaction when turf was well watered or water stressed. Effects of these treatments on stomatal diffusive resistance, leaf water potential and canopy minus air temperatures were evaluated. The following results were noted.

- Stomatal closure occurred within 2 days after exposure to low soil oxygen conditions.
- The stomatal diffusive resistance remained high for several days after alleviation of the oxygen stress.
- Soil compaction and moisture preconditioning treatment effects were not evident under low soil oxygen conditions but were evident as the soil water potential decreased.
- Compaction reduced the leaf water potential, increased stomatal diffusive resistance and tended to enhance canopy minus air temperature values at a particular soil water potential compared with the uncompacted turfgrass.
- Water-stressed plants exhibited lower leaf water potential, higher stomatal diffusive resistance and greater canopy minus air temperature values compared with well watered plants, particularly at low soil water potentials.
- These physiological responses under soil moisture deficits would subject the turfgrass to greater degrees of drought and high temperature stress.

THE SEGREGATION OF HOMOGENEOUS AND BLENDED GRANULAR FERTILIZERS FROM A ROTARY SPREADER

K J Karnok

Agronomy Journal 1986 Volume 78 Number 2 pages 258-260

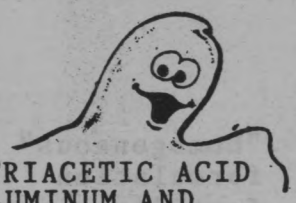
The use of blended granular fertilizers in comparison with homogeneous granular fertilizers has prompted concern over distribution patterns from rotary spreaders. The term "blended" describes the formulation process where the fertilizer components occur in separate particles which are then mechanically mixed or blended together to form the specified ratio. The term "homogeneous" is used to describe the formulation process where the various fertilizer components are combined together to form a single particle. Each particle would thus contain the specified ratio.

Several factors can affect the distribution pattern from rotary spreaders. These include:

- forward velocity of the spreader;
- angular velocity of the impeller;
- impeller vane configuration;
- impeller vane delivery position;
- impeller pitch;
- impeller angular velocity;
- fertilizer characteristics -
  - * application rate;
  - * bulk density;
  - * particle size.

Research at The University of Georgia was conducted to determine the particle segregation of several commonly used turfgrass fertilizers delivered from a rotary spreader. The following results were reported.

- Considering all fertilizers tested, there was relatively uniform dispersion of particles in the 1 millimeter or greater size range.
- Particle sizes smaller than 1 millimeter had less uniform distribution across the effective spread pattern.
- Phosphorus varied most along the spreader swath followed by potassium and then nitrogen.
- The smallest variation in spread was exhibited by a homogeneous fertilizer. It was closely followed by a blended fertilizer.
- Fertilizers having a small range in particle size had least variation in spread.
- When considering uniformity of fertilizer distribution from a rotary spreader, a uniform particle size is more important than whether the fertilizer is homogeneous or physically blended.



ALUMINUM, CITRIC ACID, NITRILOTRIACETIC ACID AND SOIL MOISTURE EFFECTS ON ALUMINUM AND IRON CONCENTRATES IN RYEGRASS

R M C Muchovej, V G Allen, D C Martens, L W Zelazny and D R Notter

Agronomy Journal 1986 Volume 78 Number 1 pages 138-144

Aluminum concentrations in higher plants are variable but generally vary from 10 to 50 parts per million in most grasses and clovers. Most forage grasses have a low tolerance to soluble aluminum in soils. As low as 0.1 parts per million aluminum as chloride or sulfate in nutrient solutions depresses growth of annual ryegrass. Although soluble aluminum is usually associated with low soil pH, aluminum absorption also occurs at high soil pH. Chelation of aluminum with organic acids, such as citric or oxalic in root exudates, prevents precipitation with phosphorus. This results in aluminum availability to plants. Aluminum complexed with citric acid and with nitrilotriacetic acid increases concentration of aluminum in aerial parts of plants grown in solution culture.

In soils, natural chelating agents originate from root exudates, decaying organic matter, products of microbial synthesis and additions of chelated and organic fertilizer. When soils are wet, the supply of oxygen is rapidly depleted and soluble organic products and other reduced materials accumulate.

Research at Virginia Tech with annual ryegrass has been conducted to investigate the effects of soil moisture, addition of chelated aluminum and the organic acids alone on plant concentrations of aluminum and iron. In addition, plant aluminum concentrations have been related to soil exchangeable aluminum and to pH. The following results have been reported.

- Flooding the soil, addition of chelates and aluminum chelates increase aluminum concentrations in annual ryegrass.
- Flooding increased soil pH and soil exchangeable aluminum.
- Chelates and aluminum chelates increased soil exchangeable aluminum.

PHENOTYPIC CORRELATIONS BETWEEN METAL TOLERANCE AND MORPHOLOGY IN FESTUCA RUBRA L.

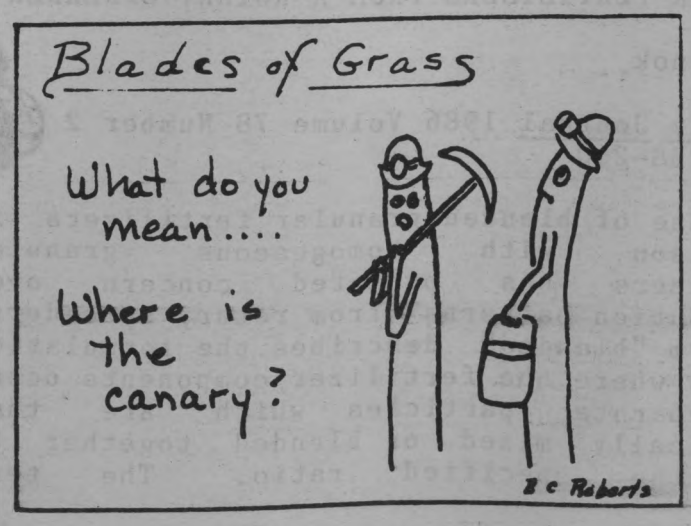
D R Huff and L Wu

Crop Science 1985 Volume 25 Number 5 pages 787-789

Plants of red fescue have been found growing on land consisting of old abandoned metal mine workings. Such soil as this is characteristically deficient in macro and micro nutrients, has unfavorable physical properties, including soil structure, is subject to soil erosion and excessive dryness in addition to some metal toxicity. Because of these generally unfavorable growth conditions, red fescues that survive may have value as a potential genetic resource for varietal improvement of the species. Because of the powerful selection pressure of soil metal toxicity, heavy metal tolerance is a major genetic character that permits survival.

Research in California with red fescue plants selected from the Trelogan Zinc Mine and the Stirling Copper Mine involved comparisons with Pennlawn red fescue, not particularly tolerant of zinc or copper. Results of tests with both tolerant populations did not indicate any substantial relationship between zinc or copper tolerance and other structural characteristics that might be important in plant improvement.

Random selection for vegetative or reproductive characters of economic importance within zinc and copper tolerant plants should not alter the degree of zinc or copper tolerance.



Winter Protection and Cold Tolerance Research

PREDICTING COLD TOLERANCE IN PERENNIAL RYEGRASS THROUGH ALCOHOL BATH FREEZING OF SEEDLING PLANTS

R P Cohen and G M Wood

Agronomy Journal 1986 Volume 78 Number 3
pages 560-563

The market for turf type perennial ryegrass seed in the United States has grown steadily to about 40 million pounds [18.1 million kilograms] annually. Improvements in density, color, texture, mowability and disease and drought resistance have been responsible for much of this surge in popularity. Improved cold tolerance in some cultivars has also played a role in this renewed interest and has permitted wider usage in Europe, the northern United States and in parts of Canada. All improved turf-type cultivars do not have adequate cold hardiness for northern regions.

Research at The University of Vermont has been designed to develop a test for quickly ascertaining the degree of cold tolerance present in a cultivar. The following progress has been reported.

- Seedling ryegrass plugs established in the greenhouse and hardened in a growth chamber are placed in test tubes, stoppered and frozen in a circulating ethanol bath at temperatures as low as minus 40 degrees Fahrenheit [minus 10 degrees Centigrade]. Following a recovery period in the greenhouse, plugs are evaluated for injury.

