

1964

December 1964

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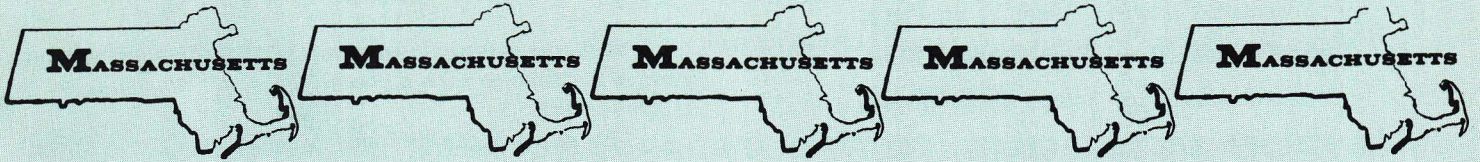


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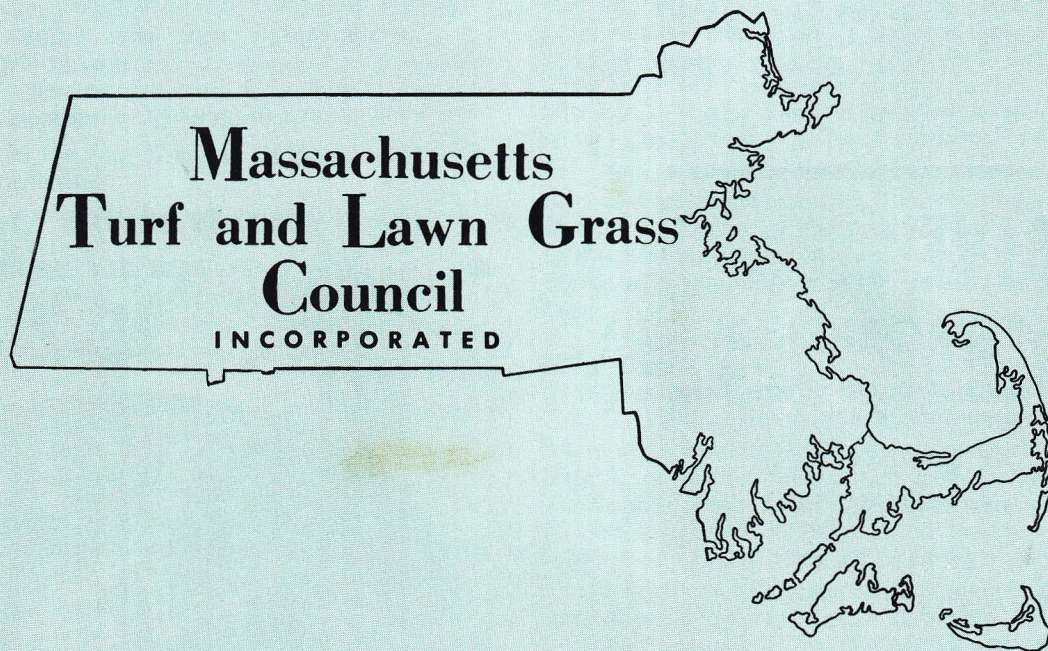
Conlin, Charles B.; St. Pierre, Leon V.; Roberts, Eliot C.; Hill, E. R.; and Dennis, Robert, "December 1964" (1964). *Turf Bulletin*. 14.
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Oct 1964



Turf Bulletin



BETTER TURF THROUGH RESEARCH AND EDUCATION

Secretary-Treasurer: Leon V. St. Pierre
 51 Fenwood Road, Longmeadow, Mass.
 Coordinator: Prof. Joseph Troll, UMass.

TURF BULLETIN

Vol. 2, No. 9

December, 1964

Turf Council Loses A Friend

EDMUND ROSSITER SAWTELLE
 5 Longfellow Road
 Marblehead, Mass.

Born: Bromley, Kent, England — October 5, 1905

Died: Las Vegas, Nevada — October 22, 1964

Achievements:

- 1929 — New England Sales Representative for Worthington Mower Company.
- 1934 — Director and Sales Manager for Worthington Mower Company.
- 1935 — Vice President and General Manager for Worthington Mower Company.
- 1938 — President of the Worthington Mower Company. "It was during Mr. Sawtelle's regime as President that Worthington expanded its sales tremendously and became one of the first local industries to convert to the 'War Effort' at the inception of World War II. It became one of the first industries to gain the Army-Navy E for excellence and subsequently awarded two white stars. During the war, he served on the War Manpower Commission's board representing Management. He also served in Washington as an industry advisory board member of the War Production Board and Office of Price Administration."
- 1945 — Arranged the sale of Worthington to the Jacobsen Manufacturing Company and served as Director, Vice President and Sales Manufacturer of Jacobsen Manufacturing Company's operations at the Worthington plant in Ttroudsburg, Pa.
- 1948 — Joined his brother, Chester, who was established in the turf equipment business in Boston and operated as Sawtelle Bros. until his death.

He was a Past Director of the YMCA in Stroudsburg, Pa., Past Director of the Security Trust Company, "Chairman" of the Greens Committee at Shawnee Country Club, and was founder of TEDA "Turf Equipment Distributors Association" (a nation-wide organization). It was at the annual meeting of this Association in Las Vegas where he choked on a piece of steak at their banquet.

He was a member of the Eastern Yacht Club, Marblehead, Mass.

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FOR BETTER GREENS CARE

E-Z RAKE!



- "stands-up" grasses, runners, grains and Poa Annua seed heads—improves greens mowing
- removes thatch on collars, aprons, tees, lawns
- improves aeration and irrigation
- improves fertilizer seed response
- cuts maintenance costs

Country Club Course Superintendent says: "E-Z Rake does a good job in getting rid of grains...best machine we ever bought!"

Model #4
 2 h.p.
 —self-propelled
 —durable finish
 —64" width

NOW—POWER COMB YOUR GREENS FOR SMOOTHER "NO BOUNCE" PUTTING!

GOLF COURSE EXPERTS AGREE thatch removal gives grass air to breathe and room to grow; reduces fungus and insects; reduces "dry spots." E-Z Rake makes healthy greens—stands runners and grains for better mowing—better putting. E-Z Rake—easy to buy—easy to start—easy to handle—easy to use! Save time, save effort, save money; use E-Z RAKE on your greens.



Durable, surmounting 2 hp Briggs & Stratton engine



Durable rubber-tire wheels



Tough, easily replaceable spring raking tines



E-Z Spin Starter



Safe! Back guard plate protects against stones, etc.

A C LAWN INC.
 41 RICHARDSON AVE.
 WAKEFIELD, MASS.
 245-7515

E-Z RAKE, INC. Acton, Indiana
 "Power tools for better lawn care"

SOLVE all your TURF PROBLEMS!

—with products of proven effectiveness in modern turf management.

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 a specialized line of

- LIQUID FERTILIZERS
- HERBICIDES
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- INSECTICIDES
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Area Representative: **Kenneth B. Turner Jr.**
 70 Taylor Road, Acton, Mass.

Stabilization Of A Sand Blow Area

CHARLES B. CONLIN

Work Unit Conservationist

Soil Conservation Service



Sand blow area taken from direction of prevailing wind prior to shaping, seeding, and mulching.



Shows bank shaped to a 3:1 and compacted ready for seeding.



Dark area in right foreground shows area that has been limed, fertilized, seeded and mulched.



In September, two months after seeding, the area is stabilized and there is little or no sand blow.

The removal of topsoil and sand and gravel commonly occurs in many areas during urban expansion. The stripping of topsoil and the excavation of gravel and sand pits often leaves the land unsightly and susceptible to erosion by wind or water. Consequently, many communities have passed laws regulating the operations of gravel pits and the removal of loam.

Communities have sought the assistance of Conservation Districts in making recommendations for the stabilization of borrow pits, stripped land, and sand pits. Recently the owner of a sand pit and the City of Springfield requested the assistance of the Hampden Conservation District for recommendations for vegetating a sand pit in the City of Springfield, Massachusetts.

