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W. R. Mullison

John R. Hall

Paul Harder

John M. Zak

Joseph Troll

See next page for additional authors

Authors
W. R. Mullison, John R. Hall, Paul Harder, John M. Zak, Joseph Troll, and Anthony J. Terzis

TURF BULLETIN

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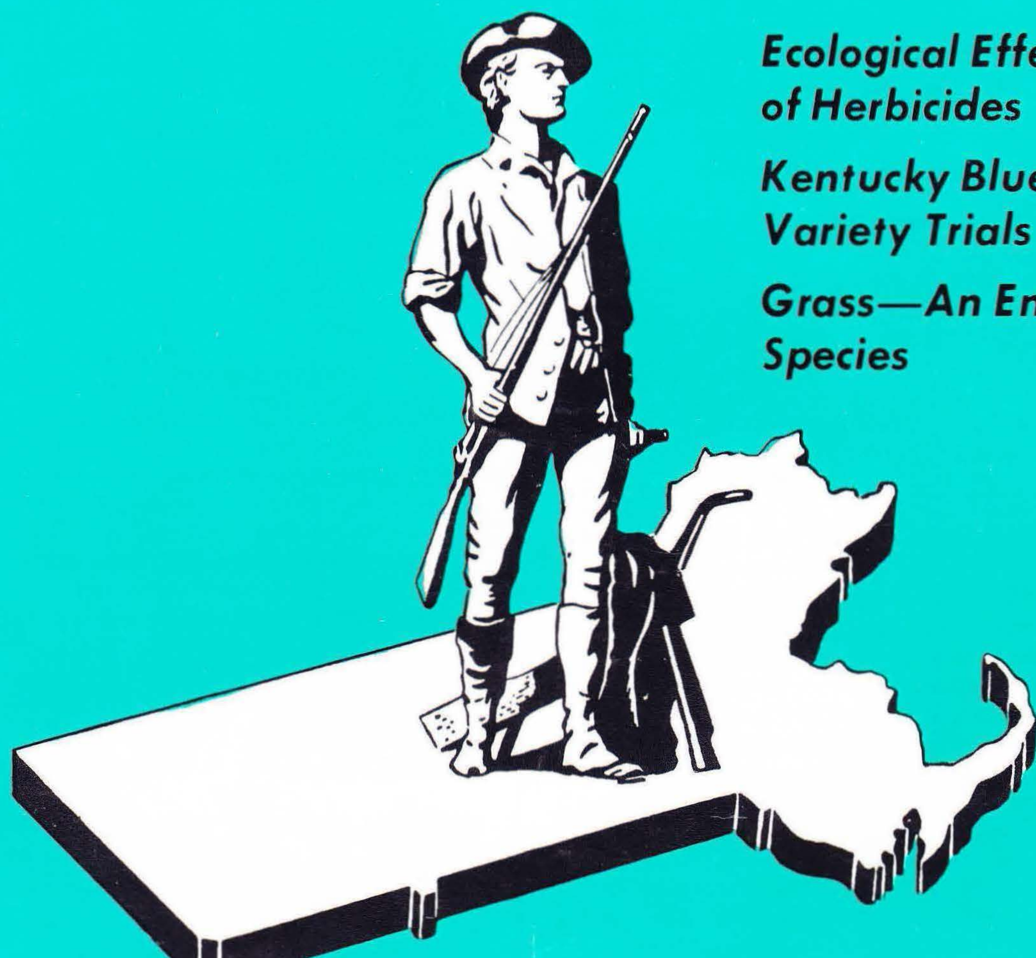
AND LAWN GRASS COUNCIL
INCORPORATED

Featured in This Issue:

Ecological Effects of Herbicides

Kentucky Bluegrass Variety Trials

Grass—An Endangered Species



FALL 1972

BETTER TURF THROUGH RESEARCH AND EDUCATION

EDITOR
Paul R. Harder
Rm. 10 Stockbridge Hall
U.M. Amherst, Mass.

SECRETARY-TREASURER & ADVISOR
Dr. Joseph Troll
RFD No. 2 Hadley, Mass.

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The Massachusetts Turf and Lawn Grass Council Incorporated is chartered under the laws of the Commonwealth of Massachusetts as a non-profit corporation. The turf council seeks to foster "Better turf through research and education."

More detailed information on the subjects discussed here can be found in bulletins and circulars or may be had through correspondence with the editor.

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— Reprinted from DOWN TO EARTH, Vol. 28, No. 2, c 1972, The Dow Chemical Company

Ecological effects of herbicides

by Dr. W. R. Mullison
Ag-Organics Department
Dow Chemical U.S.A.

Today, ecology has become a popular science and is now a household word. If you consider for a moment the meaning of ecology, that it is a science dealing with the interrelationships of living things and their environment, it becomes clear that ecology is a complex field. This is true not only because of its broad subject matter but there are unanticipated effects between living organisms and their environment. In part, this is due to their adaptability to new conditions. In addition, there are often subtle interrelationships between living organisms. A well-known illustration of an unanticipated effect was the introduction of the rabbit into Australia. There are others, such as the introduction of the water hyacinth into this country where it has multiplied so rapidly that it causes a tremendous problem by impeding and clogging our southern waterways and drainage ditches. Another example is the introduction of the blackberry into Chile, where it now occupies 5 million acres of arable land and is a tremendous weed problem. These examples, besides being of a scientific interest, have had a considerable economic impact upon these countries.

There are many examples of subtle interrelationships between living organisms. One example is the commercial Smyrna fig which is now grown in California and came from Asia Minor. The Smyrna fig produces only female flowers with no pollen. To get marketable fruit it is necessary to have the flowers fertilized, which is only done by the female of a certain species of wasp "Blastophaga psenes" which, in turn, can only reproduce on another variety of fig tree called the Caprifig. The wild Caprifig is not only necessary for the reproduction of the wasp but it also supplies the necessary pollen to fertilize the commercial Smyrna fig. This is a three-way interrelationship, the complexities of which took over a decade of scientific investigation to discover.

Our knowledge of such unexpected and complex ecological relationships has grown greatly in recent years. Modern civilization, with its physical occupancy of the land, has a great effect upon our environment. We are learning that our modern way of life is having other unexpected impacts upon our environment. This, in part, is due to the greater volume of waste products, and, in part, because we have learned that some of our waste products are not degrading as fast as we once thought. In addition, some of our products are more mobile than we had realized and are showing up in unexpected places far from their place of original use or disposal point. A well-known example of these last two points is the insecticide DDT; which, although a carbon compound, does not readily degrade to CO_2 and H_2O and is now universally distributed over the earth.

These problems have been overly simplified but succinctly stated in the following three "laws" of ecology:

Everything affects everything else.

Everything goes somewhere.

There is no such thing as a free lunch.

Many questions are being raised today as to the ecological effects of various products used in modern technology, particularly if they are relatively new. One relatively new technology is the use of herbicides in modern agriculture.