- Results obtained by this freezing technique closely agree with those obtained by subcrown internode measurement, [short internodes indicate high cold tolerance] and long-term field plot evaluations.

- A ranking of perennial ryegrass cultivars for cold tolerance from most to least lists eleven in the following order:

  * Manhattan
  * Omega
  * Diplomat
  * Pennfine
  * Derby
  * Birdie
  * Norlea
  * Citation
  * Ensporta
  * NK-100
  * Linn.

INFLUENCE OF PROTECTIVE COVERS ON REDUCING WINTER DESICCATION OF TURF

J M Roberts

Agronomy Journal 1986 Volume 78 Number 1
pages 145-147

Loss of turf to desiccation in late winter and early spring continues to be a major problem especially in northern climates. Most early research with protective covers involved the use of solid or perforated plastic tarps. Because of the "greenhouse" effect created by polypropylene covers, the proper timing of removal in the spring is of critical importance. Black insulated blankets and polyethylene of several different densities and colors have been tested and found to reduce winter desiccation and raise minimum soil temperatures, but they excluded light to cause chlorosis of the turf. Straw mulch works but stimulates snow mold.

Research at The University of New Hampshire has evaluated natural and synthetic covers for the protection of Emerald bentgrass putting green turf from desiccation during the winter and early spring and to enhance subsequent growth and appearance of the turf. The following observations have been recorded.

- Spunbonded polyester blankets provided the most beneficial results.

- Compared to the uncovered control, bentgrass grown under the spunbonded polyester blankets generally had 10 to 20 percent more spring leaf moisture, up to 24 percent more root length, 80 percent more clippings and up to 20 degrees Fahrenheit [10 degrees Centigrade] higher soil temperatures.

- Compared to the uncovered control, spunbonded polyester blankets hastened the rate of spring turf green=up by 5 to 12 days.

- Polypropylene blankets and pine needles also reduced winter desiccation although less consistently.

- Polypropylene blankets blocked up to 99 percent of the photosynthetically active radiation and caused less desirable color and growth when compared with the spunbonded polyester.

Warm Season Grass Research

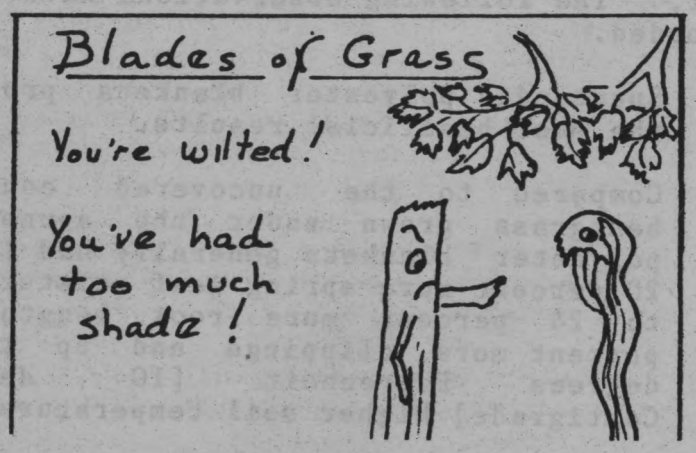
PLANT REGENERATION THROUGH SOMATIC EMBRYOGENESIS IN COMMON BERMUDAGRASS TISSUE CULTURE

B J Ahn, F H Huang and J W King

Crop Science 1985 Volume 25 Number 6 pages 1107-1109

Plant regeneration through somatic embryogenesis has been accomplished with annual ryegrass and red fescue. Callus induction and root formation from mature caryopses have been brought about in common bermudagrass but shoot regeneration is not common. Bermudagrass is a cross-pollinating tetraploid that has potential for improvement through use of tissue culture techniques.

Research at The University of Arkansas has found that calli originating from immature inflorescences is embryogenic in 16 of 19 instances. Embryogenic calli forming somatic embryos spontaneously have been maintained without loss of competence for 80 weeks. Numerous plantlets have been regenerated from each callus and grown to maturity in soil. Scanning electron microscopy has confirmed the bermudagrass regeneration through embryogenesis. This culture system is appropriate for use in improving common bermudagrass.



QUALITY AND YIELD RESPONSE OF FOUR WARM-SEASON LAWNGRASSES TO SHADE CONDITIONS

E P Barrios, F J Sundstrom, D Babcock and L Leger

Agronomy Journal 1986 Volume 78 Number 2 pages 270-273

Turfgrasses are not generally considered very shade-tolerant plants, and yet, 20 to 25 percent of all grass species used for turf are shaded by trees, shrubs or structures. Shade is particularly important in a warm environment such as the Gulf South because of its temperature-modifying influence.

Reduced light intensity decreases grass carbohydrate reserves and subsequent growth of roots, shoots, rhizomes and stolens. Smaller root systems, thin cuticles and poorly developed vascular systems of shaded turfgrasses result in an increased tendency to wilt. Plant vigor and hardiness are decreased and succulence is increased in shade. Tolerances to temperature extremes, moisture stress and wear are lessened and susceptibility to pests is increased in the shade. Chlorophyll content is also increased while respiration, transpiration rate, carbohydrate to nitrogen ratio and osmotic pressure decrease in turf grown in limited lighting.

Turfgrass quality increases in predominately blue and green wavelengths. Light under a tree canopy generally is reduced in the amount of photosynthetically active wavelengths with the proportion of wavelengths longer than 700 millimeters much higher than in full sunlight. The influence of light quality on turfgrass growing in full sunlight is not as great as light intensity or duration.

Research at Louisiana State University has been concerned with quality and yield of Emerald zoysiagrass, Floratam and Floratine St Augustinegrasses and Oaklawn centipedegrass as influenced by light and temperature under deciduous shade conditions. The following results are noted.

- Floratam St Augustinegrass was the only lawngrass whose quality and clipping yield were reduced each year with 63 percent shade.
- Oaklawn centipedegrass quality was least affected by increasing shade and had the highest quality in 63 percent shade.
- On the basis of quality, St Augustinegrass was most intolerant and Oaklawn centipedegrass was most tolerant of reduced light conditions.
- Mean air temperature at the sod level was not correlated with quality of any lawngrass.
- Quality and clipping yield were not correlated in any lawngrass.
- Lawngrass yield generally decreased with increasing shade.
- Emerald zoyziagrass clipping yields were least reduced and Floratam St Augustinegrass yields were most reduced in 63 percent shade.

Seeds and Seeding Research

PREGERMINATION OF ITALIAN RYEGRASS AND TALL FESCUE SEED

A E Dudeck and C H Peacock

Crop Science 1986 Volume 26 Number 1
pages 177-179

Sports turf is damaged continuously during the playing season. Repair and improvement in turfgrass cover is difficult especially on football fields. Closing of facilities to play is not feasible. Using pregerminated seed to minimize germination and establishment time when overseeding cool season grasses helps. Research at The University of Florida has concerned the use of fast germinating Italian ryegrass and relatively slow germinating Kentucky 31 fescue. The following recommendations have come from these investigations.

- For Italian ryegrass, seed should be treated with 100 parts per million gibberellic acid and kept moist for 48 hours at a temperature of 77 degrees Fahrenheit [25 degrees Centegrade] prior to planting. Rate of seeding should be increased 30 percent and great care should be taken when seed is sown. Fifty percent of the viable seed should germinate in 7 to 17 hours depending on temperatures after sowing.

- If soaking is the preferred method of pregerminating Italian ryegrass, seed should be kept in well-aerated water for 24 hours at 77 degrees Fahrenheit [25 degrees Centegrade]. Fifty percent of the viable seed should germinate in 3 to 6 days with this method.

- For Kentucky 31 fescue, seed should be treated with 50 parts per million gibberellic acid and kept moist for 48 hours at a temperature of 77 degrees Fahrenheit [25 degrees Centegrade] prior to planting. Fifty percent of the viable seed should germinate in 1.8 to 4.2 days depending on temperatures after sowing.

- Kentucky 31 fescue seed may also be soaked in 50 parts per million of gibberellic acid for 24 hours at 77 degrees Fahrenheit [25 degrees Centegrade]. Aeration should be provided. Fifty percent of the viable seed should germinate in 4.2 to 8.4 days depending on temperatures after sowing.