The problem was prevailing winds which were blowing sand from a steep raw bank and depositing it in an adjacent residential development. The problem was compounded by the fact that there was no loam available to spread on the area to form a good seedbed.

A plan was developed to get the area replanted to trees over a two-year period. The first phase of the plan was to establish a cover of grass sod for immediate protection and in the second year plant trees and shrubs for more permanent protection.

During the first year the banks were shaped to a 3:1 slope and compacted. Lime was applied at the rate of one ton per acre. The area was fertilized at the rate of 1000 lbs.

of 15 - 10 - 10, and the seed mixture was 10 lbs. of Chemung Crown Vetch, 10 lbs. of sweet clover, 10 lbs. of field brome and 3 lbs. of sand love grass. In order to conserve what little moisture was available and to protect the seed from intense heat, mulching was recommended. The mulch used was cellulose fiber which, following its application, was bound together with a plastic binder.

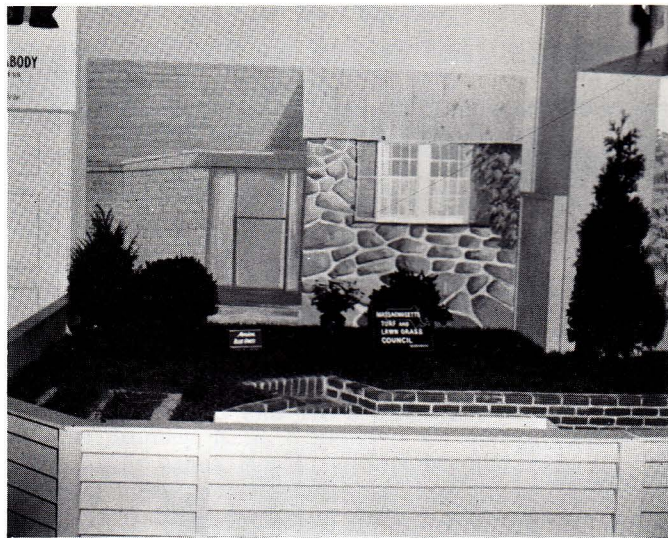
The lime, fertilizer, seed, mulch and binder were applied with a Hydro Seeder. Because of the length of the slope and nature of the sand, long hoses had to be hand carried up the slope to apply the materials. In a period of two months a sod cover was formed which eliminated the dust problem.

During the following spring the sod was top dressed with fertilizer and Red and Scotch pine were planted on a 10 x 10 spacing.

The spring and summer of both 1963 and 1964 were very dry. Water was not available to irrigate the site. The soils were loamy sands to coarse sands with some gravel, and the slopes were over three hundred feet long.

An adequate sod cover was established in 1963 to control erosion. The pine transplants started growing soon after planting in 1964. With management and necessary maintenance the erosion on this critical area will now be controlled. Sand and silt will no longer plague nearby residents and the area will have a more pleasing appearance.

THE MASSACHUSETTS TURF & LAWN GRASS
COUNCIL PARTICIPATES AT THE EASTERN
STATES EXPOSITION



The Council made up of persons or organizations interested in, or connected with, the management of Turf and Lawn areas, recently participated with their exhibit in the Massachusetts Building, of the Eastern States Exposition.

The exhibit depicted a home lawn of Merion Bluegrass and a weed display.

Members of the Council, as well as Turf Management students from the University of Massachusetts, were in attendance from 9:00 A.M. to 9:00 P.M. over a nine-day period, answering questions and handing out literature.

Five thousand copies of weeds of the Northeast, and ten thousand leaflets entitled, "Turf Tips", written by Prof. Joseph Troll, were handed out.

The greatest number of questions directed were on weeds and crabgrass.

Several persons very seriously inquired whether they could buy knotweed seed, for their driveways. They thought it looked green all summer. One lady wanted to know why Merion Bluegrass did not have a blue tint to it. Questions were also asked as to how they could get rid of Japanese bamboo.

The exhibit proved one point to the members of the Council: there is not enough research done in the Turf Grass field.

The following are the objects of the Turf Council:

1. To instigate and engage in any activities directed towards the advancement and improvement in turf and lawn culture in Massachusetts.
2. To encourage a comprehensive research program in the culture of turfgrasses in this state.
3. To disseminate present knowledge and new facts in the field of turf and lawn culture to its members.
4. To foster the free exchange of information and ideas among its members.

George Moore, of the Massachusetts Mutual Insurance Company, was Chairman of the Council Exhibit Committee.

LEON V. ST. PIERRE
Secretary-Treasurer
Mass. Turf & Lawn Grass Council

CLEARY PRODUCTS

FOR BETTER TURF

"CLEARY'S MCPP" — For selective weed control in Bentgrass Greens, kills knotweed, chickweed, clover.

"PMAS" — Crabgrass & Disease Control.

"SPOTRETE" — 75% Thiuram Fungicide.

"CADDY" — Liquid Cadmium Fungicide.

"PM-2, 4-D" — Weed control including Silver-crab.

"ALL-WET" — For hard to wet areas.

"METHAR" — DSMA in liquid or powder form for crabgrass control.

"SUPER METHAR" — The "AMA" type liquid for crabgrass control.

"THIMER" — A combination of mercury and thiuram for crabgrass and disease control. (Wettable powder)

The Fabulous Uncle

Once upon a time a mythical creature called "Uncle Sam" owned almost all of the land in the United States. He got this land following a Revolutionary War when the 13 original colonies (now called states) ceded their claims on the territory west of the Appalachian Mountains. It totalled some 237 million acres and was called the "public domain."

Uncle Sam didn't quite know what to do with all this land. Hardly anybody lived there but Indians and nobody was sure just how much land there was or what kind of land it was. So, in 1785, Uncle Sam enacted a Land Ordinance to survey this land and to devise some method of selling it to the people. He opened an office in New York (called the Board of Treasury), but within a few years so much land was being surveyed and so many people were trying to buy it that the office was moved to larger quarters in Philadelphia.

By 1790 things were in such a mess that Sam's treasurer, Alexander Hamilton, recommended a General Land Office be set up to handle the surveys and land sales, maintain records and issue patents or deeds. By this time, thousands of acres had been sold, mostly in large blocks to land speculators. Within two years so many people had migrated to Ohio that Uncle Sam had to set up local land offices out there to sell small tracts to the settlers, often on credit since they didn't have much money. By 1802 enough people had bought Uncle Sam's land in Ohio so that Congress admitted Ohio as the 14th state in the Union — the first so-called "public land" state.

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How To Sell A Turf Management Program To A Golfer

by

DR. ELIOT C. ROBERTS

Professor of Agronomy and Horticulture

Iowa State University

Ames, Iowa

The golf course superintendent is expected to know what to do at the proper time to produce top quality turf. He must know how to carry out the various maintenance operations and what equipment and materials to use. In addition he must be able to obtain the support of his greens committee or the club board of directors for the work that has to be done. Without this backing, golf course superintendents are often hampered by inadequate budgets and criticized by club officials and golfers who fail to understand the need for up-to-date programs in turf management. There is only "so much" money to go around. Where will it be allocated — to clubhouse or to ground maintenance? To a large degree the answer to this question depends on who does the best job of selling a program to the club. Since the club must pay the bill, it is important for the ground superintendent to wage a constant sales campaign designed to keep members informed of and sympathetic to his needs.

HOW TO SELL YOUR MANAGEMENT PROGRAM

Selling is not an easy job. Many superintendents feel that if they were good at this, they would be full-time salesmen and not golf course superintendents. This feeling is certainly justified, but it does not lessen the importance of good salesmanship as a requirement for effective and efficient turf management. You have a natural resource upon which to draw and that is your interest in and enthusiasm for golf turf maintenance. This interest and enthusiasm is essential. The rest of the so called selling technique is an art. It has been said that *selling is the art of letting the other person have your way*. Note that you "let" him, not "force" him. Your interest and enthusiasm must be so overwhelming that there is no question but what the greens committee will join you in supporting your program. The good superintendent may actually convince club members that "his way" is really "their way" and that this is the way it has been from the start.

