PROCEEDINGS

of

1952 TURF CONFERENCE

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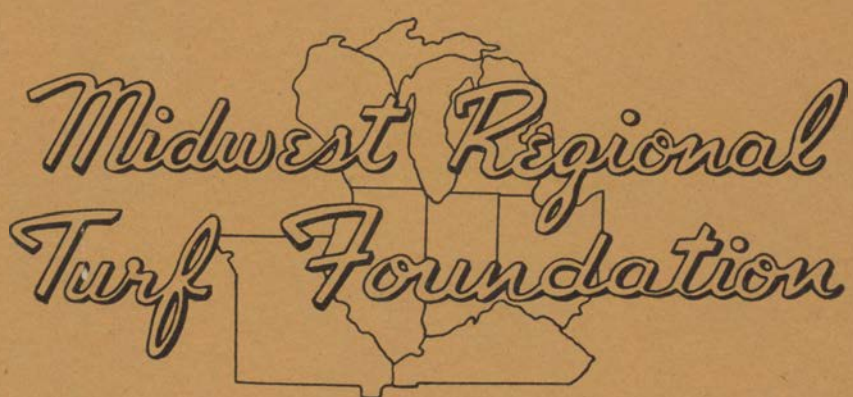

and

PURDUE UNIVERSITY

LAFAYETTE, INDIANA

March 3, 4 and 5, 1952

MIDWEST REGIONAL TURF CONFERENCE, PURDUE UNIVERSITY, 1952

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FOREWARD

The Program Committee wishes to express a very real appreciation to the many speakers who participated in our 1952 Turf Conference.

We wish to thank especially Dr. O. J. Noer for cooperating in a panel by discussing "How Management Affects Weeds". In this he stressed that chemical control of weeds and weedy grasses is only one phase of turf improvement, that renovation, sowing adapted grasses, adequate fertilization and careful watering are also to be considered.

Appreciation is also expressed to Eric G. Sharvelle for a talk entitled "Turf Tales from England". He shared by Kodachrome slides his family's summer trip to Europe in 1951. A description of the Royal Portrest Golf Course at which the "British Open" golf tournament was played in 1951 was given. The Royal Portrest Golf Course is situated on the shores of the Atlantic at the very northern tip of Ireland. It is characterized by very narrow fairways, hidden greens, difficult hazards and discouraging roughs and trapped greens. Golf in Britain is very difficult and the American player soon learns that iron play at which British players are so successful is the secret of success on British courses.

The panel discussion on Diseases and Fungicides was led by Eric Sharvelle. Results of the 1951 National Turf Fungicide trials were reported by Charles Wilson of the U.S.G.A. Green Section. Mr. Wilson's comments on the National Turf Fungicide trials are included in this proceedings.

Mr. William Klomparens, graduate student, and Dr. John Vaughn, Pathologist, of Michigan State College, discussed the turf disease and fungicide program in Michigan. Mr. Klomparens discussed the "Melting-out" disease of bentgrass caused by helminthosporium and pointed out that the ordinary turf fungicides will not prevent this trouble. Dr. Vaughn discussed the value of Acti-dione, a new antibiotic related to Streptomycin, for the control of turf diseases. Acti-dione has given promising control of dollarspot and large brownpatch and is one of the few chemicals that has prevented helminthosporium melting-out disease. We wish to thank them for sharing their experiences with us.

ATTENDANCE

MIDWEST REGIONAL TURF CONFERENCE

March 3, 4, and 5, 1952

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CHEMICAL CRABGRASS CONTROL

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Crabgrass is one of the most troublesome of all turf weeds. There are two species common to the middle west. The most prevalent one is the small crabgrass (Digitaria ischaemum). The other which is a larger plant is Digitaria sanguinale. They are annuals reproducing by seed only. Unfortunately, they produce an abundance of seed, therefore, most soils are infested with crabgrass seeds. The seeds may remain dormant in the soil for several years before germination takes place. Seeds usually germinate during the spring and early summer months although some may germinate later. In this area the first crabgrass seedlings usually make their appearance during May.

An ideal herbicide for the control of crabgrass in turfs must be sufficiently toxic to kill crabgrass seedlings that are present at the time of the application and have a residual effect so as to destroy seedlings as they appear after the treatment has been applied. It must also be non-injurious to the turf grasses. Many chemicals have been tried over a period of the last several years. More intensive work has been done recently. This work has not all been in vain as rather definite recommendations can now be made for the use of three materials-- phenyl mercuric acetate (PMA), potassium cyanate (KCNO) and sodium arsenite (NaAs).