EMERGENCE OF SEVERAL GRASSES FROM PREGERMINATED SEED AND SOME SOIL WATER EFFECTS

V L Hauser

Agronomy Journal 1986 Volume 78 Number 1
pages 206 - 210

Grasses are difficult to establish from seed on pasture or rangelands of the Southern Great Plains. Most of the desirable grass species have small seeds and must be planted with less than 4/5 of an inch [2.0 centimeters] of soil cover. This top layer of soil dries rapidly after rain, thus causing many seedling failures. Seeds that are pregerminated before planting may produce plants fast enough to become established before the seedbed dries.

Research conducted in Temple, Texas involved pregermination of 12 grass species adapted to the Southern Plains. These included:

- kleingrass
- buffelgrass
- weeping lovegrass
- switchgrass
- blue panicum
- sideoats grama
- blue grama
- big bluestem
- bahiagrass
- green sprangletop
- old world bluestem.

Seeds were germinated in aerated water held at 79 degrees Fahrenheit [26 degrees Centegrade] for up to 24 hours. Seed were then suspended in a gel and planted. The following results were noted:

- Pregermination doubled the number of plants established by kleingrass and buffelgrass.

- Weeping lovegrass and buffalograss produced 40 percent more plants from pregerminated seed.

- Switchgrass and blue panicum responded favorably to pregermination 50 percent of the time.

- Six other grass species produced the same number of plants from either pregerminated seeds or untreated seeds.

- Pregerminating seeds of species that respond to the treatment will permit reduction of the seeding rate, thus allowing the use of higher quality [more costly] seed. High-quality seed produces more plants than low-quality seed, especially under the adverse conditions normally found in the field.

Annual Bluegrass Research

ANNUAL BLUEGRASS GROWTH AND QUALITY AS INFLUENCED BY TREATMENTS OF GROWTH RETARDANTS AND WETTING AGENTS

A M Petrovic, R A White and M Kligerman

Agronomy Journal 1985 Volume 77 Number 5 pages 670-674

Annual bluegrass, an undesirable turfgrass because of its poor heat and drought tolerance and need for frequent light irrigation to survive summer stress periods, can become a major component of many intensively maintained turfgrass communities. Difficulty in maintaining the visual quality of annual bluegrass during the summer may be related to the reduction of the root system and/or depletion of the carbohydrate reserves that occur during the intensive spring flowering period.

Research at Cornell University has concerned the use of plant growth retardants and wetting agents on growth and visual quality of annual bluegrass. The growth regulators mefluidide and amidochlor and the wetting agents AquaGro, HydroWet, Basic H and Amway Spray Adjuvant were applied to golf course fairway turf prior to or at the initiation of the annual bluegrass flowering period for three years.

Seed head production and seed yield were reduced by mefluidide, amidochlor and AquaGro. The amount of reduction depended on rate and timing of application and year of the study. Mefluidide reduced clipping yields twenty percent over a two month period whereas AquaGro had no effect on yields. In two of the three years, mefluidide caused a reduction in the visual quality of annual bluegrass 14 to 24 days after treatment. AquaGro effects on the visual quality during the spring flowering period were inconsistent. In the final analysis, the visual quality of annual bluegrass during the summer months was not affected by the degree of spring seed head production. Further research is needed to understand more clearly the relationship between spring flowering of annual bluegrass, summer root growth and carbohydrate balance on the summer quality of annual bluegrass.

PLANT INTERACTION AMONG POA ANNUA, POA PRATENSIS AND LOLIUM PERENNE TURFGRASSES

A D Brede and J M Duich

Agronomy Journal 1986 Volume 78 Number 1 pages 179-184

Different grasses, such as annual bluegrass, Kentucky bluegrass and perennial ryegrass, differ in their ability to dominate a turf stand. Perennial ryegrass and annual bluegrass are vigorous, especially during establishment. Kentucky bluegrass is less vigorous during establishment and less aggressive generally. The primary goal of turfgrass managers is to maintain Kentucky bluegrass and perennial ryegrass or a mixture of both without the encroachment of annual bluegrass. Knowledge of the interaction of these species under a variety of field conditions is required.

Research conducted at Penn State University with Touchdown Kentucky bluegrass, Pennfine perennial ryegrass and annual bluegrass has attempted to determine whether plant interaction is a significant force in turfgrass stands, where close mowing and ample watering and fertilization are the norm. In addition, the study was undertaken to determine the environmental variables influencing the tillering response of these three grasses during establishment in the field. The following results have been reported.

- Interaction among turfgrass species occurred above ground even when the stand was clipped as low as 1 1/4 inches [3.1 centimeters].

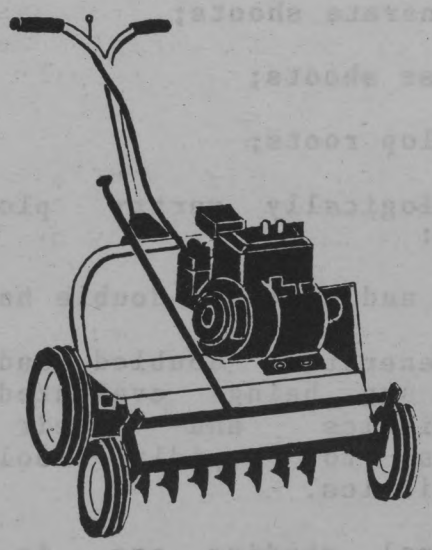
- Interaction occurred below ground even when nutrients and water were supplied in seemingly ample quantities.

- Dominance of a turfgrass species in a mixture may occur as a result of interaction above ground, below ground or both.

- Interaction above ground affected the growth of below-ground plant parts and vice versa. Hence, interaction may indicate a cyclic decline in one of the competitors.

Plant Interaction Among Poa Annua, Poa Pratensis & Lolium Perenne Turfgrasses Continued

- Kentucky bluegrass tended to dominate perennial ryegrass when the interaction was confined to above ground. When the interaction was confined to below ground, perennial ryegrass was equal to or slightly more predominant than Kentucky bluegrass.
- Perennial ryegrass is capable of out-competing many other grasses for moisture and nutrients.
- In order of decreasing relative growth rate, annual bluegrass, perennial ryegrass and Kentucky bluegrass are listed. High growth rates are characteristic of opportunistic plants. These usually possess a rather short life-cycle, low stress tolerance and the tendency to accumulate litter.
- Touchdown is a vigorous Kentucky bluegrass and demonstrated greater dominance than other bluegrasses that might have been studied.
- Relative tillering rate, measured in the field via the growth of individual transplanted shoots, generally increased with increasing temperature, day length and precipitation. Annual bluegrass had the highest rate of tillering during early autumn whereas perennial ryegrass had the highest rate during early summer.



RESPONSE TO VERTICAL MOWING AND ETHOFUMESATE TREATMENTS FOR ANNUAL BLUEGRASS CONTROL IN BERMUDAGRASS TURF

B J Johnson

Agronomy Journal 1986 Volume 78 Number 3 pages 495-498

Annual bluegrass is a severe problem in bermudagrass that is overseeded in the fall with cool-season grasses. Pre-emergence herbicides should be applied at least 30 to 60 days before planting to prevent severe reduction in stand of the newly planted cool-season grass. Herbicides applied that early often do not control annual bluegrass effectively.

Vertical mowing is a common practice that is done prior to overseeding bermudagrass with ryegrass to provide a small amount of loose soil for the seedbed.

Research at The University of Georgia was initiated to determine the effects of sequential vertical mowing and ethofumesate treatments on Tifway bermudagrass greens for annual bluegrass control. Overseeding with perennial ryegrass was included as a treatment variable. The following results have been reported.

- October vertical mowing reduced bermudagrass quality the following spring.
- Turf quality was reduced with increased intensity of vertical mowing - up to 60 percent leaf removal - the following spring.
- Vertical mowing and ethofumesate applied in October reduced turfgrass quality in April and May more than either treatment alone.
- Transition from cool-season grass to bermudagrass was generally slowest in the high-intensity vertical mowed turf.
- Early treatments of ethofumesate [October - November] caused an immediate cessation of bermudagrass growth and resulted in a longer transition from overseeded perennial ryegrass to bermudagrass the following summer.
- Turf treated with ethofumesate in October and November generally recovered by mid-February, but turf treated in November and December did not recover until mid-April.