In this paper I am first going to discuss herbicides in connection with the law, "Everything goes somewhere." This involves a discussion of the behavior of herbicides in air, soil, and water, their persistence in these media, and their possible accumulation and metabolism in living organisms. I will conclude with a discussion of herbicides in connection with the first law, "Everything affects everything else."

Individual herbicides may behave in different ways; nonetheless it is possible and useful to come to certain generalizations about their behavior in some areas of major interest to us. With this in mind, this paper gives the results of a general survey that has been made of the herbicide literature. It is interesting to note that many of these investigations pre-date the current popular interest in ecology. This shows that scientists, even those who have been working in a new technological field, have been concerned about this subject for a long time.

VOLATILITY

Now let's consider volatility and spray drift of herbicides in connection with the second ecological law—Everything goes somewhere.

2,4-D esters such as the isopropyl and butyl are the commercial weed killers most likely to cause trouble from the standpoint of volatility. The vapor pressure for the butyl ester of 2,4-D is 9.55×10^{-6} mm of Hg at 25.4 degrees C. Although 2,4-D esters such as the isopropyl and butyl have such low vapor pressures, their activity is so great that volatility can be demonstrated in the field on sensitive crops such as cotton and grapes. This can cause damage under certain conditions. Higher temperature increases volatility as would be expected. As a result of this attribute, in the early 1950's low volatile esters of 2,4-D such as the polypropylene glycol butyl ether esters and the isooctyl esters of 2,4-D were developed. These are roughly 10-20 times less volatile than the isopropyl or butyl esters. Through the combination of experience, regulation, and the use of low volatile esters, damage from this cause is now very infrequent. A rough rule of thumb is do not use any 2,4-D ester near a sensitive crop. This is forbidden by law in many states. Also, do not spray, even with low-volatile esters in areas near susceptible crops when the temperature is above 95 degrees F.

For some herbicides such as Chloro IPC, volatility as a chemical property is significant. Chloro IPC is more volatile than the isopropyl ester of 2,4-D. However, as this herbicide is both less active and has fewer visible effects than 2,4-D, this property has not been a problem with susceptible crops in field practice. In fact, while all herbicides have some degree of volatility, this effect is generally negligible in causing damage to crops or susceptible plants. The more usual method for herbicides to get into the atmosphere in sufficient quantities to cause damage to susceptible plants is by spray drift. Although the proper use of low volatile esters and amine salts of 2,4-D will prevent significant damage from volatility, their use does not prevent damage due to spray drift.

SPRAY DRIFT

It is generally agreed that spray drift off the target area is an important hazard. Herbicides are usually applied as sprays, and air currents may easily carry small droplets quite a distance from the application site. Agricultural water sprays often have a

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median mass droplet size of 100-200 microns for fine sprays and 200-500 for coarse sprays. Neglecting the factors affecting evaporation, and considering only gravitation, it will take 10 seconds for a 100 micron droplet to fall 10 feet in still air but it will travel 41 feet from the perpendicular in falling 10 feet in a 3 mile an hour wind. Thus it is easy to see that damage to susceptible plants by means of spray drift is a possibility.

Experience has taught the necessity of following good spraying practices. These, if followed, will keep you out of trouble. Some good application practices are: Do not spray near sensitive crops; prevent drift damage by using coarse sprays and low pressures in areas where damage might be expected; use additives such as thickening agents to improve spray placement; time the application so as to spray before sensitive plants have come up or are actively growing; and do not spray when wind velocity exceeds 5 mph.

If spray application is by aircraft in areas where sensitive crops or plants are growing be extra cautious. A rule of thumb here is: do not spray when the wind is blowing towards the sensitive plants; spray only when wind velocity is less than 5 miles per hour; use coarse sprays with no more than 20 pounds pressure at the nozzles and apply at least 5 gallons of spray per acre. Recently, investigations indicate that aircraft spraying during a dead calm should also be avoided. Do not apply too high from the ground; 5 to 10 feet above the height of the crop is fine. An additional aid for the spray operation is the use of a smoke column. This will indicate the direction and velocity of the air flow. It also will warn of a temperature inversion by a layering of the smoke. Most important of all, do not use this application method when susceptible crops or plants are growing nearby.

Following the label instructions, the latest state and local regulations, and in general being cautious and using good judgment prevents problems of damaged plants due to spray drift. Violations of such good application methods can readily cause trouble. Practically speaking, whether damage results from volatility or spray drift, the end result is the same.

HERBICIDES IN THE SOIL

There is relatively little movement of herbicides in the soil that is not associated with soil water. Absorption into plants and adsorption onto clay particles and organic matter usually occur quickly, the actual rate depending upon the sorptive properties of the herbicides and the soil in question. This prevents accumulation either into lower soil water or as runoff, following rains, into streams or irrigation ditches. What little is left free may follow either gravitational movements downward or capillary forces upward. There is no published data that the author found indicating that herbicides are leaching down into the ground water. Speaking of herbicides in water, with the exception of aquatic herbicides there is little doubt that the most likely source of water contamination by herbicides is not through actual spraying of the crops but through dumping of unused portions from spray tanks, the dumping of rinse water from cleaning out the equipment, and from disposal down drains of old stocks which are being cleared away.

Herbicides as a rule break down relatively rapidly in the soil. It has been well established that 2,4-D and Dalapon*, when used for agronomic crops, break down in 4 to 6 weeks in soil under conditions favorable for plant growth. The general mechanisms for their decomposition will be discussed in the next section.

A very few herbicides are resistant to breakdown and, if not strongly adsorbed by soil colloids, may be subject to leaching. With these, it might be that contamination of the ground water is a possible hazard so such chemicals need and get careful investigation before they are approved for sale. Sheets[1], who has done a great deal of work on this subject, states that massive accumulation of herbicides at the rates used on agricultural land for controlling weeds in crops is unlikely. A tabular summary of the persistence in soil of commonly used herbicides is given in Table I.

DEGRADATION OF HERBICIDES

Fortunately, the activity of most herbicides is short-lived, and many of our widely-used ones, such as the phenoxy herbicides, are readily decomposed by microorganisms. That these microbes use the herbicide as an energy source is well established, and it is widely recognized that this is the major factor in the decomposition of these chemicals.

Extensive investigations into the effects of herbicides on soil microorganisms have shown clearly that soils are not permanently sterilized to the detriment of future agronomic uses; beyond this, conclusive effects are not clear. Both retardation and stimulation of microbial life have been found to occur. Changes in actual species composition of a population have not been investigated a great deal, but a few investigators have stated that no long-lasting changes have occurred.

Degradation is brought about mainly by aerobic microorganisms. There is some circumstantial evidence that anaerobic decomposition occurs, but this field requires further investigation. Chemical decomposition, apart from that caused by microorganisms, plays only a minor role in their breakdown. Photodecomposition is known to occur, but the importance of its role remains to be determined.