MEANS OF COMMUNICATION

It is easy to see that selling is a specialized means of communication. You have information concerning turf management needs. This information must be passed along to the greens committee or club board. Often the breakdown in communication occurs at this point. The committee is not well educated in the terminology of turfgrass technology and the men may not have the background necessary to understand the full significance of the information you have provided them. Individuals on the committee may assume that others understand what's involved and so there may never be a real clarification of issues involved. So often this lack of understanding, this inability to communicate leads to the rejection of projects and programs that are needed badly.

There is an old out-dated school of thought that emphasizes the saying that a little knowledge is a dangerous thing. It has been concluded from this that each superintendent should keep his trade secrets to himself and that he should not attempt to inform anybody about the intricacies of his job or profession. The old fear was that if he did so, he would likely be replaced by someone he had helped educate. Also, there was the concern that misunderstandings would develop from incomplete information and that

the superintendent would end up trapped by the exceptions to the rules which he had laid down. It cannot be denied that superintendents have been treated unfairly because of the way they have handled the release of information to other superintendents and club members. On the other hand there is overwhelming evidence to support the theory that well informed golfers are more sympathetic to the day to day problems that face the superintendent and more anxious to support a progressive program of turfgrass management.

SHOW INTEREST IN THE GOLFER

Many superintendents have attempted to hold educational sessions in conjunction with discussions on budget requests or project proposals. If you wait this long to get background information to committee members it is not likely that they can make good use of it at that time. Also, it is often obvious that you are attempting to sell something in a hurry and because of this natural sales resistance may be expected. In order to avoid this the superintendent should plan ahead in respect to keeping the golfer informed of turfgrass management operations. His methods should be indirect and designed to show a real interest in and concern for the golfer. This may be developed in three ways. First, the superintendent must know the game of golf and the principles of golf course design. In this way he can gain the confidence of the golfer in regards to layout and effects of change on course management. Second, he should attempt to appeal to the golfer's interest in nature and the natural features of the landscape on the course by keeping him informed of wildlife developments and changes. And third, the superintendent should keep the golfer informed of weak areas in the turf management program, where poor turf conditions are likely to develop, where reconstruction or new construction is needed and where renovation should be considered. In general he should emphasize the technical nature of his work and lay the foundation for a better understanding of the problems involved in growing turf. Four methods may be utilized in accomplishing these objectives.

REPORTS ON TURF MANAGEMENT

Many superintendents submit report to their greens committee at regular intervals. These serve as valuable records of present conditions and often are of special importance in recording the position of the superintendent on controversial issues. They may also help to explain why certain conditions have developed, and to this extent may be educational in nature. Keeping accurate records and writing comprehensive reports for the club membership is a must; however, it is recognized that these documents may not always receive the attention they deserve. They should not be relied upon as the only means of communication between the superintendent and the golfer.

DISPLAYS OF SPECIAL TOPIC POSTERS

An effective means of gradually selling turfgrass management to the golfer may be realized through use of posters such as those produced by The Program Aids Company.¹ These posters are designed with conspicuous headings and contain space below for brief informative statements. They are ideal for pointing out present conditions, planned maintenance operations, miscellaneous points of interest, and

(Continued on Next Page)

general educational topics (Tables 1, 2, and 3). Posters should be displayed in some convenient place where they are easy to see by a large number of people. A permanent display area in the club house, pro-shop, or locker room is ideal. Usually the maintenance headquarters is too far removed from the normal flow of traffic for effective use of this location for display purposes. Posters should be

¹ The Program Aids Company, Inc.
550 Garden Avenue
Mount Vernon, New York

carefully designed and lettered and the information provided kept short and to the point. A glance of 5 to 10 seconds should be sufficient to get the idea across. Posters should be changed often so that new and different information is featured every few days. The use of these displays will let the golfer know who the superintendent is and impress him with the variety of activities and responsibilities that fall under his jurisdiction.

DISPLAYS OF COMMERCIAL LITERATURE

Another type of display that may be useful consists of attractive arrangements of commercial leaflets and bulletins. The average golfer has little idea of the technology involved in growing high quality turf. He cannot help but be impressed by noting the large inventory of maintenance equipment used in turf management, or the design and set-up of irrigation systems, or the wide choice of fungicides, herbicides, insecticides, fertilizers, soil conditions or grass seed varieties. These displays are not intended to provide details, but only to show at a glance that turfgrass management is a very specialized endeavor. The golfer should draw the conclusion that a superintendent who has to be an expert in all these areas must be a pretty sharp fellow, one whose programs should be supported for the good of the club.

USE OF A MODEL GOLF COURSE

Finally a scale model of your golf course can be helpful in showing where various maintenance and renovation activities are taking place. Models can also be used to project changes in design and to serve as focal points for a variety of educational exhibits and displays. A scale model golf course is not difficult to make and if properly protected with a plexiglass cover should prove serviceable for years. From time to time the model may be used in the clubhouse or pro shop to help sell some turf management project.

PERSONAL CONTACTS WITH THE GOLFER

Reports and displays have both a direct and an indirect effect on the golfer. First, they sell the point you want stressed at the moment and this is important. Second, they introduce you, the superintendent, to the golfer in a professional way. They make it easy for you and the golfer to talk about the course, its layout, its condition, and its maintenance program. Through these personal contacts the job of selling the best program possible is carried out. Background information has been provided through use of reports and displays. The golfer believes in your ability and judgment and it should be easy to let him have your way.

Table 1

USE OF SPECIAL TOPICS POSTERS

<i>Poster Heading</i>	<i>Example of Information Supplied by Superintendent</i>
ANNOUNCEMENTS	Fifth Green Under Renovation, Use Temporary Green
EXTRA	\$847.00 Saved During 1964 Season Because of Improved Turf Maintenance Techniques

NEW
NOTE THIS

TODAY

NOW

TOMORROW

GOLF

SPECIAL SERVICES

SAFETY

ANNOUNCING

BIG EVENT

INSTRUCTION

NOTICE

MEETING

CLUB NOTES

BIG NEWS

LOOK

ALL PURPOSE
(NO PRINTED HEADING ON POSTER)

Tee Markers on Back Nine
Hummingbird Nest on Lower Branch of Oak Tree at Rear of Ninth Tee
Insect Control Treatments on All Fairways
In Full Bloom Mountain Laurel on West Side of Second Fairway
Seventh, Eighth, and Ninth Greens to be Aerified
Iowa Golf Course Superintendents Golf Tournament September 15, 1964
Fall Fertilization and Renovation of Home Lawns — Club Special
Foot Bridge Over Stream Through Third Hole Not Safe for Golf Carts
Change in Fairway Height of Cut to 1½" Because of Hot Weather
Opening of New Redesigned 17 Hole
Lawn Maintenance Clinic Thursday Evening 7:30
High School Auditorium
Speaker J. P. Kneebone
Club Superintendent
Greens Closed to Play Wet Wilt Conditions
Greens Committee July 24
Written Requests Welcome
New Aaerifier Just Purchased Will Keep Playing Surface Better During Aerification Operations
New Chipping Green and Practice Trap Area Now Open
Control of Knotweed Around Pro Shop With New MCPP Herbicide To Cover Any Other Topic Desired

Table 2

USE OF DAY BY DAY POSTERS

<i>Poster Heading</i>	<i>Example of Information Supplied by Superintendent</i>
SUNDAY	Pole Greens, Mow Greens, Syringe Greens
MONDAY	Pole Greens, Mow Greens, Fertilize Greens, Water Greens, Change Cups, Mow Tees, Topdress Tee Divots and Seed, Resod First Tee, Mow Fairways, Police Course
TUESDAY	Pole Greens, Mow Greens, Hand Weed Greens, Syringe Greens, Spike Greens, Control Clover in Aprons, Fertilize Tees, Water Tees, Insect Control Tees, Water Fairways, Mow Roughs, Dutch Elm Disease Control, Cultivate Clubhouse Flower Beds, Mow Clubhouse Lawns

(Continued on Page 8)

Reproductive Potential of Yellow Nutsedge by Seed

E. R. HILL, ET AL.

Research Fellow, Plant and Soil Service Department
University of Massachusetts

Abstract and Summary. Three-quarter inch seedlings of northern nutsedge (*Cyperus esculentus* L.) were transplanted into the field where numbers of plants, inflorescences and the rate of spread were recorded. Seed was collected from each plot and germination tests conducted. During one growing season, a single seedling developed into a stand of plants that produced a yield of 90,000 seeds with a germination of 51%.