Three experiments conducted on the Purdue University Golf Course during 1951 gave some interesting results. One included application of six materials. Three applications were made, the first on May 12 and repeat applications at intervals of approximately 14 days. Calcium trichloroacetate, however, was only applied once on May 12. The spray solutions were applied at the rate of 100 gallons per acre. Plant counts were made. The following table gives results in number of crabgrass plants found per square foot on dates when counts were made.

Chemical & Rates per acre	Plant Counts 6-20	7-31
Dinitro-Pre merge 1 lb. - Amine salt	25.1	111.0
CMU-3 (para-chlorophenyl-1-1 dimethyl-urea) 1 lb.	20.5	54.0
PMA-Phenyl mercury acetate 5 pts. of 10%	1.0	9.0
EH2-Dichloral urea 8 lbs.	0.3	28.0
N-1-Napthyl phthalmic acid 4 lbs.	98.2	167.0
CATCA-Calcium trichloroacetate 4 lbs.	9.5	45.0
Control	183.0	305.0

All materials used except naphthyl phthalmic acid gave promising results. Phenyl mercuric acetate produced the best results by keeping down crabgrass growth throughout the summer. Dichloral urea produced a good kill of crabgrass present at the time the application was made, but did not retard later growth.

In another experiment, eleven materials were applied according to the manufacturers recommendations. Treatments were applied on June 14, re-sprayed on June 27 and July 5, 1951. Water was used at the rate of 100 gallons per acre. Results were determined by plant counts made on July 15 and on August 20 and are reported in numbers of crabgrass plants per square foot. Readings to determine discoloration of turf grasses were made on June 18, June 22 and July 1. An index of 4 was considered as severe burn. The turf grass was mainly Kentucky bluegrass.

Material	Rate Per acre	Plant Counts 7-16	8-20	Discoloration 6-18	6-72	7-1
Cleary 10% PMA	7 pts.	0.2	0.5	1.3	0.5	1.0
Cleary PMA 140	13.5 pts.	63.1	88.4	1.7	0.8	1.2
Linck 10% PMA	8 pts.	1.6	16.3	2.0	1.0	1.5
Linck 13% PMA	8 pts.	0.9	5.4	2.0	1.3	1.8
Linck PMA 2% powder	220 lbs.	1.5	2.1	0.3	0.5	0.5
S1998 Boronium Flouride	60 lbs.	56.7	91.1	2.7	1.7	1.7
S1840 Boronium Flouride	35 lbs.	53.2	63.1	2.0	1.8	1.2
Standard Oil	80 gal.	109.9	228.6	1.0	0.2	1.3
Potassium cyanate	8 lbs.	24.3	28.0	1.0	0.2	1.3
Sodium arsenite	1 lb.	51.7	107.5	1.7	0.2	0.7
Dow Selective (Dinitro)	1 lb.	67.4	106.7	1.0	0.0	0.3
N-1-Naphthyl Phthalmic acid	4 lbs.	58.3	63.9	1.0	0.0	0.7
Control		168.0	273.0	0.0	0.0	0.0

Phenyl mercuric acetate again proved to be the most promising material. Results varied somewhat with the types of materials used.

A third experiment was done in cooperation with the U.S. Golf Association. Three materials were used--potassium cyanate, phenyl mercuric acetate and sodium arsenite. PMA was applied at the rate of 5 pints of 10% PMA per acre. Potassium cyanate was applied at 8 pounds per acre and sodium arsenite at 1 pound per acre. One hundred gallons of water per acre was used. A wetting agent was added. Igepon AP extra concentrate .025% by volume. Three treatments were made (1) Spring, (2) Late Summer and (3) Spring and late summer combination.

Results of spring treatment, May 28, on crabgrass--Materials and plant counts on dates indicated.

Treatment	Average Plant Count 6/25	7/31
PMA	0.2	5.5
KCNO	8.3	50.5
NaAs	74.9	185.0
Control	186.6	258.0

Results of summer treatment, Aug. 13, on crabgrass--Materials and plant counts on dates indicated.

Material	Average Plant Count 9/12
PMA	2.5
KCNO	6.7
NaAs	10.7
Control	20.7

Results of these trials show the importance of early treatments when using PMA. This is also true of KCNO, however, it is apparently more toxic to crabgrass than PMA and, therefore, may be preferred to PMA where treatments are delayed until the crabgrass is well established. Although NaAs did not maintain the desired kill of crabgrass, it reduced the stand. Being an inexpensive material, its use may be practical for extensive areas.