Table I. Persistence of various herbicides in soil

Herbicide	Lb/Acre	Residual Phytotoxicity (months)
Amitrole	3-18	1-3
Atrazine	2-4	4-7
Diuron	3.6-4	5-7
Fenac	4-5	12
Monuron	2-4	5-6
Endothall	6	1
Simazine	2-5	12
Dalapon	6-20	1
2,4-D	1-5	1
2,4,5-T	1-5	3-6
Silvex	1-5	4-7
TCA	12.5-67	7-12
Picloram	0.5-1	6-12
2,3,6-TBA	15-20	12-32

Under conditions favorable for plant growth

Modified from Sheets, T. J. and C. I. Harris, Herbicide residues in soils and their phytotoxicities to crops grown in rotations. pp. 123-124 from "Residue Reviews, 11" F. A. Gunther (Ed.), Springer-Verlag, New York, 1965.

EFFECT OF HERBICIDES ON WATER, FISH AND PLANKTON

Herbicides tend to be toxic to lower plant life forms by their very nature. As all plants may be weeds, it would be expected that

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[1]See reference, Table 1

*Trademark of The Dow Chemical Company abroad. The active ingredient in DOWPON® grass killer.

TURF MANAGEMENT

John R. Hall, Extension Turf Specialist
Natural or Synthetic Turf

The startling fact that consumer products each year injure 20 million Americans, permanently disable 110,000, and kill 30,000 more led to the hearings before the subcommittee on Commerce and Finance concerned with bills to protect consumers against unreasonable risk of injury from hazardous products. The safety of synthetic turf was questioned during these hearings. The hearings have been completed and it seems a good time to summarize the subcommittee findings and discuss synthetic and natural turf.

The first artificial turf sports surface was installed in 1964 on a fieldhouse floor at Moses Brown Prep School in Providence Rhode Island. The first synthetic outdoor football surfaces were installed in 1967 on stadium fields at Indiana State University and Seattle Memorial High School. The popularity of the artificial surfaces increased rapidly to the point where 42% of all National Football League games were played on synthetic turf in 1971. There are now more than 100 football fields in the United States constructed of synthetic turf. Many cities and schools are considering the installation of synthetic turf. There is disagreement over the usefulness and safety of synthetic turf. The subcommittee attempted to shed some light on the question of the safety of synthetic turf.

Mr. Edward R. Garvey, Executive Director of the National Football League Players Association related the complaints of NFL players to the members of the subcommittee. He noted player complaints of sore knees and ankle joints, increased burns, excessive heat build-up, secondary injury from the bouncing effect, and increased danger of helmets grabbing on synthetic surfaces.

Dr. James G. Garrick, Orthopedic surgeon and Assistant Professor at the University of Washington presented data from locally conducted research that involved 228 games played by 26 high school football teams and 1350 players. This data indicated that in the 1970 football season there were 0.76 injuries per game on synthetic turf and .52 injuries per game on grass. Dry synthetic turf produced .93 injuries per game compared to .61 injuries per game on wet synthetic turf. Games played on dry grass turf produced .53 injuries per game compared to .50 injuries per game on wet grass. College level studies by Dr. Garrick further support the contention that dry conditions on either synthetic or natural turf lead to increased injuries as a result of better traction and harder player-to-player contact.

Dr. Garrick never contended that his research had settled the question, but did indicate that further studies were needed. A witness testifying in behalf of the synthetic turf industry later criticized the research work of Dr. Garrick, indicating his study method was superficial and his results inconclusive. Considerable data was presented by the synthetic turf industry in defense of the safety of their product. Their survey data generally contradicted the findings of Dr. Garrick.

For The Homeowner —

HOW TO HANDLE THOSE TOUGH SHADY SPOTS

Paul Harder

There is little doubt that trees of every variety lend beauty and comfort to any home landscape. The comfort, in the form of shade, is an undeniable treat on a hot summer's day. Unfortunately, growth of turfgrasses in these same shaded areas is a problem that often yields bare spots and frustration for a conscientious turf grower. There are several handicaps to turf in shaded areas. These include competition for water and nutrients from the trees, reductions in the quality and quantity of light reaching the grasses, and higher humidity and longer lasting dew under trees which encourage fungal diseases. Since all of these factors are working against the growth of grass in shade, one might ask whether or not there are any alternatives? Depending on the location of the shaded areas and the amount of sunlight reaching the ground surface, several options do exist. The most difficult areas to maintain a vigorous stand of turfgrass on are those where shade lasts from sunrise to sunset. Ground covers like pachysandra which are shade tolerant can substitute for turf in some instances. Ornamentals, such as azalea and rhododendron, which thrive in deep shade, may be planted and surrounded by woodbark mulch to make an attractive setting. In partial shade, healthy lawns can be maintained by emphasizing grass varieties in the fescue family which are inherently more vigorous in shade than other types of grass. There are also varieties of bluegrasses that have been selected for their shade tolerance and these should be relied on when preparing a lawn seed mixture. A conscientious lime and fertilizer program throughout the growing season is essential in shaded areas. Mowing height should be higher in shaded areas than in full sunlight so that more leaf surface can be exposed to the reduced amounts of sunlight. Finally, trees that can afford to be pruned of excess branches and leaves to allow sunlight to reach your lawn should be trimmed. A good time for this job is when the trees are at peak foliage so that you can decide the final shape of your trees.

Crownvetch—One Answer to Those Problem Maintenance Areas

John M. Zak

Crownvetch is a perennial herbaceous legume whose potential for erosion control is well established in many sections of the Eastern states. It is deep-rooted, drought tolerant and spreads by strong fleshy adventitious roots. Its abundant deep green topgrowth is laced with very attractive pinkish-white to violet blossoms during the flowering season from June to August.

Crownvetch has not been used in Massachusetts in the past because of failures in establishing the plant consistently and reliably. Since many seedings and plantings of crownvetch were failures, interest in growing this plant waned. In 1967 greenhouse studies with crownvetch growing on acid soils typical of those in Massachusetts showed that it was essential that the lime requirement be met by applying limestone in accordance with a lime test. This lime application would raise the pH to tolerable levels—between pH 6.0 and 7.0. It was also found that phosphate and potash were essential in establishing crownvetch on soils of low fertility. Past failures of crownvetch have also been due to the seeding of crownvetch with grass mixtures. The speedy germination and rapid young growth of grasses crowds out the crownvetch seedlings. In these mixtures common commercial fertilizer mixes were used which favored the grasses instead of the crownvetch and this also contributed to poor establishment of crownvetch.

Recent experiments and field seedings have shown that crownvetch can be successfully established in Massachusetts. It provides excellent cover, protects areas from erosion and requires little or no maintenance once it is established. Areas on home lawns that are too steep to mow or that frequently erode are excellent areas to cover with crownvetch. Border areas and property boundaries that are normally witchgrass and weeds could be made more attractive with crownvetch. Steep slopes, areas around ponds and isolated low maintenance sections of golf courses can also be permanently taken care of by establishing a vigorous stand of crownvetch. The problems related to these nuisance areas are eliminated simply and the entire area is beautified.