INTRODUCTION

YELLOW nutsedge is one of the most serious perennial weeds of the Northeast. Land owners and research workers have generally recognized that nutsedge has a remarkable reproductive potential but until recently, little was known as to the relative rate of propagation under natural conditions.

Tumbleson and Kommedahl (1, 2) published data on the reproductive potential of nutsedge by tubers. In their studies, a single tuber produced 1900 plants and 6900 tubers in one year in an area 7 feet in diameter and 10 inches deep. This was equivalent to a tuber yield of 8.3 tons (green weight) per acre.

Previous published studies have not considered the propagation potential by seed. Recent work by Durfee³, however, indicates that propagation by seed may be responsible for initiating new stands of this pest. Preliminary experiments indicated that there was no significant difference in rate of growth and spread in direct seeded plots or transplanted plots. The studies reported here were conducted to determine the growth rate and reproductive potential of yellow nutsedge when grown from transplants.

MATERIALS AND METHODS

The experiment was begun on July 14, 1960 when seeds were germinated under conditions of 16 hours dark at 20C and 8 hours light at 35C. On July 29, when the seedlings were three-quarters of an inch tall, they were planted individually in 40 plots, each four feet square. The soil type was a Scarborough very fine sandy loam with a pH of 5.8. It was on a site that is well drained, naturally moist, and in a moderately high state of fertility.

On August 9, 1960, an additional 80 seedlings were planted individually as on July 29. All plots were watered lightly and a plastic protector was placed over each seedling to prevent damage from wind and rain.

RESULTS

Data were recorded from June 13, 1961 until the end of the growing season in the July 29, 1960 planting. Plant counts per plot were recorded from June

Table 1. Growth rate of nutsedge.

Date 1961	Daily increase number of plants		Spread inches per day		Number inflorescences	
	Experiment 1 ^a	Experiment 2 ^b	Experiment 1	Experiment 2	Experiment 1	Experiment 2
June 13.....	—	—	0.26	0.22	—	—
June 20.....	4.2	1.97	0.46	0.13	—	—
June 26.....	6.3	2.26	1.15	0.19	—	—
July 6.....	8.6	2.66	0.53	0.27	0.33	—
July 13.....	6.9	2.02	0.35	0.38	0.97	—
July 19.....	—	1.17	1.11	0.83	2.03	—
July 26.....	—	1.59	0.83	1.02	3.94	0.06
Aug. 4.....	—	—	1.98	0.79	7.61	0.44
Aug. 10.....	—	—	—	0.97	16.83	1.38
Aug. 17.....	—	—	—	—	—	4.24
Aug. 24.....	—	—	—	—	—	8.81

^aPlanted July 29, 1960. Values are the means of 36 plots.
^bPlanted August 9, 1960. Values are the means of 63 plots.

13 to July 13, when counting was terminated because rampant growth resulted in a coalescence of the plots (Table 1). The values for growth rate among the plots were quite variable but the most rapidly growing plot increased at the rate of 3.7, 16.0, 23.4 and 13.0 plants per day, respectively, during the 4 weeks that data were recorded.

Plant growth and spread from individual seedlings developed in the approximate form of a circle. Data on the rate of spread were recorded from June 13 until August 10 and are expressed as the distance between the two most widely separated plants in each plot (Table 1). Observations were terminated on August 10 when most of the plots had coalesced. Plants in one plot spread at the rate of 0.28, 1.0, 0.42, 1.28, 0.14, 1.28, 0.57 and 4.28 inches per day, respectively, during the 8 weeks of the experiment.

Inflorescences were counted from July 6 to August 10 at which time they varied from 0-89 per plot. The latter figure would indicate a yield of 242,000 inflorescences per acre. As the inflorescences matured, seed was collected from each plot until the end of the growing season. The seed was air dried, hand threshed, and cleaned in an air blower. Only the heaviest seed was saved, since results obtained by Durfee had indicated a positive relationship between seed weight and germination rate. The seed from each plot was weighed and its germination tested.

From the 40 original plots, seven failed to produce seed. Production from the remaining plots was extremely variable ranging from 1.4 to 16.5 grams (Table 2). One hundred seeds from each plot were counted and weighed, and the approximate number of seeds was calculated from the yield and weight per 100 seed sample. The

Table 2. Reproductive potential of nutsedge in seed yield and germination from the July 29, 1960 planting.

	Yield g	Wt. 100 seeds g	No. produced	Germ. %	No. viable
Total (33 plots).....	212	.580	1206000	—	562000
Mean.....	6.5	.018	36500	46	16800
High plot.....	16.5	.021	90000	51	45900
Low plot.....	1.4	.015	9600	43	4100

calculated production varied from 9,400 to 90,000 seeds per plot; this would indicate a production of 45,000 grams or approximately 245 million seeds per acre. Germination tests were then conducted on the seed harvested from each plot. The average germination for all plots was 46%. The number of viable seeds per plot varied from 4,100 to 46,000 or between 11 and 125 million per acre.

On the other hand, observations on a very dense stand of nutsedge, undisturbed for perhaps 5 or 6 years, indicated that seed production was practically nil. The great number of nutgrass plants present in this field developed few flowers and practically no seed. This suggests that seed production is associated with and dependent upon young vigorously growing plants.

Counts of plant increase from the August 9, 1960 planting were made at weekly intervals from June 12 to July 26, 1961 (Table 1). Table 1 also presents measurements on the rate of plot spread taken from the period June 12 to August 24.

The most rapidly growing plot increased by 358 plants, an average daily increase of 8.13 plants. The slowest rate of spread was .23 plants per day. The rate of

NUTSEDGE (Continued)

plot spread was also quite variable, with the most vigorous plot increasing 60 inches during the period. Inflorescences first appeared July 26. The rate of inflorescence development increased as the season progressed. The number of inflorescences produced per plot ranged from 0-71.

ACKNOWLEDGMENT

This project was financed in part by funds from Northeastern Regional Project NE-42, "Studies of the Life History of Northern Nutgrass (*Cyperus esculentus*) as Related to Possible Methods of Control".

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2. _____ and _____. 1961. Reproductive potential of *Cyperus esculentus* by tubers. Weeds 9:640-653.