Recommendations for Control

Results with (1) phenyl mercuric acetate (PMA) and (2) potassium cyanate (KCNO) for the eradication of crabgrass have been sufficiently good to recommend them. Their use may be limited to treating small areas because of the high cost of the materials. PMA (a 10% material) should be used at the rate of 2½ ounces in 2 gallons of water per 1000 square feet or on an acre basis, approximately 7 pints per acre in 100 gallons of water. Three treatments should be made-- the first as crabgrass emerges, the resprayes at 10 day or more intervals.

KCNO is apparently more effective than PMA as a contact spray on established plants but has no residual effect in the soil. When using a 55% material, 5½ ounces in 2 gallons of water is used per 1000 square feet. A teaspoonful of "Dreft" or other household detergent added to the solution should increase the efficiency of KCNO. Eight pounds of KCNO in 100 gallons of water is sufficient to cover one acre. Applications, usually three in number, should be repeated at 8 to 10 day intervals. KCNO is non-toxic and should not be confused with potassium cyanide (KCN), a deadly poison.

Since both PMA and KCNO are expensive, cost may prohibit their use on large acreages. Sodium arsenite (NaAs) will give some measure of control when applied at the rate of 1 pound in 100 gallons of water per acre. Three applications made 10-14 days apart are usually required. Applications should be continued until no further crabgrass emerges. It is most effective when applied under dry conditions. NaAs is very effective for repeated burning of turf areas prior to renovation and reseeding. Caution - NaAs is a poisonous material and must be handled with care.

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SHRUBS - SELECTING AND PRUNING

H. W. Gilbert
Department of Horticulture
Purdue University

The shrub problem on golf courses, school grounds, parks and home grounds where shrub plantings are established is largely twofold. They either need periodic attention by pruning, according to their habits and

environment in order to make them most useful, or they may need to be transplanted to new locations or otherwise removed and replaced with appropriate plants. Unfortunately, the latter can be observed in too many instances.

The general requirements of hardiness and freedom from insect pests and diseases, in order to reduce maintenance, are the same in all of the above classifications. However, it may not be possible to get the variety desired at a local nursery.

The selection of shrubs having the above requirements should be based primarily on their use. The more common uses are for backgrounds, screens or windbreaks, enclosure effects and for foundation plantings. In general, the collective effect should be informal or naturalistic with the possible exception of foundation plantings and hedges.

The best way to reduce pruning problems to the minimum is to select, arrange and space the shrubs according to a pre-determined planting plan.

In doing good design, one should be concerned with the characteristics and ornamental values of the shrubs. The pattern in flower, fruit, fall color and winter effect shall be designed to attain a unified mass effect when mature. Shrub species will thus be used in varying sized groups predominantly, rather than every plant in the mass or bed being of a different specie. The selection and space requirement thus become a matter of design, requiring knowledge of plant characteristics. In informal and naturalistic plantings, shrubs will usually be spaced a distance of about 3/4 of the plant at maturity, or nearby the distance of a mature shrub.

It is well to plan informal plantings based on the general principle that good shrubs are most beautiful when permitted to develop their characteristic proportions and habits and to reduce interference with their normal habits by means of pruning to a minimum. When repressive pruning is necessary, it is an admission of misjudging the character of the shrub in the original planning.

Helpful bulletins on ornamental shrubs are available from your State Extension Service. Space does not permit a long list of desirable shrubs, but it is difficult to imagine a shrub planting of any size without considering the merits of the variety of Viburnums, Euonymus, Privets, Dogwoods, Cotoneasters and, in some instances, the Honeysuckles and Sumacs.

One or more of the following reasons may be causes for pruning.

1. To maintain plant vigor. (Take out oldest branches periodically - frequency may be one, two or three years, depending on plant and conditions.)

2. To remove dead, injured, diseased or insect infested wood.

3. To balance top growth with the root system at transplanting time.

4. To control the form of the shrub.

5. To obtain highest performance of bloom and fruit.

6. To rejuvenate old and unsightly shrubs.

Avoid these pruning habits:

1. Late fall pruning that leaves a dehorned appearance in winter.

2. Do not prune early spring blooming shrubs until soon after bloom, except in cases that show extreme neglect.

3. Do not prune good shrubs too severely at any time. When shrubs become old and ugly, it is often best to cut them at the ground line.