The best and cheapest method of establishing crownvetch is by seeding during the spring months. Seed bed preparation is the same as that for grasses although preparation need not be as meticulous. Limestone and fertilizer should be well mixed into the upper surface of the soil. Limestone rates vary according to the pH of existing soils as determined by a soil test. Fertilizer mix of 0-20-20 proportions used at a rate of 800 to 1000 lbs per acre will provide adequate nutrition. Crownvetch seeds should then be inoculated and broadcast at a rate of 18 to 20 lbs per acre and raked into the soil lightly. On areas where erosion may be a problem, 20 lbs per acre of either ryegrass, K-31 tall fescue or creeping red fescue mulch with straw or hay mulch (1½ to 2 tons per acre) to serve as a rapid and **temporary** cover crop while crownvetch establishes itself. Dormant seedings can also be made in November before the ground is frozen. The same procedure should be followed in the spring.

On smaller areas potted plants can be planted on 2 to 3 foot centers in alternating rows. Limestone and fertilizer should be broadcast over the whole area as suggested above for seeding. To insure fast and vigorous cover 0-20-20 fertilizer should be applied the following spring at a rate of 500 lbs per acre. There is no need to mow crownvetch. However, mowing grass areas around crownvetch planting will insure that the crownvetch will be confined to the desired area.

For further information see publication 74, "Crownvetch—An Adaptable Ground Cover for Massachusetts Roadsides," John M. Zak and Peter A. Kaskeski, Dept. of Plant and Soil Sciences, University of Massachusetts, Amherst 01002.

KENTUCKY BLUEGRASS VARIETY TRIALS

University of Massachusetts — Dr. Joseph Troll

Common Kentucky bluegrass and its improved varieties are suggested for use in lawns, golf course fairways, tees and other areas seeded to turfgrass in the Northeast. Improved varieties are generally selected for their resistance to disease, density of growth, ability to withstand a close height of cut, etc. However, environmental adaptability and management of these varieties can adversely effect their growth and persistence. Turf breeders are continuously working on the selection and breeding of still better varieties. As the new varieties come into being, there always is a need to test and evaluate them.

A regional Kentucky bluegrass variety test was initiated in 1968 by turfgrass workers from various Northeastern universities. The objective of the study, in part, was to conduct uniformly planned and managed turfgrass trials and include all feasible management and environmental variables. The test carried out by the University of Massachusetts was known as "Basic Test A," i.e., only a minimal number of variables were introduced in the project. Thirty-seven Kentucky bluegrass varieties were seeded each to three randomized 4 X 6 feet plots in the fall of 1968. Two varieties were sodded each to randomized plots in 1969. The test site was on a well-drained sandy loam soil located on the Montague Farm, Amherst. Prior to seeding, ground limestone was applied to bring the pH of the soil to 6.5. In addition, 0-20-20 and 10-10-10 starter fertilizers were applied to the seedbed. The established turf received four pounds of nitrogen in a complete fertilizer per 100 square feet, split into three applications each season, 1969, 1970 and 1971. All turf plots were mowed at 1-½ inches with a reel mower. No irrigation other than natural precipitation was applied. Broadleaf weeds were controlled with an application of MCPP in 1971 and a preemergence crabgrass control chemical was applied to all plots in 1970. Fungicides and insecticides were not applied during the test. Varieties were rated for quality on a scale of 1 to 9, 9 equaling the best. Results are shown in Tables 1, 2, 3 and 4.

Results of this test were obtained from environmental conditions unique to Amherst, Massachusetts.

We wish to thank the Massachusetts Golf Association for their contribution which helped defray the expenses of this project.

Table 1. Kentucky Bluegrass Variety Evaluation, 1969, University of Massachusetts, Amherst.

Variety	Monthly Evaluation 1969						
	April	May	June	July	August	September	1969 Average
1. Merion	6.0	4.0	9.0	9.0	9.0	9.0	7.67
2. RI PP-1	5.3	5.0	8.3	8.6	9.0	8.0	7.37
3. NJE P-115	5.0	4.3	8.3	8.3	8.6	8.0	7.08
4. NJE P-69	4.6	3.6	8.6	8.6	8.6	8.0	7.0
5. NJE P-35	2.0	3.6	8.0	8.6	8.6	7.6	6.40
6. Sodco	3.6	3.0	8.3	8.6	8.6	8.6	6.78
7. WK-412 Weibull	4.0	3.3	8.6	8.6	8.3	8.0	6.80
8. NJE P-56	3.0	3.3	7.6	8.3	8.3	7.6	6.35
9. WK-411 Neibull	4.6	3.3	8.6	8.6	8.6	7.6	6.88
10. A-34	2.6	4.3	8.3	8.3	8.0	7.6	6.52
11. Belturf	4.0	3.6	8.0	8.6	8.6	6.6	6.57
12. NJE P-114	3.6	3.6	8.0	8.3	8.6	8.0	6.68
13. NJE P-5	3.0	3.3	7.6	8.0	8.0	8.0	6.32
14. Nugget	3.0	2.6	8.0	8.6	8.0	7.6	6.30
15. Southport	4.3	3.0	8.3	8.3	7.3	7.3	6.41
16. Ba 6124	2.6	4.3	8.0	7.6	8.0	7.6	6.35
17. Prato	4.6	3.0	9.0	9.0	8.0	7.3	6.82
18. Campus	4.0	3.3	8.6	8.6	8.0	7.0	6.58
19. Primo	4.3	4.0	8.6	9.0	8.3	8.0	7.03
20. Park	8.0	7.6	8.0	8.0	8.0	6.6	7.70
21. Windsor	6.3	6.6	8.0	8.0	7.0	7.3	7.20
22. PSU K-107	2.3	3.6	8.6	8.0	7.6	6.6	6.12
23. Cougar	3.6	3.6	9.0	9.0	9.0	7.6	6.97
24. Newport	5.3	6.0	8.3	8.3	7.6	7.6	7.18
25. WK-408 Weibull	6.0	6.0	7.6	7.3	8.0	7.3	6.92
26. Arista	4.0	3.0	8.3	8.0	7.0	7.0	6.22
27. Zwartberg	4.6	3.6	9.0	8.3	8.0	7.0	6.75
28. Delta	6.6	6.0	8.0	7.3	7.3	4.6	6.63
29. Palause	8.6	7.6	8.0	7.0	6.6	7.0	7.47
30. Pennstar	5.3	3.6	8.3	8.6	7.6	7.3	6.78
31. Geary	6.6	6.3	8.0	7.6	7.3	6.0	6.97
32. Fylking	4.6	4.0	8.6	8.6	8.6	7.6	7.00
33. S-21	7.6	6.0	8.3	7.6	7.0	6.3	7.13
34. Kenblue	4.6	5.6	7.6	7.6	7.6	6.3	6.55
35. PSU K-62	2.6	4.6	8.0	7.0	6.6	4.0	5.75
36. Minn - 6	4.6	4.6	8.0	7.6	7.6	6.0	6.40
37. South Dakota	7.0	7.3	7.6	7.0	6.6	6.6	5.31

Turf rated for quality on scale of 1 to 9, 9 equaling the best.