Tall Fescue Research

GENETIC VARIABILITY OF MINERAL CONCENTRATIONS IN TALL FESCUE GROWN UNDER CONTROLLED CONDITIONS

L R Reeder Jr, H T Nguyen, D A Sleper and J R Brown

Crop Science 1986 Volume 26 Number 3 pages 514-518

Improved quality is a common objective of forage [and turfgrass] breeding programs. Concentrations of different mineral elements in herbage [or foliage] is an important aspect of quality. Several metabolic disorders of plants [and animals] have been associated with mineral nutrient imbalances.

Research at The University of Missouri has involved fifteen parental plants of tall fescue, randomly chosen from a genetically broad-based population for use in a polycross mating design. Half-sib families have been evaluated for herbage yield, herbage concentrations of magnesium, calcium and potassium and the ratio of potassium to calcium plus magnesium for two harvests when plants were grown under two controlled temperature regimes and two soil magnesium levels.

Additive genetic variance was significant for all trials. Most genotype times environment interactions were significant and indicated that plants should be evaluated under different temperatures and levels of soil magnesium. Narrow-sense heritability estimates on a family mean basis were 77, 75, 79, 89 and 77 percent for yield, magnesium, calcium, potassium concentrations and potassium to calcium plus magnesium ratio respectively. Predicted gains from one cycle of phenotypic family selection were 12, 13, 14, 19 and 16 percent of the base population mean for yield, magnesium, calcium and potassium concentration and the potassium to calcium plus magnesium ratio respectively.

TALL FESCUE DOUBLED HAPLOIDS VIA TISSUE CULTURE AND PLANT REGENERATION

M J Kasperbauer and G C Eizenga

Crop Science 1985 Volume 25 Number 6 pages 1091-1095

The USDA Agricultural Research Service is involved in the genetic improvement of tall fescue. This is a slow process by conventional breeding methods. Use of haploid and doubled haploid plants coupled with appropriate selection and evaluation schemes may help to speed up the process. This involves use of plants with the gametic chromosome number for evaluation under various environmental conditions to identify superior genotypes. Twenty-two cytologically verified haploid plants were derived from anthers of field grown tall fescue by anther-panicle culture. These were increased through tillering, and subdivided several times to increase material for replicated field evaluations and to provide material for chromosome doubling. The following flow chart identifies steps used in the regeneration of double haploid shoots from somatic tissue excised from tall fescue haploids:

- cytologically - verified haploid;
- excise dividing - young stem segment;
- establish callus;
- excise callus from primary explant after 4-5- weeks;
- sub-culture once and age calli until they begin to senesce;
- regenerate shoots;
- excise shoots;
- develop roots;
- cytologically verity ploidy in root tips;
- grow and evaluate double haploids.

The regenerated doubled and quadrupled haploids are being evaluated for forage characteristics and their potential usefulness to rapidly isolate desired characteristics.

Additional studies are in progress on chromosome pairing in the doubled haploids and on cross-fertility of the doubled haploids with conventionally derived breeding lines.

AMINO ACID COMPOSITION OF TALL FESCUE SEED PRODUCED FROM FUNGAL ENDOPHYTE-FREE AND INFECTED PLANTS

D P Belesky, J J Evans and S R Wilkinson

Agronomy Journal 1985 Volume 77 Number 5 pages 796-798

Tall fescue is a widely adapted and grown cool-season perennial grass. The presence of an endophytic fungus is believed to be responsible for its failure to generate expected live stock gains. Pyrrolizidine [loline] alkaloids in tall fescue occur in concentrations in direct proportion to fungal infection level. The loline alkaloids, regardless of function in tall fescue toxicosis, arise from secondary metabolic pathways of amino acids. Consequently, the occurrence of a fungal endophyte in tall fescue and the concomitant increase in alkaloid concentration may result in altered amino acid composition of the host plant. Genotypic and environmental factors influence the nitrogenous components of tall fescue and subsequently affect the types of nitrogen compounds provided by the host plant which could be used by the fungal endophyte. Host nutrition has been suggested to influence the growth habit of the fungal endophyte as well as the production of toxic metabolites. The endophyte of tall fescue is known to be disseminated by seed only. The fungus hyphae grow into the developing seed and are primarily located between the scutellum of the embryo and the aleurone layer. The presence of the endophyte in the seed may affect the types of amino acids deposited in storage protein. Furthermore, since the production of secondary nitrogen metabolites is enhanced by the presence of the endophyte in growing tall fescue plants, the types and amounts of nitrogen compounds available for export to developing seeds of endophyte-infected plants may be different than in noninfected plants. A characterization of amino acid composition of tall fescue could help eluicidate any potential role the fungal endophyte may have regarding the excellent adoptive and survival traits of the grass.

Research in Georgia has been concerned with amino acid composition of tall fescue seed as affected by the fungal endophyte status of the parent plant. New [viable endophyte] and old [stored for at least two years - nonviable endophyte] seed of Kenhy, Kentucky 31, an experimental line EXP and Fawn tall fescue were studied. Quantitative evaluation of seed amino composition did not reveal any alterations in amino acid composition which could be attributable to fungal endophyte status of the parent plant.

ERGOT TOXICITY FROM ENDOPHYTE - INFESTED GRASSES: A REVIEW

C W Bacon, P C Lyons, J K Porter and J D Robbins

Agronomy Journal 1986 Volume 78 Number 1 pages 106-116

Researchers at the Toxicology and Biological Constituents Research Unit, R B Russell Agricultural Research Center in Athens, Georgia have reviewed current knowledge concerning ergot toxicity from endophyte-infected grasses. The following points are worthy of note.

- The association of endophytic fungi with grasses is widespread, occurring on all but four of the grass tribes.
- Without regard to any beneficial effects derived by each member from the association, infected grasses are potential hazards to cattle.
- Ergot pasture grass toxicities should not necessarily be attributed to infection of the major forage grass established by the farmer nor to infection by the genus Claviceps; the involvement of endophyte-infected grasses growing in association with pasture grasses should be explored.
- Endophytic parasites of many genera of warm-season perennial weed grasses and tall fescue are producers of toxic ergot alkaloids. This group of fungi is distinct from the closely related genus Claviceps in being an intercellular parasite of leaf tissue. These fungi are parasitic on nine tribes of grasses that have a wide geographic distribution in the Western Hemisphere.
- The endophyte of tall fescue produces both the clavine and ergotamine peptide groups of alkaloids in culture and in the grass.
- The production of ergot alkaloids by weed grass endophytes is host-related; therefore, each parasitized weed grass must be assessed for alkaloid production.
- While no extensive survey has been done, all infected tall fescue examined contains ergot alkloids. The main peptide alkaloid produced by the tall fescue endophyte is ergovaline.

Turfgrass Cultivar Identification

MORPHOLOGICAL IDENTIFICATION OF ST AUGUSTINEGRASS CULTIVARS

P Busey

Crop Science 1986 Volume 26 Number 1
pages 28-32

Turfgrasses persist in the landscape for many years without replacement. During this period identity is often lost. At the same time, sound management usually depends on accurate identification of the grass or grasses present. In Florida, the chichbug resistant cultivar Floratam St Augustinegrass may be treated with an insecticide to prevent this pest when such a spray is unnecessary, expensive and could have harmful nontarget effects.

Research at The University of Florida has concerned morphological traits of 242 unknown St Augustinegrass lawn and sod samples in comparison with traits of 16 known clonal cultivars and taxonomic representatives. Leaf blade length, width and thickness; internode thickness and length; and inflorescence traits, such as floral region, branches and spiklet length, were measured for 5 groups of St Augustinegrasses. These were:

- Floratam Group - containing:
  Floratam,
  Floralawn;
- Bitterblue Group - containing:
  Bitterblue,
  Floratine;
- Longicaudatus Race - containing:
  Roselawn,
  Florida common;
- Breviflorus Race or Gulf Coast Group - containing:
  Test cultivars;
- Breviflorus Race or Dwarf Group - containing:
  Seville.