TURF MANAGEMENT (Continued)

WEDNESDAY	Pole Greens, Mow Greens, Insect Control Greens, Water Greens, Change Cups, Mow Tees, Disease Control in Fairways, Trim Traps and Bunkers
THURSDAY	Pole Greens, Thin Greens, Mow Greens, Aerify and Topdress Practice Green, Syringe Greens, Spike Tees, Water Fairways, Trim Around Trees
FRIDAY	Pole Greens, Spike Greens, Mow Greens, Syringe Greens, Water Tees, Fungus Control Tees, Mow Fairways, Mow Clubhouse Lawn, Weed Traps, Trim Hedges, Pick Up Litter From Storm
SATURDAY	Pole Greens, Mow Greens, Water Greens, Change Cups, Fungus Control Greens, Mow Tees, Water Fairways

Table 3

USE OF MONTH BY MONTH POSTERS

Poster Heading	Example of Information Supplied by Superintendent
JANUARY	Repair and Recondition Machinery and Equipment
FEBRUARY	Prevent Winter Desiccation of Greens
MARCH	Prevent Snow and Ice Accumulations From Injuring Greens
APRIL	Spring Renovation of Greens, Tees and Fairways to Repair Winter Injury
MAY	Control Crabgrass With Pre-emergence Herbicides
JUNE	Fertilize For Summer Hardiness of Turfgrass
JULY	Control Disease Complexes on Greens
AUGUST	Encourage the Survival of Poa Annuua
SEPTEMBER	Renovation of Greens and Tees to Reduce Soil Compaction and Thatch Accumulation
OCTOBER	Weed Control in Greens, Fairways and Tees
NOVEMBER	Water Lines Drained and Blown Dry for Winter
DECEMBER	Greens Treated for Snow Mold

FABULOUS UNCLE (Continued)

These Ohio settlers and farmers had a problem, however. It cost a lot of money to haul their products back East over the mountains. They soon realized that it would

be a lot cheaper and quicker to float them down the Ohio and Mississippi Rivers to market. Only trouble was that France still had claims on most of the land through which these rivers flowed. So Thomas Jefferson, one of Uncle Sam's helpers, made a deal with a Frenchman named Napoleon. The deal was completed in 1803 and for \$15 million (less than 4 cents an acre) Uncle Sam got another 500 million acres of wilderness.

Within a few more years, Uncle Sam made more real estate deals. He got 46 million acres from Spain (including Florida) in 1819, 183 million acres from Great Britain in 1846 (including Washington, Oregon, Idaho and western parts of Montana and Wyoming), 338 million acres from Mexico in 1848 (including California, Nevada, Utah, Arizona and portions of New Mexico, Colorado and Wyoming). In 1853 another of his helpers named Gadsden purchased still another 19 million acres from Mexico. Finally, in 1867 Uncle Sam made his last big deal when he bought 375 million acres (the entire territory of Alaska) for \$7.2 million from Russia. The Russians have been sorry ever since.

All of this land that Uncle Sam got cost him slightly over \$8 million. It totalled 1,837,762,560 acres. Never in the history of the world has so much valuable real estate been acquired for so little money — and so little bloodshed.

Today, however, some people think Uncle Sam owns too much land. They make all kinds of speeches, statements, and sarcastic remarks about old Sam. According to them, Sam is a greedy, mean, powerful old man who doesn't want anybody to use his land or its natural resources. They say he even wants more land, especially land he can turn into outdoor playgrounds. They claim Sam really doesn't need all the land he owns now and that there is no need for additional recreation areas. Specifically, here's what is being said about Uncle Sam and what should be said about him. We've called these statements the "Fables and Facts About Federal Land."

FABLE: "Government-owned lands pay no taxes."

FACT: Although the Constitution exempts the Federal government from paying "taxes," there are some 50 laws under which payments are made on Federally-owned lands in lieu of taxes. To cite a few examples — since 1908, the Federal government has paid 25% of gross receipts from each national forest at the end of each fiscal year to the state in which the forest is located. This money is earmarked for the benefit of public schools and roads in the counties where the national forest is located. In 1963 this 25% fund returned \$29,993,939.48 to the local schools and roads. On the Boundary Waters area of the Superior National Forest in Minnesota, Uncle Sam pays 75% of the assessed value of the land to the counties for expenditure as they see fit. Last year this amounted to \$130,986.46. In Oregon on the O&C Lands, 75% of the receipts go to the counties. In 1963 that amounted to \$4,341,915.79.

Suppose the national forests didn't belong to the Federal government but were owned by "tax-paying" individuals or corporations. How about taxes then? In 1952 a very careful study was made of this question (now being reviewed and up-dated but results not complete). It showed the average private forest owner paid taxes amounting to 19 cents per acre. Under the 25% of gross receipts fund, Uncle Sam was paying 11 cents per acre to local schools and roads. But at the same time the Federal government was also paying for forest fire prevention and control on these acres, plus costs of building and maintaining roads and highways. The Forest Service was also conducting research, results of which were available at no cost to private forest-land owners, and was likewise protecting the forests from insect damage and disease. If state, county or local gov-

(Continued on Page 12)

THE FASCINATING STORY OF HERBICIDE ACTION

by *Dr. Robert Dennis*
Agronomist
University of Arizona
Agricultural Service

Herbicides when properly used, alter, inhibit or terminate the growth of weedy plants. They make an important contribution in the continuing effort by American farmers to provide safe, wholesome food in abundance at reasonable prices.

Some herbicides kill all plants or at least the plant parts with which they come in contact. In general, however, the selective herbicides are of greatest interest in field crop production. A study of the phenomena of absorption of herbicides by leaves and roots and their translocation within the plant, helps in understanding their action.

The three dimensional line drawing of the cross-section of a typical leaf shows the complexity of leaf structure. The surface of the leaf is covered with a waxy material called a cuticle. This barrier to the entry of herbicides tends to be thicker on leaves growing under conditions of intense sunlight. Some movement of most herbicides applied to leaves takes place through the cuticle. Ester formulations of chlorophenoxy and many other herbicides may enter the plant in this way.

The stomata of a leaf also present a pathway for the entry of some herbicides. Herbicides which are soluble in water, such as certain forms of 2,4-D, dalapon and amitrole may enter the plant through open stomata. Oils move freely into leaves through open or closed stomata. Stomatal penetration of water soluble herbicides and penetration of many herbicides through the cuticle is increased by the use of surfactants. Surfactants are used to reduce surface tension of spray solutions.

A herbicide applied to leaves and stems may penetrate the cuticle and stomata, move to the food or water

conducting tissue and then to other parts of the plant. The pattern of translocation within the plant is influenced by the kind and stage of growth of the plant. Sometimes the herbicide is absorbed and inactivated by cells in the leaf, and sometimes it may remain on the leaf surface and never enter the plant. The herbicide 2,4-D appears to be absorbed and held more in the cell walls of grass than broadleaved type plants, a factor probably important in its selectivity.

Absorption of soil applied herbicides such as chlorate, diuron, monuron, prometryne and trifluralin occurs primarily through root hairs and through the cortex cells just behind the root cap. The line drawing of a typical root tip shows areas of particular importance in herbicide absorption. Movement of soil applied herbicides into the plant

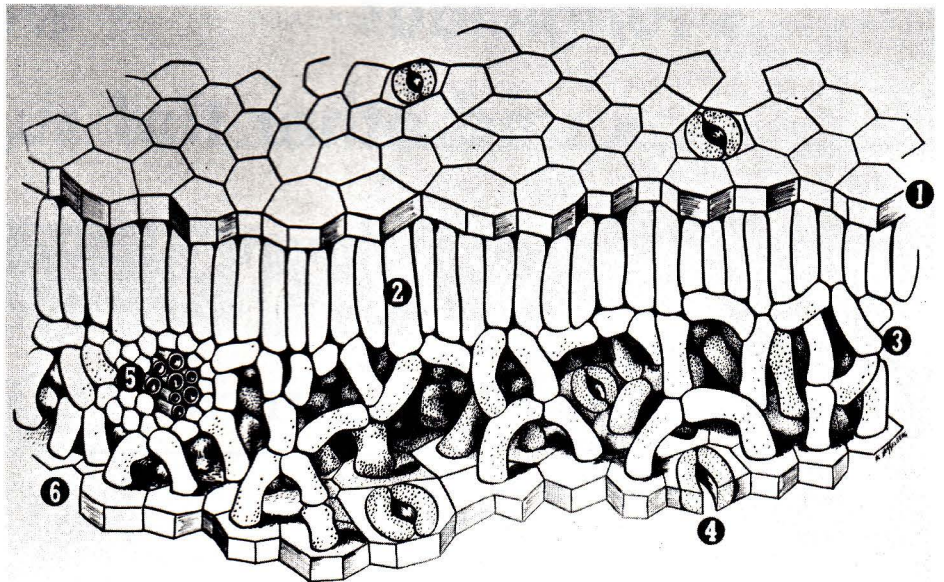
and to other parts of the plant is with water and nutrients. Factors which favor rapid growth of plants also favor rapid absorption of herbicides.