Table 2. Kentucky Bluegrass Variety Evaluation, 1970, University of Massachusetts, Amherst.

Variety	Monthly Evaluation 1970 April	May	June	July	Aug.	Sept.	Oct.	1970 Avg.	Disease
1. Merion	2.3	7.0	9.0	8.3	8.0	7.3	8.6	7.21	S*
2. RI PP-1	4.0	7.3	8.6	8.3	6.6	8.6	8.0	7.34	M
3. NJE P-115	4.0	7.6	8.3	8.0	6.3	7.0	7.6	6.97	M
4. NJE P-69	4.6	7.6	8.6	7.0	5.3	6.6	8.0	6.81	S
5. NJE P-35	4.3	7.3	9.0	7.3	6.0	6.0	8.6	6.93	S
6. Sodco	4.0	7.6	8.6	7.0	6.6	7.0	8.6	7.06	VS
7. WK-412 Weibull	3.3	7.0	7.0	7.0	7.3	7.0	8.3	6.73	S
8. NJE P-56	4.0	7.6	8.6	7.3	6.0	6.3	8.6	6.91	VS
9. WK-411 Weibull	3.0	6.6	6.6	7.6	7.0	7.3	8.3	6.63	VS
10. A-34	3.0	7.3	8.3	6.3	5.6	6.6	7.6	6.39	M
11. Belturf	3.0	5.6	6.6	6.6	5.3	5.6	8.0	5.81	M
12. NJE P-114	4.6	7.6	8.3	6.6	5.3	6.3	8.0	5.57	VS
13. NJE P-5	4.3	7.0	8.3	6.6	5.3	5.6	7.6	6.39	M
14. Nugget	2.0	7.0	8.6	7.6	7.3	7.3	7.3	6.73	VS
15. Southport	2.6	7.6	8.6	5.0	5.6	6.6	7.0	6.14	VS
16. Ba 6124	4.0	7.6	8.3	4.3	4.0	5.0	8.0	5.89	S
17. Prato	2.0	5.3	6.0	5.0	5.3	6.3	7.6	5.36	M
18. Campus	3.0	6.0	6.0	6.6	5.3	6.6	8.6	6.01	M
19. Primo	2.3	6.6	5.0	7.0	5.3	6.0	8.0	5.74	M
20. Park	4.3	4.3	3.3	3.6	3.3	4.0	6.0	4.14	M
21. Windsor	3.0	5.3	5.6	5.0	4.3	5.0	6.3	4.93	S
22. PSU K-107	3.0	6.6	7.6	5.3	4.0	5.6	8.0	5.73	M
23. Cougar	3.0	6.3	5.0	5.6	6.0	5.3	7.3	5.50	M
24. Newport	2.3	5.6	7.0	4.3	1.3	5.0	7.0	4.64	S
25. WK-408 Weibull	4.0	5.0	5.3	4.3	4.0	5.0	6.6	4.89	M
26. Arista	2.3	5.0	5.0	5.0	6.0	6.0	7.6	5.27	M
27. Zwartberg	4.3	5.6	6.6	6.3	4.6	5.0	7.0	5.63	S
28. Delta	4.0	5.3	4.0	3.0	1.3	3.3	6.6	3.93	M
29. Palause	5.0	3.6	3.6	3.3	3.0	3.3	5.6	3.91	M
30. Pennstar	3.0	7.3	6.6	5.0	4.6	5.0	7.0	5.50	S
31. Geary	4.0	3.6	3.3	2.6	1.6	3.6	5.6	3.47	M
32. Fylking	2.0	6.3	7.3	5.0	4.6	5.0	5.6	5.11	VS
33. S-21	4.0	4.3	3.0	2.6	2.0	3.3	5.3	3.50	M
34. Kenblue	3.3	3.0	3.6	2.6	2.6	3.6	6.6	3.61	M
35. PSU K-162	6.6	6.6	6.0	1.6	1.0	1.3	6.0	4.16	S
36. Minn - 6	4.3	3.6	4.0	2.6	2.3	4.0	6.3	3.87	H
37. South Dakota	3.6	3.3	2.0	1.6	3.3	1.6	4.3	2.67	M
38. A-10		8.0	5.3	5.0	5.6	7.0	5.3	6.31	VS
39. A-20		9.0	9.0	9.0	8.6	8.6	9.0	8.81	VS

Turf rated for quality on scale of 1 to 9, 9 equaling the best.

*Disease rating: VS - very slight; S - slight; M - medium; H - high.

Table 3. Kentucky Bluegrass Variety Evaluation, 1971, University of Massachusetts, Amherst.