Floral traits were extremely useful in St Augustinegrass identification when they were available, but qualitative vegetative traits permitted rapid identification of samples from a uniform environment. The vast majority of unknown Florida St Augustinegrass samples fell within known racial groups.

IDENTIFICATION OF CULTIVARS OF PERENNIAL RYEGRASS BY SDS-PAGE OF SEED PROTEINS

J M Ferguson and D F Grabe

Crop Science 1986 Volume 26 Number 1
pages 170-176

In early 1985, there were 46 cultivars of perennial ryegrass entered under the certification program and more than 220 cultivars eligible for production under regulations of the Organization for Economic Cooperation and Development in Oregon. Many of these cultivars are phenotypically and genetically similar and the task of identifying different cultivars is becoming increasingly difficult. Accurate and rapid laboratory techniques to differentiate between cultivars has become increasingly important for both consumer protection and plant variety protection.

Research at Oregon State University involving electrophoresis [sodium dodecyl sulfate-polyacrylamide gel - SDS-PAGE] procedures has resulted in the identification of 27 bands many of which were common for the 28 cultivars studied. Cultivars were characterized by presence or absence of specific bands and by band intensity ratios. Of the 28 cultivars researched, only Pennant and Premier, and Omega and Birdie could not be adequately identified from each other. All other cultivars were differentiated by unique banding patterns irrespective of year, location of production, class of certified seed, viability or vigor of the seed. These cultivars were:

Barry	Regal
Caravelle	Dasher
Citation	Game
Cropper	Pennfine
Linn	Belle
Grimalda	Diplomat
Princess	Blazer
Derby	Fiesta
Elka	Yorktown
Pelo	Yorktown II
Manhattan	Ranger
Palmer	Prelude.

Because of the methods of breeding perennial ryegrass cultivars, it is doubtful if any one specific test will successfully separate all cultivars. Many varieties are closely related, often with common parents in their breeding background. The need for standardization is well established in all aspects of seed testing. The ability to standardize each electrophoresis gel with a commercially available molecular weight standard makes it possible to compare SDS-PAGE results between laboratories.

Research Technology

A COMPACT CONTINUOUS FLOW AND CONSTANT LEVEL SOLUTION CULTURE RENEWAL SYSTEM

L M Callahan and R E Engel

Agronomy Journal 1986 Volume 78 Number 3
pages 547-549

The principle of nutrient culture for growing plants is a widely adopted concept. These systems are popular in that they provide for plant growth under controlled conditions and often greatly accelerated rates of plant growth. They also adapt well to a variety of treatments and studies.

Research at The University of Tennessee and at Rutgers University has resulted in the development of a practical, compact and versatile continuous flow and constantly renewed nutrient culture system. Numerous individual culture jars can be supported by a single solution reservoir and distributor jar. Solution flow throughout the system is automatic with only the reservoir unit needing manual replacement or resupply. The level of solution in culture jars can be fixed easily and maintained reliably by adjustment of the air inlet tube in the reservoir jar. Each culture jar can be regulated for drainage and aeration. A compact aeration system adapts to the entire unit.

TECHNIQUE TO MEASURE ROOTING OF SODS GROWN IN SMALL CONTAINERS

R E Schmidt, R H White and S W Bingham

Agronomy Journal 1986 Volume 78 Number 1
pages 212-216

Research at Virginia Tech has been concerned with the development of a technique for anchoring small containers so that a vertical force may be used for efficiently measuring rooting. Washing of soil from roots of turfgrass samples to measure root development is very time consuming. Roots must be washed free of soil, dried, weighted, ashed and reweighed.

The new technique consists of placing sod plugs in wire mesh bottomed rings and transplanting to metal containers filled with soil. After approximately 4 weeks, the containers are anchored to a heavy base and the sod holding rings are attached to a block and tackle. Vertical force is applied to separate the sod from the underlying soil by slowly adding sand to a container attached to the opposite end of the tackle. Weight of the sand is a measure of root development. Energy required to vertically separate roots from soil significantly correlated with fresh and dry root weights.

Pests and Pest Control Research

CRABGRASS AND GOOSEGRASS CONTROL IN A BENTGRASS GREEN IN THE TRANSITION ZONE

L M Callahan

Agronomy Journal 1986 Volume 78 Number 4
pages 625-628

Crabgrass and goosegrass continue to be two of the most serious weeds in creeping bentgrass greens in the transition zone. Overlapping northern and southern climates characterize the transition zone and create environmental stresses unsuited to optimum growth of both cool- and warm-season perennial turfgrasses. Competition by annual weedy grasses is enhanced when a perennial turfgrass cannot compete at its best.

Research at The University of Tennessee has been conducted to determine effectiveness of ethofumesate, metribuzin, a benzofuran herbicide, napropamide, oxadiazon and prosulfalin in controlling crabgrass and goosegrass and in evaluating phytotoxicity to Penncross bentgrass grown on a high porosity green. The following results were noted.

- Metribuzin was ineffective as a pre-emergence treatment for large crabgrass control. All other herbicides gave some control with oxadiazon and prosulfalin giving nearly 100 percent control at all rates.

- If accumulation of herbicides and buildup occurred in the soil over a 4 year period, it was not evident based on increased weed control.

- Oxadiazon and prosulfalin provided effective control of goosegrass.

- Sod loss was not noted with 1 year treatments of prosulfalin at 3 and 6 pounds per acre [3.4 and 6.7 kilograms per hectare] or ethofumesate at 1 pound per acre [1.1 kilogram per hectare]. Repeat treatments for 3 more years at reduced rates resulted in no sod loss with ethofumesate at 1/2 and 1 pounds per acre [0.6 and 1.1 kilograms per hectare], oxadiazon at 2 and 4 pounds per acre [2.2 and 4.5 kilograms per hectare] and prosulfalin at 1 1/2 and 3 pounds per acre [1.7 and 3.4 kilograms per hectare].

SELECTIVE TALL FESCUE CONTROL IN KENTUCKY BLUEGRASS TURF WITH DICLOFOP

P H Dernoeden

Agronomy Journal 1986 Volume 78 Number 4
pages 660-663

Tall fescue is a desirable turfgrass species when grown in monoculture. When it is mixed with Kentucky bluegrass, it becomes a highly objectionable weed. As of October 1985, no herbicides were registered for selective control of tall fescue in Kentucky bluegrass.

Research conducted at The University of Maryland has been concerned with field studies to determine safe and effective rates of diclofop for selective control of tall fescue in a South Dakota certified Kentucky bluegrass turf. A total of three applications of diclofop were made spring and fall at rates of 2, 3, or 4 pounds per acre [2.2, 3.4 or 4.5 kilograms per hectare]. Results of this research indicate the following.

- Greater than 90 percent tall fescue control was obtained from applications of diclofop.

- The 4 pounds per acre [4.5 kilogams per hectare] rate was more effective [98 to 99 percent control] but normally caused a reduction in Kentucky bluegrass cover.

- Diclofop was most injurious when applied to Kentucky bluegrass less than one year old. Mature turf sustained much less injury from high rates of diclofop.

- The 2 pound per acre [2.2 kilogram per hectare] rate was generally safer to the turf than the 3 or 4 pounds per acre [3.4 or 4.5 kilogram per hectare] rate and the level of tall fescue control ranged from 91 to 96 percent.

- Diclofop stunted and discolored the Kentucky bluegrass turf. These effects generally persisted for 2 to 3 weeks.

- More information is needed on the influence of water dilution on potential phytotoxicity to bluegrass turf, on the relative sensitivity of Kentucky bluegrass cultivars and on the impact of environmental stress on herbicide efficacy and safety.

TURFGRASS THATCH COMPONENTS AND DECOMPOSITION RATES IN LONG-TERM FUNGICIDE PLOTS.

R W Smiley and M C Fowler

Agronomy Journal 1986 Volume 78 Number 4
pages 633-636

The balance of organic litter accumulation and decomposition in grasses is determined by complex processes. Routine use of fungicides causes this balance to shift in favor of accumulation. Certain fungicides induce thatch accumulation in turf but do not always inhibit or alter the population or composition of the soil microflora. Some fungicides may induce thatch accumulation by increasing the rate of plant tissue production rather than by reducing the rate of litter decomposition. Repeated applications or high-dosage applications of systematically translocated fungicides may alter the physiology, morphology and growth of turfgrass plants so as to cause thatch to accumulate.