Most of the water conducting tissue of the plant is non-living. Some absorption and translocation of phyto-toxic chemicals may occur even after other root tissues have been killed by a herbicide.

There are many theories concerning the reasons why herbicides kill or injure plants. Observation of treated plants and plant parts provides some information. However, finding the why of herbicidal action is very difficult.

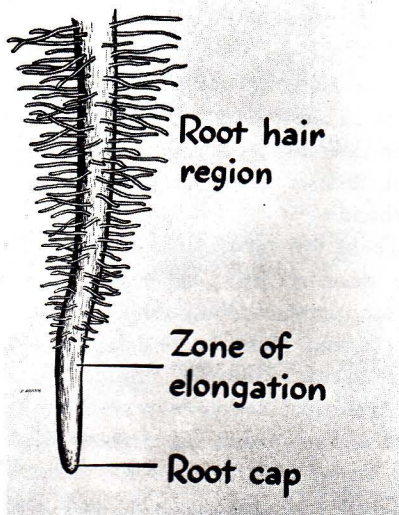
It is known that the slightest disruption in enzyme reactions has a marked influence on the growth and development of the plant. For example, dalapon, a grass killer, reduces the production of one of the B vitamins, and this vitamin is an essential part of a coenzyme system. Substituted urea and triazine herbicides block photosynthesis, but the actual cause of death probably is not starvation. Certain herbicides block an essential step in the respiration cycle while other coagulate protein or alter in some way the normal pattern of growth.

Agricultural Extension Agents use weed control test demonstrations to



Three dimensional line drawing of cross-section of a typical leaf. Leaf parts are (1) upper epidermis, (2) palisade parenchyma, (3) spongy parenchyma, (4) stoma, (5) vascular bundle (vein), and (6) lower epidermis.

(Continued on Next Page)



Line drawing of typical root tip.

show the effective use of herbicides. Dramatic results such as those in the Navajo County, Arizona, tansy mustard test plot show something of what may be expected when herbicides are used effectively. The control of weeds in cotton in Arizona, using pre-plant and post-emergence herbicides is now receiving special attention.

Each year there are many new herbicides cleared for use in agriculture by the U.S. Department of Agriculture. Carefully planned chemical weed control tests are conducted by State Experiment Station and U.S. Department of Agriculture personnel. Those herbicides which are effective and which are approved for use, following submission

of their labels and other data to the Federal authorities, are included in the annual publication, Bulletin A-1, "Chemical Weed Control Recommendations". This publication is available at each of the Agricultural Extension offices in the state.

There have been many changes in the science of weed control since World War II, when 2,4-D was developed. It seems safe to predict, however, that there will be more innovations in the use of herbicides during the next five years than during the past 50 or more years.

Drawings by Al Hesselberg, University

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FABULOUS UNCLE (Continued)

ernments had to do all these things, or if private enterprise had to pay for them, it would have cost 24 cents per acre. So, Uncle Sam actually contributed more on his forests (35 cents per acre) than private landowners paid in taxes (19 cents per acre). In addition, Federal payments are automatic at the end of each year. There is no cost for collection. The public also receives other non-monetary benefits from national forests and other Federally-owned land such as recreation, watershed protection, etc.

FABLE: "The Federal government owns more than one out of every three acres of the land area of the United States."

FACT: Although this statement is statistically correct, before deciding whether or not this is good or bad, you should consider (1) how Uncle Sam got those acres, (2) where those acres are located, and (3) what kind of acres they are.

(1) The gross area of the United States is 2.3 billion acres (including Alaska and Hawaii). During U. S. history the Federal government has, at various times, held title to about four-fifths of the nation's gross area. To date, title to approximately 1.1 billion acres has been transferred to individual citizens, business and non-Federal governmental organizations. Of these 1.1 billion acres, 287 million acres have been granted to homesteaders, 331 million acres have been granted to states to help support public schools, develop transportation systems, and for general economic development.

(2) Various Federal departments, agencies or commissions now hold title to about 771 million acres but 365 million of these acres are in Alaska and another 360 million acres are in the 11 contiguous Western states. Only 45 million acres are Federally-owned in the other 38 states combined.

(3) Much of the Federally-owned land is remote mountain land, arid desert, surface waterways, or other types of land not suitable for development by private individuals or corporations. Of America's 530 million acres of commercially valuable forestland, 73% is privately-owned by individuals or forest industries.

FABLE: "There is an increasing flow of land from private ownership to government ownership — particularly at the Federal level."

FACT: Less than 1% of the land now under Federal government ownership was obtained through purchase, condemnation, gift or exchange. Of the 770,796,843 Federally-owned acres, 710,373,123 acres remain of the Public Domain; only 51,423,919 acres have been acquired in the past 97 years. Although some land is acquired through purchase, condemnation or gift each year, other land is being sold or given away. During fiscal year 1963, for example, the Bureau of Land Management (largest of the Federal land management agencies) issued 5,392 patents which transferred 633,340 acres of public lands from Federal ownership to private, local or state ownership.

FABLE: "The rush to remove from tax rolls productive forestlands, grasslands, croplands and other areas in the name of an imagined crisis in outdoor recreation cannot be justified by the facts."

FACT: Anyone who has visited a public campground, tried to hunt on public game lands, launched a boat from a public access ramp, or used other types of outdoor facilities presently available has surely seen the need for additional land and water for public recreational use. A "crisis" is largely a matter of opinion but here are some facts about American outdoor recreation demand. From 1952 to 1962 visits to state parks increased 113%, visits to national parks increased 87%, visits to other Federal recreation areas increased 238%, and the number of outboard motors in use increased 94%. The population increase during this period

was 19%. About 90% of all Americans participated in some form of outdoor recreation in the summer of 1960. In total, they participated in one activity or another on 4.4 billion separate occasions.

All of these fables and facts are designed to help you answer one question — Are the public lands, especially in the West, an aid or an obstacle to progress?

What has this government land meant to the private sector of the economy, and to the states, counties and municipalities? What kind of federal investments have been made, and what has been the result in terms of both local and national economies? Are local interests consulted and accommodated in carrying out resource policies? Do national parks contribute to the economics of the several states; if so, how much? Would it really be profitable for the states to have the Federal lands transferred to state ownership?

The Reclamation Program in the West is regarded as a model today in all parts of the world. Under this program, the Federal government has spent 4.5 billion dollars in building dams, canals and irrigation works needed to provide the assured supply of water that has made 8.5 million acres of land permanently productive. Over 90% of the money advanced by the Federal government for construction has been repaid.

Since the close of the Second World War, the Federal government has spent more than \$375 million developing, operating and maintaining the units of the National Park System, chiefly in the West. These investments have been a major factor in development of a tourism industry that is now an economic mainstay for the Western states.

The wildlife habitat on public lands provides the best outdoor recreation in the West. The states and the tourist industry reap large economic benefits. On the Taylor Act lands, grazing fees are paid by range users. Part of those receipts are paid in cash to the states. Oil, gas and several other minerals on the various public lands are managed by the Federal government under a mineral leasing system. Only 10% of the total revenues realized from mineral leasing on public domain lands are returned to the General Fund of the United States Treasury. Of the remaining 90%, the Reclamation Fund gets 52½% and the states 37½%.

The Federal government provides health, education, welfare and development funds for the Indian people and their resources. In fiscal 1964 these funds will total more than \$228 million. Again, the benefits to the Western states far outweigh the burdens. If the Indian lands were "put on the tax rolls" and the states had to provide the same level of public service, all of the "Indian States" would need new taxes to carry this extra load. In Arizona, if the state government assumed the responsibility for these services, it would entail nearly a 20% increase in its current budget.