Variety	Monthly Evaluation 1971 April	May	June	July	Aug.	Sept.	Oct.	1971 Avg.	Disease
1. Merion	7.6	8.6	9.0	8.0	7.3	8.6	8.3	8.20	VS*
2. RI PP-1	7.6	8.6	8.6	8.0	7.3	8.3	9.0	8.20	S
3. NJE P-115	7.3	8.6	8.6	7.0	6.3	8.3	8.6	7.81	S
4. NJE P-69	7.3	9.0	8.3	7.6	7.3	8.3	8.6	8.06	S
5. NJE P-35	7.3	8.6	9.0	8.3	8.3	9.0	9.0	8.50	S
6. Sodco	7.3	7.6	8.3	8.0	8.3	8.6	6.0	7.73	S
7. WK-412 Weibull	7.0	8.0	8.6	6.3	7.0	8.0	9.0	7.70	S
8. NJE P-56	7.3	8.0	8.6	7.3	6.3	8.3	9.0	7.83	S
9. WK-411 Weibull	7.0	8.6	8.3	7.0	6.6	7.0	8.3	7.54	S
10. A-34	7.6	8.6	8.6	7.3	7.0	7.0	8.3	8.06	S
11. Belturf	7.0	8.3	9.0	9.0	8.6	9.0	9.0	8.56	S
12. NJE P-114	7.3	8.3	8.6	7.0	6.3	7.3	8.3	7.59	S
13. NJE P-5	7.0	8.3	9.0	8.0	8.0	8.3	8.6	8.17	S
14. Nugget	5.6	8.3	9.0	8.0	6.6	7.3	8.3	7.59	VS
15. Southport	7.6	8.6	9.0	7.6	6.6	7.3	8.0	7.81	VS
16. Ba 6124	8.3	8.0	7.6	7.3	7.3	8.6	8.6	7.96	S
17. Prato	7.0	7.6	9.0	7.3	8.6	8.3	8.3	8.01	S
18. Campus	6.6	6.6	7.6	6.6	8.6	8.3	8.3	7.51	S
19. Primo	7.0	7.3	7.3	6.6	6.6	8.0	8.3	7.31	S
20. Park	6.6	7.6	7.3	7.6	8.3	8.3	9.0	7.81	S
21. Windsor	7.3	7.0	7.0	7.0	6.6	9.0	8.3	7.46	M
22. PSU K-107	7.0	8.0	7.6	6.3	7.6	8.3	8.6	7.63	S
23. Cougar	6.6	7.6	7.3	6.3	5.3	6.0	7.3	6.63	M
24. Newport	7.3	6.6	6.6	5.6	7.6	8.6	8.6	7.27	S
25. WK-408 Weibull	7.3	6.6	5.0	5.6	8.0	8.3	8.3	7.01	M
26. Arista	5.6	6.3	7.6	7.0	7.6	8.6	8.3	7.29	M
27. Zwartberg	6.6	6.6	6.3	5.0	5.0	6.0	7.6	6.16	M
28. Delta	6.3	8.0	8.0	6.6	8.6	8.6	9.0	7.87	S
29. Palause	6.3	6.3	4.6	6.3	7.3	8.6	8.6	6.86	S
30. Pennstar	6.3	8.0	6.0	4.3	4.3	5.6	7.6	5.97	M
31. Geary	6.0	7.0	6.0	7.0	9.0	8.6	9.0	7.51	S
32. Fylking	5.6	7.0	5.6	5.0	4.3	6.0	6.6	5.73	M
33. S-21	5.6	7.0	5.6	6.6	8.3	7.6	9.0	7.10	M
34. Kenblue	6.0	6.3	6.0	6.6	7.6	8.6	8.6	7.10	M
35. PSU K-162	6.3	7.6	7.3	6.6	8.3	8.3	9.0	7.63	S
36. Minn - 6	6.0	6.6	6.3	5.6	7.6	8.3	8.3	6.96	S
37. South Dakota	5.3	4.3	5.6	5.3	6.3	8.6	8.3	5.31	S
38. A-10	6.0	6.1	7.0	5.8	6.3	7.0	8.0	6.60	M
39. A-20	8.6	8.6	9.0	8.0	8.6	9.0	9.0	8.70	S

Turf rated for quality on scale of 1 to 9, 9 equaling the best.

*Disease rating: VS - very slight; S - slight; M - medium; H - high.

Table 4. Yearly Average and Combined Average of Quality Ratings on Kentucky Bluegrass Varieties, University of Massachusetts.

	Variety	Yearly Average Rating 1969	1970	1971	Combined Average	
1.	Merion	7.67[1]	7.21	8.20	7.69[2]	a
2.	RI PP-1	7.37	7.34	8.20	7.64	
3.	NJE P-115	7.08	6.97	7.81	7.29	b
4.	NJE P-69	7.00	6.81	8.06	7.29	c
5.	NJE P-35	6.40	6.93	8.50	7.28	
6.	Sodco	6.78	7.06	7.73	7.19	
7.	WK-412 Weibull	6.80	6.73	7.70	7.08	
8.	NJE P-56	6.35	6.91	7.83	7.03	
9.	WK-411 Weibull	6.88	6.63	7.54	7.02	
10.	A-34	6.52	6.39	8.06	6.99	
11.	Belturf	6.57	5.81	8.56	6.98	
12.	NJE P-114	6.68	6.67	7.59	6.98	
13.	NJE P-5	6.32	6.39	8.17	6.96	
14.	Nugget	6.30	6.73	7.59	6.87	d
15.	Southport	6.41	6.14	7.81	6.79	
16.	Ba 6124	6.35	5.89	7.96	6.73	
17.	Prato	6.82	5.36	8.01	6.73	
18.	Campus	6.58	6.01	7.51	6.70	
19.	Primo	7.03	5.74	7.30	6.69	
20.	Park	7.70	4.14	7.81	6.55	
21.	Windsor	7.20	4.93	7.46	6.53	
22.	PSU K-107	6.12	5.73	7.63	6.49	
23.	Cougar	6.97	5.50	6.63	6.37	
24.	Newport	7.18	4.64	7.27	6.36	
25.	WK-408 Weibull	6.92	4.89	7.01	6.27	
26.	Arista	6.22	5.27	7.29	6.26	
27.	Zwartberg	6.75	5.63	6.16	6.18	
28.	Delta	6.63	3.93	7.87	6.14	a b
29.	Palause	7.47	3.91	6.86	6.08	
30.	Pennstar	6.78	5.50	5.97	6.08	
31.	Geary	6.97	3.47	7.51	5.98	
32.	Fylking	7.00	5.11	5.73	5.95	
33.	S-21	7.13	3.50	7.10	5.91	
34.	Kenblue	6.55	3.61	7.10	5.75	
35.	PSU K-162	5.47	4.16	7.63	5.75	
36.	Minn - 6	6.40	3.87	6.96	5.74	c
37.	South Dakota	7.02	2.67	6.24	5.31	d

1/ Values followed by the same letter are not significantly different at the 5% level of Duncan's multiple range test.

2/ Average of 3 replicates for each year. Turf rated for quality on a scale of 1 to 9; 9 equaling the best.

—*Reprinted from Proturf Issue Four, published by O. M. Scott & Sons, Proturf Division, Marysville, Ohio.*

GRASS
AN ENDANGERED SPECIES

by Anthony J. Terzis

An endangered species is one whose prospects of survival and reproduction are in jeopardy. Usually when someone mentions endangered species we think of eagles, alligators or leopards. But what about grass—should we not also consider grass an endangered species?

Urban sprawl threatens to make grass extinct from the cities, an environment that needs its contributions desperately. The President's Council on Environmental Quality recently reported that each year one million acres are being removed from green growth. Of this, about half are developed for urban use while an additional 160,000 acres are converted to highways and airports. It is estimated that by the year 2000, three-fourths of America's 235 million citizens will be living on 10% of the land. These urban areas are creating deserts of concrete, glass and asphalt, leaving only tiny oases of greenery of perhaps a thousand square feet or so. Just how important can such a small area be? The answer may surprise you.

Basic to life is the need for an ever-renewed supply of oxygen. Through photosynthesis, plants produce oxygen, all the while removing carbon dioxide and other polluting gases from the air. One thousand square feet of turf produces enough oxygen to sustain two people.

Living turf transpires, that is it releases water vapor through tiny pores in the leaves. On a hot summer day one thousand square feet of turf can lose as much as 60 gallons of water through evapo-transpiration. This evaporating water has a tremendous cooling effect. Another reason for a grassy area being cooler is that it absorbs only 50%-60% of incoming solar radiation while buildings and pavement absorb up to 90%. The effectiveness of these two features became evident when natural turf was replaced with artificial turf in sports stadiums. Measurements made at Busch Stadium in St. Louis showed the official temperature to be 90 degrees while the artificial turf was a scorching 123 degrees. At one foot above the surface the temperature was 118 degrees and 114 at six feet.