Research at Cornell University has been concerned with long-term effects of 3 recently registered fungicides on the microfloral composition of turfgrass on thatch depth, thatch physical components and decomposition of cellulose and natural thatch incubated in the fungicide-treated plots for up to 20 months. Three older fungicides were also included in these studies for comparison purposes. Results of this research include -

- Seven applications of benomyl or iprodione per year caused thatch to become deeper than in the untreated turf; however, three applications per year did not.
- Increased thatch accumulation was not noted with cycloheximide, metalaxyl, propiconazol or triadimefon.
- None of the fungicides reduced the decomposition rate of buried thatch or altered the thatch pH or microbial composition.
- Iprodione and benomyl increased the overall amounts of recognizable tissue in the thatch matrix.
- Fungicides influencing thatch accumulation are likely to do so by increasing the rate of tissue production without changing the rate of tissue decomposition.

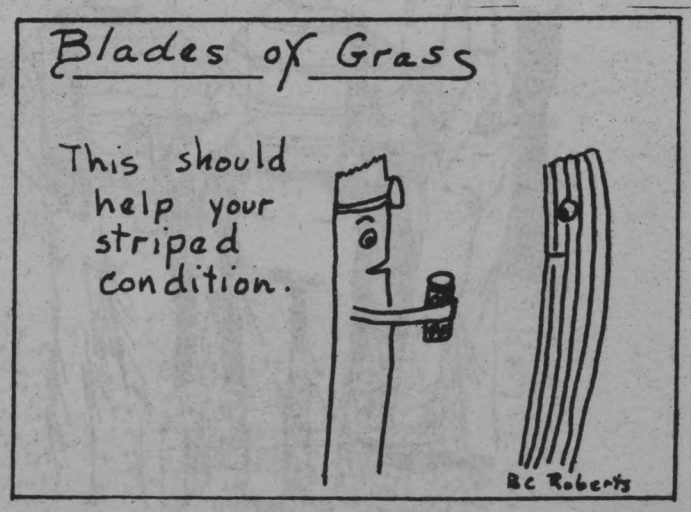
COMPARATIVE WATER-USE RATES AND EFFICIENCIES, LEAF DIFFUSIVE RESISTANCES, AND STOMATAL ACTION OF HEALTHY AND STRIP-SMUTTED KENTUCKY BLUEGRASS

J L Nus and C F Hodges

Crop Science 1986 Volume 26 Number 2
pages 321-324

Pathogen induced water stress is common in diseased plants. Water uptake may be limited by pathogen-induced root growth inhibition or by vascular blockages. Stripe smut infection decreases root growth and root-shoot ratios of Kentucky bluegrass. Pathogen-induced alterations in host water relations also may result from a loss of ability of cells to retain solutes and water. Kentucky bluegrass infected with stripe smut exhibits less capacity for osmotic adjustment to osmotically induced water stress than do healthy plants. Pathogen-induced water stress may also arise from an increase in host transpiration because of decreases in cuticular resistances or to an inhibition of stomatal movement.

Research at Iowa State University with Merion bluegrass has compared stripe smut diseased with healthy plants for water-use rate, water use efficiency, leaf diffusive resistance and critical leaf-water potentials for stomatal closure in an effort to help explain causative factors for increased mortality of diseased plants during periods of water stress. Results suggest that although the capacity of diseased plants for osmotic adjustment in response to environmentally imposed water stress may be curtailed because of infection, in the absence of such environmental stress pathogen-induced water stress can provide a stimulus for osmotic adjustment in diseased plants that healthy plants would not encounter.



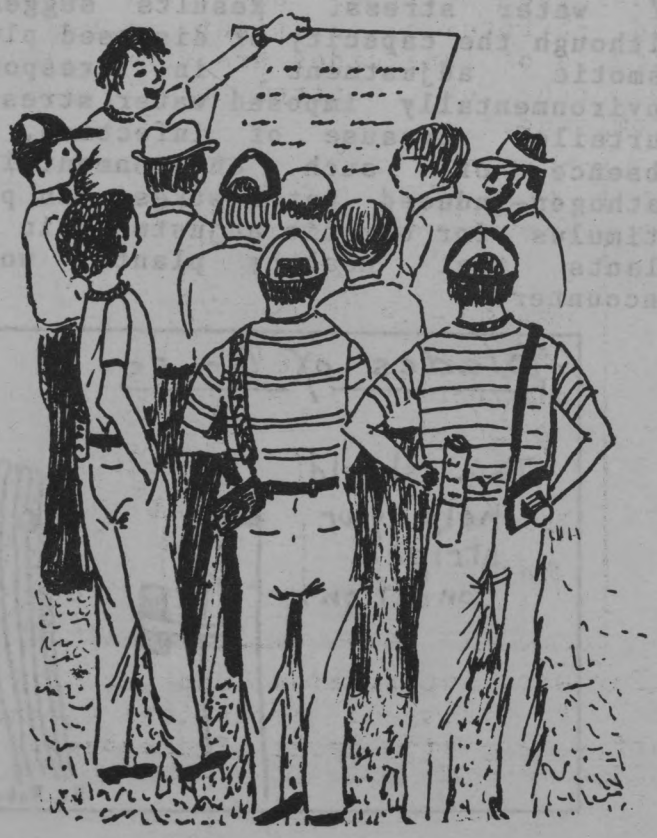
Field Day Score Card

1986 Virginia Tech Turfgrass

Research Results Worth Million$

Research and Extension faculty at Virginia Tech presented results of current turfgrass investigations at field days held September 16-18 in Blacksburg. Industry value of information presented would have to be assessed in millions of dollars based on potential for enhancement of lawn and sports turf in the region of application for these research results. The 110 page Field Days Report is a fine tuned, up to the minute manual from which turfgrass construction, renovation and management recommendations on a wide variety of topics will be drafted in the months ahead. Congratulations to Virginia Tech Turfgrass Staff for excellence in Research and Education:

- R E Schmidt
- L H Taylor
- S W Bingham
- H B Couch
- J R Hall III
- D R Chalmers
- S J Donahue
- A Divine
- J Wollmer
- J Landwehr
- M Goatley
- R Shaver
- E Rucher



Only a few highlights of these research results can be presented here.

National Variety Trials

Extensive cultivar and variety evaluations, including Kentucky bluegrasses, fine fescues, perennial ryegrasses, tall fescues and bermudagrasses demonstrate which turfgrasses are best in this part of the transition zone.

Establishment

Sod strength and transplant enhancement research has shown that a single [March 14] application of Bayleton plus iron increased sod strength by 30 percent. Vegetative zoysiagrass establishment is also enhanced by use of iron and a natural cytokinin - cold water extract MZ63.

Nutrition

Iron fertilization should be an integral part of a bentgrass maintenance program to obtain optimum quality turf. When bentgrass is growing slowly, and consequently not requiring frequent mowing, the influence of iron fertilization on turf color can be expected to persist up to four months. Maximum benefits should be expected from a 0.5 pound iron per acre application in October and again in December.

As for nitrogen on Kentucky bluegrass, considering the potential burn when using urea, and the delay nitrogen release as well as cost, the 50/50 or 75/25 UF/urea ratios are superior to using UF or urea alone.

Field Day Score Card CONTINUED

Wetting Agents

Although a non-ionic wetting agent initially may slow down Kentucky bluegrass foliar growth slightly, the subsequent stimulation of foliar growth may be apparent up to ten weeks following the wetting agent application.