Transfer of the public lands "to the tax rolls" would automatically alter the liberal highway fund matching concessions which the states now enjoy. In fiscal year 1963, the Western states would have had to raise an additional \$145 million if they had no Indian and public domain lands within their boundaries. There are other special Federal road financing benefits as well. Some \$74 million was spent by Uncle Sam in fiscal 1963 for forest roads. An additional \$30 million of unmatched Federal funds were expended on highways and roads within the national parks and monuments, on Indian reservations and other Federal lands.

But there is still one unanswered question. Perhaps it is the most important question of all. WHO IS UNCLE SAM?

Anyone who takes the time and effort to think seriously about this question will come to one, inescapable answer — Uncle Sam is YOU! —U. S. Conservation News

Chemistry And Our Lawns

The aim of all of us is to have a beautiful lawn or to help in developing the best lawns possible. In many cases the lawns are established, and we have to work with the maintenance of the lawns. This will be the basis for my discussion with you.

In the development of beautiful lawns, we must consider (1) construction, (2) selection of grasses, and (3) maintenance. In maintenance we have the cultural part of mowing and watering which does not involve the chemistry of lawn maintenance. Chemistry in lawn care plays an important part in fertilization, and in the control of insects, crabgrass, weeds, and diseases. Due to the vastness of chemistry in our lawn problems, most of my discussion with you will be on insect and crabgrass control.

Lawn insects can be grouped according to where they are found or where they feed. I have set up the following classifications:

- I. Soil and Root Pests
 1. Grubs
 2. Ants
 3. Wireworms
 4. Earthworms
 5. Mole crickets (in the South)
 6. Billbugs (usually in the South)
 7. Desert termites (occasionally in the Southwest)
 8. Wild bees and Cicada-killer wasps (make holes in turf and may sting people)
 9. Periodical Cicada (emergence holes)
- II. Leaf and Stem Feeders
 1. Sod webworms
 2. Armyworms and cutworms
 3. Leaf bugs
 4. Grasshoppers (occasionally)
 5. Billbugs (adults usually in the South)
 6. Moth (Fiery and Lucerne) (occasionally in California)
- III. Pests That Suck Plant Juice
 1. Cinch bugs
 2. Scale insects (mainly southern part of United States)
 3. Leafhoppers
 4. Mites (clover) Eriophyids (Bermudagrass)
 5. Spittlebugs (Northeastern and North Central States — Control seldom necessary)
- IV. Miscellaneous Pests — Generally do not damage lawns, but can be real problems.
 1. Chiggers
 2. Ticks
 3. Fleas
 4. Spiders and scorpions
 5. Slugs and snails
 6. European earwigs
 7. Snowbugs and pillbugs
 8. Millipedes and centipedes

The groups of lawn pests which are the most destructive and most widespread are the grubs and ants. Grubs or larvae do the extensive damage and are not easily detected due to the fact that they feed underground. Grubs also are found at different soil depths depending upon the temperatures. Some of the grubs are represented as May or June beetles, Japanese beetle, Oriental beetle, Asiatic garden beetle, European chafer, masked chafers, rose chafer, white-fringed beetles, green June beetle, and rhinoceros beetle.

The May or June beetles cause injury in all areas; whereas, other grubs are more localized. Japanese beetles have been found mainly in the East, but now are becoming a serious pest West to the Mississippi River with one outbreak in the Sacramento area of California. The Asiatic garden beetle and Oriental beetle are mainly found in the North Atlantic seaboard area, and the European chafer occurs mostly in New York, but with a few other isolated infestations. The masked chafers, northern and southern, are widely distributed and are sometimes called annual white grubs. The green June beetle is found mainly in the Southern part of the United States, and the larvae have the unusual habit of crawling on their backs.

Ants of many kinds are found in all areas. They destroy roots of grass, "grass seed collectors", and the ant hills in some cases become problems in lawns. The fire and harvester ants have vicious bites.

Certain of the insects will be placed in groups where the control is similar, and the chemicals will be given in alphabetical order. For grubs and ants dusts, granular and sprays are generally available for aldrin, chlordane, DDT, dieldrin and heptachlor. This group of materials has given excellent control, and the residual properties are good. The dosages are often given in pounds actual per acre, but some references show the dosage of formulation per 1000 square feet. In general, the suggested dosage for aldrin, dieldrin, and heptachlor is 5 pounds actual per acre (100 pounds of 5% granular) per acre or about 2½ lbs./1000 sq. ft. Chlordane is used at the rate of 5-10 pounds actual per acre and DDT 25 pounds actual per acre.

Dr. J. B. Polivka, Ohio Agricultural Experiment Station, has reported on the above chemical and others in his studies and research work with DDT which started in 1944. Results from 16 DDT field tests indicate that one application of 25 pounds per acre controlled all grubs for six years or more. Chlordane at 5 and 10 pound rates were still effective 7 years after application, and in 2 tests the above rates on the basis of low grub population still were 100% effective after 11 years. Heptachlor at 3 and 5 pound rates was still 100% effective on different grubs at the end of 7 years. Dieldrin at 3 and 5 pound rates was still 100% effective after 4 years. In one test the 3 pound rate gave poor control the second year, and the reason for the variation was not determined at the time. Aldrin applied at 3 pound rate was still giving 100% control 4 years after application. These tests were still in progress when Dr. Polivka reported the results, and the residual effectiveness will continue.

Wireworms, cicada-killer wasp, and wild bees have been satisfactorily controlled at the same rates for the same chemicals as listed for grubs and ants. Armyworms, cutworms, and mole crickets are controlled by chlordane, dieldrin, and heptachlor at 5 pound rate of each according to House and Garden Bulletin No. 53. Chinch bugs have been and are still being controlled in many areas with chlordane, DDT, and dieldrin. In some areas chinch bugs have become very difficult to kill, and phosphates are used. For areas where the chinch bugs are so difficult to control we suggest your contacting the local or state research group for the latest and best control methods. New Jersey suggests the use of 6 ounces 25% Diazinon in 5 to 10 gallons of water per 1000 square feet of lawn area. Control of sod webworms has generally been satisfactory with the use of materials listed for white grubs, but there are problem areas

where it will be advisable to consult with the entomologist doing the turf insect work as the treatment may be changed.

For some of the other pests, metaldehyde bait is the standard for slug and snail control. Desert termites, millipedes, and earthworms have been controlled with chlordane, dieldrin, and heptachlor. In Connecticut, where the Oriental earthworm is a problem, 40 pounds actual chlordane per acre is suggested. This rate is double that suggested for the common earthworm. For a formulated material use 10 pounds of a 5% chlordane dust or granular per 1000 square feet.

Crabgrass is a serious problem in our lawns in many areas. The early control was by cultural methods of hand weeding, seed sweeping, mechanical disking, and lawn renovation. Dr. J. A. DeFrance, reporting on crabgrass at the "Turf Section Northeastern Weed Control Conference" in January, 1956, indicated crabgrass to be the number one weed problem in lawns, putting greens, and other turf areas. It has been estimated that one crabgrass plant may produce as many as 200,000 seeds. The early chemical control was the post-emergence treatment which required several applications after the appearance of wide yellowish-green leaf blades of crabgrass in the turf in June and July.

Many materials, such as oils, arsenates, arsenites, mercuries, cyantes, and dinitro have been investigated since the first crabgrass control studies in the "Thirties." With the post-emergence material treatments should be applied every 7 to 10 days until the crabgrass is controlled. In general, the post-emergence material often causes a "discoloration" of the turf grasses. Some of the post-emergence materials now being used are phenyl mercury, acetate (PMA), potassium cyanate (KOCN), and three organic arsenicals, namely: disodium methyl arsonate (DMA), calcium methyl arsonate (CMA), and amine methyl arsonate (AMA). Most of the post-emergence crabgrass materials are poisonous and require care in use and storage.