Grass and trees are effective dust traps. They act to slow the air and allow dust particles to settle on the leaves. Eventually, rain will wash the dust back into the ground. Tests which measured the number of dust particles in the air, found the dust count to be 75% lower on the sheltered side of a planted area than on the windward side.

Plants fight noise pollution too. A grass covered slope will deflect and absorb sound. Effective landscaping with evergreens or a thicket of deciduous trees can reduce the roar of traffic to a distant murmur.

Urbanization creates large impervious areas such as shopping centers, parking lots and highways, but grass keeps the soil open through an incredibly extensive root system. Grass roots open channels in the soil which permit water to percolate deep down, thus, replenishing underground water supplies while minimizing runoff. Grass shelters the soil and prevents it from washing away.

A major problem of our nation's waters today is sediment. Sediment interferes with our recreation; nobody wants to swim in

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muddy water, and you won't find fish there either because silt has reduced their food supply and killed their eggs. The amount of soil eroding from a turf area is so small as to be non-existent. This is important, too, because phosphorus—the element which nourishes the growth of algae—enters water attached to soil particles. Thus, turf does an amazing job of reducing the amount of phosphorus entering the water through erosion.

Environmentalists are quick to point out that while individually our contributions to pollution are small, each little bit adds up to the total problem. Likewise, while the assets of our individual lawns may be small, the cumulative effect of them significantly improves the quality of our environment. The words of Jonathan Swift take on added meaning. Nearly 250 years ago, Swift, in seeming anticipation of our environmental crisis, wrote: "Whoever could make two blades of grass grow where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together."

TURFGRASS RESEARCH

Since our last issue, several additions and inadvertant omissions have come into our Turfgrass Research Fund which we wish to acknowledge. Progress has been made toward furthering turf research at the University in the past few months. Dr. Robert N. Carrow, a recent graduate of Michigan State University, will join the turf faculty this fall. Hopefully, all facets of turf education and research can be expanded with additions of professional personnel. There are also great needs for increasing the acreage of turf plots for educational and research purposes. The potential for accomplishing this exists and further support from agencies and individuals concerned with the turf industry would benefit everyone. It would seem, at this point in time, that many of those expressing a desire for more research in the past were not ready to take an active part in the campaign for research funds.

We do wish to acknowledge all the contributions of recent months and give a special word of gratitude to the people of Hart Seed Company who donated the funds for our alumni letter of last winter. The following golf clubs and individuals have contributed to the UMass Turfgrass Research Fund since 1 May 1972:

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lower as well as higher forms of plant life would be affected. Their effect on plankton has not been extensively studied; but the investigations which have been made indicate that any deleterious effects are usually only temporary.

Most herbicides are of low toxicity to fish, and it is quite possible and often true that other ingredients in the formulation, such as solvent oils, are more toxic than the weed killer itself. This means that the formulation itself must be tested for toxicity to fish, rather than just the active ingredient, before a product is sold commercially.

The sorptive properties of the compound may play an important role in fish toxicity. Trifluralin per se, for example, is highly toxic to fish but it is so strongly sorbed onto the soil particles that there is little danger to fish from its agricultural applications. In fact, generally it should be noted that in the way herbicides are applied for crop production there is little likelihood of their getting into water.

At present, there is little evidence that concentration of weed killers in food chain organisms occurs with herbicides. There is considerable evidence indicating that herbicides are degraded in many ways in plants and animals, which in itself prevents situations where biological magnification might occur. Biological magnification does not appear to be a problem with our present commercial weed killers.

Now let's consider the ecological effects of herbicides in connection with the first "law" of ecology—"Everything affects everything else." Herbicides are used to kill unwanted plants, that is, weeds. For example, a farmer applies a chemical weed killer to a field of wheat where there are many broadleaved plants or weeds growing. A great number of plants are killed. But a heterogeneous field that would have produced a low yield has been changed to a nearly pure stand of wheat. This will result in an excellent harvest both in quantity and quality. This is a tremendous ecological change but it is also one that is highly desirable.

There are other situations less often considered where herbicides are used to convert one habitat to another; for example, changing a forest to an open meadow, clearing of rushes in a lake to have open water areas, and changing a brushland to a pasture. All of these clearly have a dramatic ecological effect but they are by design.

When aquatic weeds are controlled with herbicides there are multiple effects. The direct toxic effect on fish and bottom organisms in the field appear to be relatively minor if the herbicides have been properly used. However, the indirect effects of herbicides resulting from the destruction of the vegetation may produce important changes on the biota of the aquatic environment. Whether these changes are beneficial or deleterious depends on a number of factors; for example, fish would be in trouble if the herbicide destroyed the specific plants upon which this fish feeds. On the other hand, serious oxygen depletion of an aquatic environment may occur when mats of floating weeds completely cover the surface of the water and shade the photosynthetic plants below. In this case, an important benefit to fish and other aquatic biota can often be produced through the application of herbicides for improving the fish habitat.

Ecologically, the main effect of weed killers from the wildlife viewpoint is their altering the environment through the control of certain plant species; this brings about changes in the food and habitat for wildlife. Thus, it makes no difference in making a pasture from a forest whether the trees and brush are cleared with saws and axes or by herbicides. The primary effect on wildlife comes as a result of changing the forest to a meadow. Ascertaining the positive or negative value of such changes is very difficult as it is an extremely complicated problem and the answer often depends upon the individual species being considered.

This change in type of vegetation present has both a direct and indirect effect on the food chain for mammals, birds and lower forms of animal life, as well as directly affecting their physical habitat. The long-term effect on wildlife may be beneficial or detrimental, depending on the species involved. Studies in this and other countries have shown that herbicidal treatment of forested areas improves wildlife habitat and is favorable to certain animal populations, particularly game animals. It is also clear from the foregoing that by so doing it may be unfavorable to some other species.

CONCLUSION

Organic herbicides have been extensively studied and used for a relatively short period of time, approximately the last thirty years. Nonetheless, during this time, their ecological effects in modifying man's environment have been well recognized. Thus, herbicides are used for the selective killing of unwanted plants, i.e. weeds, according to man's desires and for his benefits.

Experience to date indicates a vast preponderance of beneficial results from the proper use of herbicides.

Fears that they will render the soil permanently sterile are unfounded, as they break down in the soil. Most commercial herbicides now in use are low in toxicity to man and animals. Further, they are now used in such a way that they do not accumulate and create a hazard in our environment.

Man's tools frequently are used to interfere with nature, and herbicides are a powerful tool. As is true with others of man's tools, it is the wisdom with which they are used that will determine whether they have a beneficial or harmful ecological effect.

—Reprinted from U.S. Golf Association Green Section Bulletin, 1929.