Extending Bermudagrass Growth

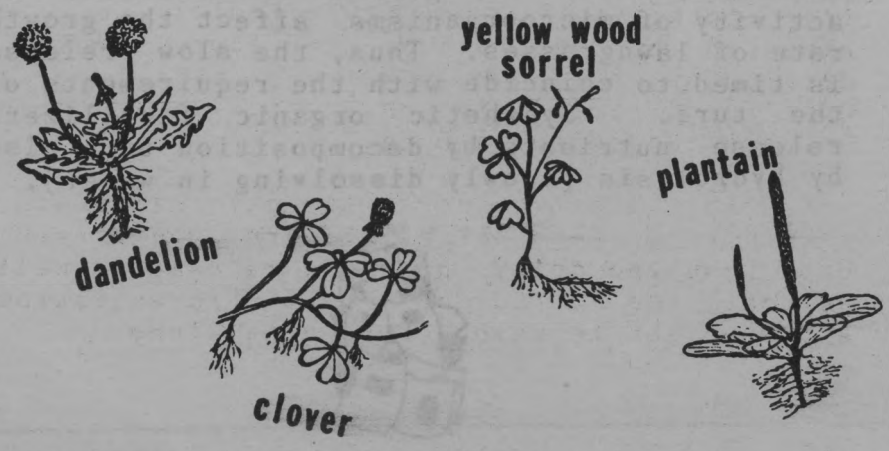
All covers placed on the turf in the fall after dormancy produced more post-dormancy break as of April 7 than the control. Clear plastic had the highest percentage of dormancy break. Greenzit applications prior to fall bermudagrass dormancy extended growth in the fall and stimulated spring growth. Spring applications of Greenzit enhanced post-dormancy growth.

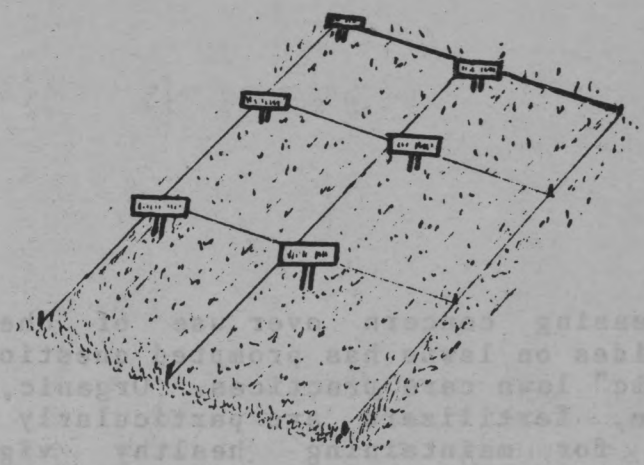
Weed Control

The following weeds have been subject for herbicide control research:

- goosegrass
- crabgrass
- corn speedwell
- cut leaf evening primrose
- cinquefoil
- red sorrel
- clover - white - low hop - red
- curled dock
- dandelion
- plantain
- crown vetch
- mousear chickweed
- yellow wood sorrel
- buttercup
- hawkweed
- wild violet
- ground ivy
- yellow nutsedge
- tall fescue
- annual bluegrass.

A variety of herbicides and combinations of herbicides have been evaluated on different grasses grown for lawn and sports turf.



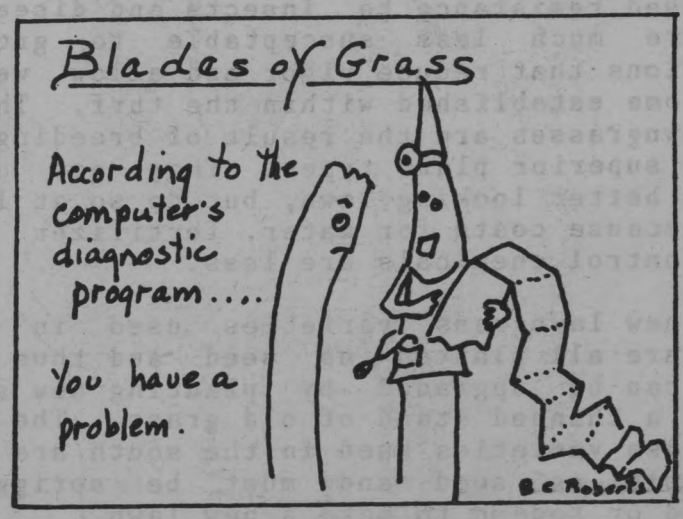


Growth Regulators

Growth regulator research on tall fescues maintained as lawn turf has evaluated a number of materials with mostly mixed results. Applications that are not phytotoxic have generally failed in some measure of growth reduction or seedhead control. For some, results are inconsistent. Much is to be learned from continuing research.

Disease Control

Corticium red thread and sclerotinia dollar spot control trials have provided new information on use of fungicides. In addition, relationships between the pH of fungicide mixtures and their effectiveness and phytotoxic or plant growth regulator effects of fungicides are under study. New research on control of algae appears promising.



For more information, contact J R Hall III or D R Chalmers, Extension Agronomists - Turf, Virginia Tech, Blacksburg, Virginia 24061.

'Organic' Lawn Care

by

Eliot C Roberts
Director
The Lawn Institute

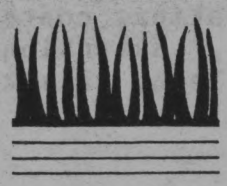
Increasing concern over use of chemical pesticides on lawns has prompted questions on "organic" lawn care practices. Organic, slow release, fertilizers are particularly well suited for maintaining healthy vigorous lawngrasses. Thus, "organic" lawn care can and should result in reduced use of pesticides, if not in their elimination.

Lawngrass Vigor and Insect and Disease Resistance

Natural or common lawngrasses such as Kentucky bluegrass, fine fescue, perennial ryegrass, tall fescue and bentgrass used in the north and bermudagrass used in the south have little natural resistance to insects and diseases. They are subject to growth recessions induced by local climatic conditions that cause lack of vigor and thus infestations of weeds. Such lawns cannot be maintained weed, insect and disease free without the frequent use of pesticides.

The new proprietary [named] varieties of Kentucky bluegrass, fine fescue, perennial ryegrass, tall fescue and bentgrass used in the north and bermudagrass, St Augustinegrass, zoysiagrass, and centipedegrass used in the south have increased resistance to insects and diseases and are much less susceptable to growth recessions that reduce vigor and allow weeds to become established within the turf. These new lawngrasses are the result of breeding to create superior plant types. They not only make a better looking lawn, but do so at less cost because costs for water, fertilizer and pest control chemicals are less.

The new lawngrass varieties used in the north are all planted as seed and thus old lawns can be upgraded by planting new seed within a thinned stand of old grass. The new lawngrass varieties used in the south are not available as seed and must be sprigged, plugged or sodded to make a new lawn.



"Organic" lawn care starts with the planting of new improved lawngrasses that have the ability to respond well to applications of organic, slow release, fertilizer by maintaining an insect and disease resistant turf with sufficient vigor all season long to crowd out weed seedlings. This type of response to organic fertilizer is not consistent with the natural or common type lawngrasses.

Slow Release Organic Lawn Fertilizers

There is a wealth of natural organic, slow release, materials available for lawn fertilization. They are low analysis and most often contain from 2 to 6 percent nitrogen and even smaller amounts of phosphorus and potassium. Thus, they are bulky and easy to spread. Because they are natural in origin, they are usually waste or by-products of some type of processing. Their bulk increases shipping costs and thus locally available fertilizers are often less expensive.

Synthetic organic lawn fertilizers are made to release nutrients slowly like the natural materials. They may contain ureaformaldehyde, methylene ureas, sulfur coated ureas or isobutylidene diurea [IBDU]. These are marketed as the active ingredients in lawn fertilizers.

Natural organic fertilizers release nutrients as microorganisms decompose the material. The same general fluctuations in activity of microorganisms affect the growth rate of lawngrasses. Thus, the slow release is timed to coincide with the requirements of the turf. Synthetic organic fertilizers release nutrients by decomposition but also by hydrolysis [slowly dissolving in water].