Dr. R. E. Engel in 1956 stated at the Northeastern Weed Control Conference as follows, "Pre-emergence crabgrass control is the best theoretical answer for our worst turf weed problem. The goal is a safe, sure, and single application treatment." In the early studies, arsenicals, chlordane, phenyl mercury acetate, chlorophenoxyethyl sulfate, benzoate compounds, and butylurea preparations showed promise.

Arsenicals have been used extensively and have a long residual, but in some areas and under some conditions cause considerable injury to turf grass species. Of the other early pre-emergence materials tested, chlordane has been and is still used extensively. In general, when chlordane has been applied at recommended dosages there has been no injury except in a couple Atlantic Coastal areas. Some results in crabgrass control have been variable in some localities. Dr. D. D. Hemphill has applied chlordane at the recommended rate for four years and reports the turf in a very vigorous growth free of crabgrass. The first year there were crabgrass plants after the treatment, but since then there has been excellent control. Insect control will also be obtained with chlordane and arsenicals at rates used in the crabgrass plots. Arsenicals in the above tests show definite thinning of the grass.

In the last few years there have been many new pre-emergence crabgrass materials. In 1961, the following materials were observed in tests, arsenicals (tricalcium arsenate and calcium arsenate), Bandane, calcium propyl arsonate, chlordane, Dacthal, diphenatril, dipropalin, trifluralin, and Zytron. Pre-emergence crabgrass killers marketed prior to 1960 were chlordane, calcium arsenate, and tricalcium ar-

senate. In 1960, Dacthal and Zytron were marketed followed by calcium propyl arsonate and diphenatril in 1961. Bandane and trifluralin were being marketed in 1962. Of the materials now used arsenicals, chlordane, Dacthal, and Zytron are the most common. Calcium propyl arsonate, Bandane, diphenatril and trifluralin are on the market. Calcium propyl arsonate requires care in timing as it has a limited residual. It should be applied just before emergence to give the best results and some post-emergence action has been noted. Bandane shows excellent safety without evidence of injury to grasses at rates above the 35 pounds recommended for crabgrass control. Field treatments of 35 pounds per acre have given near perfect control. Diphenatril shows a good safety margin on grasses, but control is not as good as desired. Trifluralin has given outstanding control of crabgrass, but injury has been observed in a number of cases. In some cases dosages have been too high. Definite care in application as to rate appears very important.

Dacthal and Zytron have been used and have given and are giving very good crabgrass control. Residual studies are underway to determine the effect of annual use. There are indications that some rates in some localities have reduced stands, but additional study is necessary.

The problem of soil type, grass species, cultural practices, fertilization, and other factors all enter into the safety and efficacy of the pre-emergence crabgrass control. The aim is to have a safe material that gives the best possible crabgrass control using a formulation most commonly used by the home owner.

Weed control in lawns, other than crabgrass, is becoming an important phase of the use of chemistry in turf work. Broadleaf weeds in many cases are real problems. To make the problem more complex; ornamentals, trees, and even clover in the lawns should not be injured. 2,4-D of low volatile forms is used extensively. 2,4-D has given excellent control of dandelions, plantains, shepherds purse, and others, but there are various weeds such as chickweeds, knotweed, henbit, ground-ivy, dock and sorrel, oxalis, speedwells (*Veronica*), yarrow, and others that are not satisfactorily controlled. For these hard-to-control lawn weeds, there are a number of materials being used and tested such as, Silex, endothal, Banvel D, Zytron, arsenicals (in some cases), and others. Now valuable information on better and safer control is being obtained each year.

Turf diseases are a big problem and our lawn culture may aid in increasing the problem. Most grasses in lawns are grown out of their natural environment which probably makes conditions more favorable for the development of the disease organisms. Vigorously growing and healthy lawns of adapted grasses which are properly managed generally best survive disease attacks.

Some of the main diseases are *Helminthosporium* (leafspot or foot rot), brown patch, dollar spot, *Pythium* diseases, snow mold, and others. Many advances have been made during recent years in turf disease control, and much more research is needed to solve the problems. Mercuries, cadmium compounds, thiram, carbamates, combinations, and others are being used with good control.

—*Courtesy Velsicol Chemical Corporation*

The information given and the recommendations made herein with respect to the products discussed are based on extensive research and are believed to be accurate; however, because Velsicol Chemical Corporation has no control over formulations, storage, handling and conditions of use, which are of critical importance, Velsicol Chemical Corporation makes no representation or warranty of any kind.

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TURF BULLETIN

TROLLING

Merry Christmas From The Officers, Directors and Editor of The Turf Bulletin

Why do you apply lime to acid soils? Or use lemon juice to keep sliced apples from turning brown? Why does sodium bicarbonate settle your stomach? Why do you wash with vinegar to prevent caustic soda burns? Or with baking soda after exposure to sulfuric acid?

You are using one of the basic principles of chemistry: Add chemicals to solutions to reduce their harmful or inconvenient acidity or basicity.

These little "tricks" do help you use the acids and bases which surround you in your home and on your farm. But you could make better use of them by knowing the answer to one primary question:

WHAT IS pH?

In its simplest definition, pH is a measure of the effective or active acidity or basicity of a solution. Water (H_2O) is the basis for pH values since it is a combination of the acid hydrogen and basic hydroxyl ions, H^+ and OH^- .

Water breaks down to a slight degree, forming equal amounts of H^+ and OH^- . In a liter of water, there is usu-

ally 0.0000001 or 10^{-7} mols each of H^+ and OH^- . It has a pH of 7 (pH is the negative logarithm of the active hydrogen concentration).

The total concentration of H^+ and OH^- must add up to 10^{-14} mols per liter. Higher concentrations will combine to form water. If we add acid to the water, we increase the amount of H^+ and decrease the amount of OH^- .

For example, milk added to water can give an H^+ concentration of 0.000001 or 10^{-6} mols per liter. We then have an OH^- concentration of 10^{-14} minus 10^{-6} , or 10^{-8} mols per liter. The solution has more H^+ than OH^- ions, so it is acidic. Its pH is 6.

Similarly, adding egg white to water can give us an OH^- concentration of about 10^{-6} mols per liter. This means the H^+ concentration is 10^{-8} mols per liter, so our pH is 8. The solution is slightly basic.

Neutral solutions with a pH of 7 have equal amounts of H^+ and OH^- . Solutions with more H^+ than OH^- have a pH below 7 and are acidic. If the pH is above 7, the solution has more OH^- than H^+ , so it is basic.

pH of common HOUSEHOLD ITEMS		pH of common INDUSTRIAL CHEMICALS		H^+ CONCENTRATION Mols/Liter		OH^- CONCENTRATION Mols/Liter	
	pH		pH		pH		pH
	0	← Sulfuric Acid, 4.9%		1	0	0.00000000000001	
	1	← Hydrochloric Acid, 0.37%		0.1	1	0.00000000000001	
Lemon Juice →	2			0.01	2	0.00000000000001	
Orange Juice →	3	← Acetic Acid, 0.6%		0.001	3	0.000000000001	
Beer →	4			0.0001	4	0.000000000001	
Cheese →	5			0.00001	5	0.0000000001	
Milk →	6			0.000001	6	0.00000001	
Pure Water →	7	← Pure Water		0.0000001	7	0.00000001	
Egg White →	8	← Sodium Bicarbonate		0.00000001	8	0.000001	
Borax →	9			0.000000001	9	0.00001	
Milk of Magnesia →	10	← Ammonia, 0.01%		0.0000000001	10	0.0001	
	11			0.00000000001	11	0.001	
	12	← Caustic Soda, 0.04%		0.000000000001	12	0.01	
	13	← Lime (Saturated Solution)		0.0000000000001	13	0.1	
	14	← Caustic Soda, 4%		0.00000000000001	14	1	