Have Times Changed?

CARING FOR TREES ON THE GOLF COURSE (1929)

Golf courses are at first generally blessed with an abundance of handsome forest trees. As the virgin underbrush is cleared from the woods to make room for fairways and putting greens, the trees, however, are robbed of the natural layer of decomposing vegetation which is the source of their food and water. Fertilization and irrigation must be resorted to in most cases if these native trees are to be retained in locations where the turf is kept cut short, as on fairways and tees and near putting greens. Often subirrigation is necessary to save trees in such locations, and it has been practiced successfully on some courses. Where subirrigation is impracticable or not deemed necessary, additional surface water beneath the trees can and should be applied. Soil beneath a tree is generally drier than soil in the open, due to the double draught on the moisture supply by the tree and the surface vegetation, and also to the interception by the branches of the natural rainfall coming from showers. There is also a double draught on soil nutrients beneath trees, and for this reason additional fertilization is called for in such locations. On the golf course this additional fertilization can perhaps best be attained by more frequent application of fertilizers under the trees. Of greater value perhaps are top-dressing with compost and, in early winter, spreading a mulch of thoroughly rotted animal manure on the ground over the spread of the roots of the tree. This mulch should be allowed to remain on the ground over the winter. Any residue that may remain the following spring may be raked away if it is deemed objectionable. Trees must also be kept pruned if they are expected to thrive. Dead branches should be carefully removed to make room for new growth and to prevent the spread of decay. No annual budget of a golf club is complete unless it includes an item to cover tree surgery, tree replacement, and general care of the trees.

—Reprinted from AGWAY COOPERATOR, June 1972

LIME

. . . 350 million years in the making

Some 350 million years ago during one of the great geological periods, corals and other forms of sea life that thrived in clear, warm sea water abundantly flourished and eventually died in some areas of the Northeast.

After they died, their remains sank to the bottom of the seas. Subsequent geological upheavals lifted these deposits above sea level still covered with up to 100 feet of overburden.

These tiny sea animals are responsible for the supply of a large part of a commodity important today for farmers of the region—lime.

Before lime can be spread on farmers' fields to provide its varied benefits for the soil, however, it must be freed from the overburden quarried from the earth.

Trucks, bulldozers and conveyors and shovels and draglines move mountains of this earth and shale. They may operate around the clock, taking huge bites of earth to uncover the abundant limestone. The shale is then blasted from the quarry and crushed and screened for sizing, a process repeated at limestone quarries operated throughout the Northeast.

Strangely enough, high-quality agricultural lime is produced by crushing the large pieces of limestone to be used to make steel, glass and paper. Some fine lime, not suitable for steel, paper or glass but perfect for farmers, inevitably results.

Excellent limestone also is produced by some suppliers expressly for agricultural applications by finely grinding the stone.

In some cases, lake freighters carry limestone from Michigan quarries to Ohio and western New York ports. Several Agway stores can send their spreader trucks right to nearby plants and pick up loads of ready-to-spread lime.

This practice is repeated by stores close to Agway's other sources of lime. However, the great majority of stores receive their lime supplies by rail or truck shipment and stockpile it for loading into spreaders.

Why lime? There are a number of agronomic reasons for liming. Here are some of them:

Lime reduces soil acidity, a condition caused by an excess concentration of hydrogen ions in the soil.

It supplies calcium and magnesium needed for plant growth.

It assists plant uptake of nitrogen, phosphorus and potash.

It helps the proper amount of nutrients enter the plant's root system.

It increases the efficiency of fertilizers.

It reduces the availability of toxic aluminum and iron in the soil.

It may also improve the soil's structure, promote aeration and increase water intake and holding capacity.

Liming may be done whenever the ground is solid enough to support the spreader. Many farmers start thinking about lime in the fall and spring, when trucks are busy and service is slow. The ideal situation is summer liming, which gives the lime lots of time to react and neutralize acid soil.

Summer liming beats the fall rush for spreading and minimizes the danger of trucks digging up or getting stuck in wet fields.

While Northeastern fields could have used eight million tons of lime last year, they received only two million tons in spite of the fact that agronomists continually warn that low crop yields and crop failures can often be traced to a lack of the mineral.

FROM

MASSACHUSETTS TURF AND LAWN GRASS COUNCIL
INCORPORATED

RFD #2, HADLEY, MASS. 01035

1972—A Tough Season

Paul Harder

Turfgrass managers in the Northeast have not been treated kindly by Mother Nature this season. The uncontrollable problem of excess water combined with those man-made troubles arising from heavy play and the use of golf carts have given all but a few superintendents more than their share of problems.

The season started off poorly in many of the northern sections where many courses had massive "winterkill" problems caused by ice and wind. Southern areas of the Northeast were not as severely affected by winterkill but as the season progressed water caused havoc. The excess of water that is common almost everywhere this season has set off a chain of events that have all been working against the superintendent. Most directly linked to heavy rainstorms are the turf areas in fairways which die due to stagnant puddles which prevent oxygen from reaching the grass plant. The ever-increasing use of golf carts has made soil compaction a serious problem which makes adequate drainage and aeration more difficult to achieve. The resultant increases in water runoff have not made this season's troubles any easier. Courses with naturally poor drainage have been seriously affected by this process. Heavy rains have also stimulated succulent growth. Further application of fertilizer have then added to the lushness of turf. This condition can be the beginning of several major troubles. A succulent grass plant is susceptible to every fungal disease imaginable and the Northeast region has had all of them.

Dollar spot has invaded fairways and tees on many courses. Helminthosporium leaf spot has covered bluegrass blades throughout the entire season and has extended itself well past its "normal" life expectancy. In many southern sections, pythium blight has been a widespread problem that has been tough to control. When high temperatures finally did arrive this year, "melting-out" and "wet wilt" have made "Poa annua" a prime target. Many fairways at this time show the brown scars where "Poa" once was in June. Nematode populations are also abnormally high. Many samples of "Poa annua" showing wilt have also yielded record numbers of nematodes.

Chemicals commonly used to control many diseases have been applied quite frequently due to weather conditions and signs of toxicity have been occurring. Some greens have gone out for reasons that are still not apparent. It has taken a great deal of good fortune to come through this season unscathed. One can only hope for a beautiful autumn so some of this season's wounds will have time to heal.

Special management practices involving overseeding, aerifying and installation of drainage may aid in recovery of lost areas. We certainly hope all is green in time for the snow mold season.

Join Your Massachusetts Turf And Lawn Grass Council

For more information write:

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attn.: Dr. Joseph Troll
RFD #2, Hadley, Mass., 01035

The Massachusetts Turf and Lawn Grass Council is a non-profit corporation. Its officers derive no benefits except the satisfaction of keeping Massachusetts and its neighbors first in turf. It was founded on the principle of "Better Turf Through Research and Education." We must support our University to accomplish this, and we can with a large and strong Turf Council.

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