'Organic' Lawn Care continued

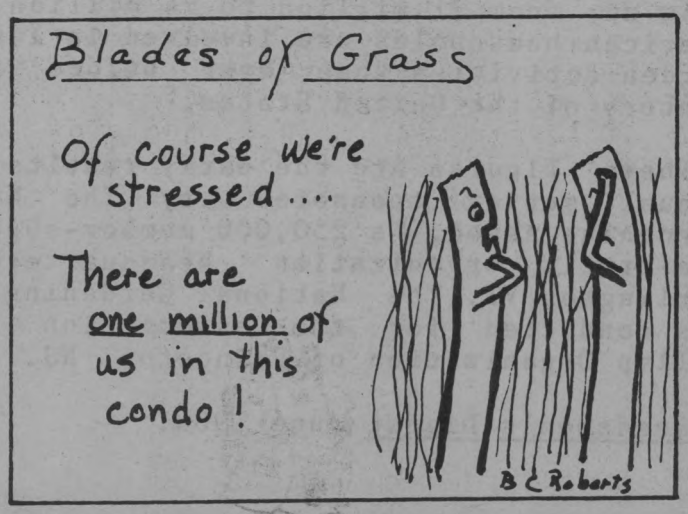
It is the slow release of nutrients that creates a healthy but vigorous turf, one that has maximum resistance to insects and diseases that are always present in the environment of lawngrasses. This type of controlled vigor causes lawngrasses to prevent the establishment of some 10,000 weed seeds per 1,000 square feet of lawn that are most always in the soil, ready to germinate.

What happens if there is not a controlled release of nutrients ? Then lawngrasses either get too much or too little. In either case the growth rate is abnormal, faster if there is too much nitrogen, slower if there is not enough. Lawngrasses with too fast or too slow growth rates are unhealthy. They are more prone to spread of insects diseases and weeds.

If the lawngrasses are the new improved types, they will respond to organic fertilization by creating a disease, insect and weed free lawn with pesticide use reduced or eliminated. Thus, a beautiful lawn is much less expensive to maintain.

Stress Within Lawngrasses

Most fine lawns contain close to 1,000,000 individual plants per 1,000 square feet. That's a lot of individual plants, each growing on its own. It is easy to see how insects, diseases or weeds would have a difficult time getting started in a good healthy turf. On the other hand, if these plants are run down, weak and lack vigor, it is easy to see how vulnerable they would be to these pests.



All lawngrasses are subject to stress that tends to make them lose vigor. Excessive traffic on parts of the lawn will compact the soil and this makes it more difficult for the grasses to grow there. Too much rainfall or watering that saturates the soil causes poor root growth and thus a stressed turf. Too little rainfall or watering causes turf to wilt and thus become stressed. Long periods during the summer of exceptionally high temperatures, particularly at night, cause lawngrasses to be stressed. Lawngrasses become stressed by low light intensity and thus turf may be more open and thin in the shade than in the full sun.

All these conditions in various combinations can weaken a lawn so that even the best of the new improved grasses may be subject to insect attack, disease infection or weed infestation at times. With the new improved lawngrasses these attacks, infections and infestations will be minor and not usually require use of chemical pesticides. With natural or common lawngrasses, pesticide use will be required more often.

Pesticide Use When Needed

Should a lawn under "organic" lawn care become diseased, insect infested or weedy, use of a pesticide is appropriate. But first determine what has caused the stressed condition within the lawn and see that this is corrected as far as possible. Use of pesticides without improving growth conditions that have resulted in weak rundown turf will only perpetuate need for the pesticide.

Careful use of pesticides is important. County Agricultural Extension Service offices can provide information on local restrictions and safe use. Read manufacturers directions and follow these without deviation. When in doubt, call on the services of a lawn care company that has the proper equipment and expertise for safe and effective application.

Survey Update

Study Says Americans Spending More Time Mowing Lawns

Americans are spending more time riding or pushing their lawnmowers. In fact, many are devoting a full work week every year to cutting their grass.

A survey by Champion Spark Plug Co, Toledo, Ohio, found that the average lawnmower owner spends 40 hours at the controls. This is up from 35 hours just four years earlier.

There are 55.5 million privately owned power mowers in the country, according to the Champion study, with about 12.9 million of them riding mowers.

Sometimes homeowners overlook some preventive maintenance practices that might ensure better operation of equipment. For example, 53 percent of owners said they had not installed spark plugs during the past 12 months.

With engine maintenance a key factor in how well the power mowers operate, Champion engineers recommend that the fuel systems should be flushed, the air filters cleaned, the oil changed, and the spark plugs replaced annually.

A panel of some 850 lawnmower owners nationally was interviewed as part of the Champion study.

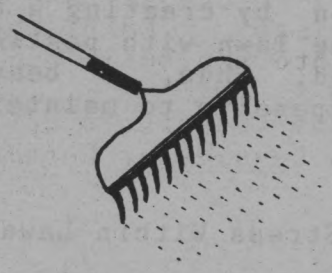
Lawn and Garden Marketing June 1986

Gardening Tops Leisure Activities Again

Twenty-seven categories of leisure activities are included in the 1985 poll conducted by the Gallup Organization of Princeton, NJ, and which has been announced by the National Gardening Association, 180 Flynn Ave, Burlington, VT 05401. Gardening was enjoyed by 44% of the population, followed by 42% swimming, 34% fishing, 33% bicycling and 29% do-it-yourself projects. At the bottom of the list were ice skating and sailing with 5% each.

Gardening of some kind was enjoyed by 29 million households where ages averaged between 30 and 49. This age group spent an average of $202 on lawn and garden purchases last year. Sizes of gardens are smaller. More people grow vegetables for the freshness and good taste, than for the saving of money. It was estimated over $12 billion dollars was invested in lawn and garden activities.

Greener Gardening-Easier April 1986



Gardening Grows with America

For the second consecutive year, more American households participated in some form of lawn and garden activity. Reflecting the growth in the number of households in America this year, 1985 also saw an increase in the numbers of gardening households. From 1984 to 1985 the number of households involved in one or more kinds of lawn and garden activity went up from 71 million to 74 million. More American households are involved in lawn and garden activities than ever before in the history of the United States.

These figures are the early results of an annual survey sponsored by The National Gardening Assoc, a 250,000 member-supported, non-profit organization headquartered in Burlington VT. The National Gardening Survey was conducted for the association by the Gallup Organization of Princeton, NJ.

Seedsmen's Digest June 1986.

Little Known Facts About Golf Courses

Ecologically, the golf course provides some pretty fantastic help to mankind, in addition to just giving him a place to exercise and enjoy life. For example:

An average 18-hole golf course, approximately 150 acres, can produce enough pure oxygen through photosynthesis for at least 100,000 people for the entire year. On a smaller scale, that means a well maintained lawn 50 by 50 feet liberates enough oxygen to meet the needs of a family of four, day after day.

The same average golf course of 150 acres can effortlessly absorb 12 million gallons of water during a three-inch rainfall.

Grass also provides a cooling effect. A 2000 square foot plot releases as much as 120 gallons of water through a method called evapotranspiration. This release of water reduces the heat factor. Grass absorbs only 50-60 percent of the incoming solar radiation while building and pavement absorb 90 percent.

Grass and tree leaves also help cleanse the atmosphere because of their ability to trap dust particles through static electricity of dense foliage. Rain then washes the particles into the soil.

Golf Course Superintendents Association of New England Newsletter September 1986

Landscaping Increases Property Value

According to a study by the American Association of Nurserymen, a nice-looking yard increases property value up to 30% with an average of about 12%.

Weeds Trees and Turf July 1986

Loss Estimates for Insects and Related Pests of Lawns and Turf for 1985

Dr Randy Hudson
Extension Entomologist-Turf
Tifton, GA

Recently an estimate of losses by insects on lawns and turf were compiled by the Survey and Losses Committee. These estimates are based on personal observations and contacts with many in the turf industry. As expected, grubs were identified as the insect causing the greatest amount of damage. Many of the turf growers in the coastal plains might argue this point in favor of mole crickets. But, grubs, unlike mole crickets, are a statewide problem and not just confined to the sandy soils of the coastal plains.

Loss Estimates for Insects and Related Pests of Lawns and Turf, 1985

Pest	Control Cost	Damage	Total
White grubs	$2,819,000	$4,815,000	$7,634,000
Chinch bug	1,100,000	1,100,000	2,200,000
Mole crickets	1,600,000	2,000,000	3,600,000
Fall armyworm	500,000	800,000	1,300,000
Miscellaneous[1]	2,856,000	3,077,000	5,933,000
	$ 8,875,000	$11,792,000	$20,677,000

[1] Ants [excluding fire ants], billbugs, leafhoppers, sod webworms, earwigs and sowbugs.

Turfgrass Topics,UGA,CES Sept/Oct 1986

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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.

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