4. Do not cut back strong growth at the top only. This will destroy its natural form.

5. Do not prune all shoots to the same height for you do not want the effect of an inverted broom.

6. Heavy pruning of ornamental fruited sorts. Prune these moderately before and after bloom.

Except at planting time, spading shrub beds is a waste of money and energy. Shrub beds should be mulched at planting time for a distance about equal to the ultimate spread of the shrubbery after spading. This makes mowing easier without damaging the lower shoots. The decay of a mulch approaches a natural environment. Usually, in established shrub beds where spading is practiced, it indicates either a poor selection and arrangement, or poor pruning has been practiced. A planting faced down toward the ground with branches is not suggestive to climbing inside to do the spading.

In some instances, ground cover plants may be a way to attain better appearances.

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PLANTING LARGE LAWN AREAS

Harold Bohling
Bohling Nursery and Landscape Service
Munster, Indiana

It is indeed a pleasure to be on your program here at Purdue. I believe meetings of this nature are beneficial to groups having similar interests. When Dr. Daniel asked me to appear on your program, I hesitated as my only qualifications for addressing a group of turf men is my own experiences in the field of landscaping. Being in this field, we are called on in the course of a year to install approximately 50 acres of lawns. These lawns are installed on private homes, schools, churches and industries. In doing this type of work, we are confronted with many problems of soils care the lawns will receive after being planted and the cost of putting in large lawns.

There are many things expected of a commercial landscape firm when it is given a job of installing a lawn. First, the customer expects to have a beautiful properly installed lawn in a short period of time. He expects to pay a reasonable price for this service. He is not greatly interested in the problems that might face you in the matter of soil preparation, soil on the site, seed selection and difficulties that might be expected in the installation. In other words, he is only interested in getting a good turf.

In northern Indiana, we have many types of soils ranging from black sands to heavy clays. In most of our work we are required to work with the soils on the site and new top soil is brought in only to reach required grades or when there is nothing but yellow sand on the site. This necessitates us to vary our seed mixtures to suit the soils we are working with. On sandy soils we use a mixture containing approximately 50% Kentucky blue, 25% creeping red fescue, 10-15% red top, 10-15% common rye. On heavier soils we increase the bluegrass and decrease the fescue. In certain instances we have increased the common rye to above 15% depending on what facilities are present for maintaining the turf.

The question of the use of common rye is a much debated point and I will attempt to say something in its defense. We all know that it is vigorous and can become a problem by its competition to slower growing grasses. The quick growth that rye offers is an asset to the germination of the slower seeds. It shades the soil and helps maintain a moist condition favorable to the germination of the other seeds. This is important on large areas because it is difficult to properly water large seeded areas. It has another effect-- a physiological effect on the customer. He is seeing grass grow and is more likely to keep watering faithfully. It has been our experience that when a lawn is seeded with grasses germinating in 14 to 21 days, a customer will water faithfully for a week and if he sees no results, he will generally relax his efforts. If weather is hot and windy at this time, this will generally mean trouble. It has been of interest in the past few years to listen to customers complain about popular brands of seeds. These complaints are most frequent to seed blends that contain no nurse grass. I think a mistake is being made by seedmen in removing nurse grasses as people in general do not know how to handle blends without them. Ryegrass, being of a temporary nature, is generally out of a lawn in the second year and the permanent grasses are well established.

The actual installation of a large lawn is a simple matter. We use Ford equipment and do all operations by means of equipment. We have one tractor equipped with a Wagner lift and the other tractors are regular units. The lift equipped tractor is used for leveling and spreading top soil. With a good operator, this tractor can spread and level approximately 800 to 1000 yards of dirt per day. After leveling, fertilizer is applied at the rate of 30 to 50 pounds per 1000 square feet and then worked into the ground. After disking, the final grade is completed and seed is sown at the rate of 5 pounds per 1000 square feet. We use an "Easy-Flow" spreader for both fertilizing and seeding. After seeding we use a converted corn weeder to rake the seed into the soil. Rolling is also done with a tractor. A "Brillion Seeder" has tremendous possibilities for large lawn areas. This piece of equipment with its culti-packer is very useful for rolling grounds where washing might be a problem. The cordoroy surface left by the culti-packer is very good in preventing washing. The actual use of various types of equipment depends to a large extent on the types of conditions under which you are working. With this Ford equipment with its three-point hook-up, we are able to do lawns as small as 5000 square feet mechani-

cally. By using a combination of 2 tractors, it is possible to install a 10 acre lawn in a day. It has been our experience that it is a lot easier to install a lawn of 20,000 square feet and over than the one of 10,000 square feet or less.

After a lawn is installed, we instruct the owner to start watering and never let the top surface dry out. The first mowing is recommended when the lawn is about 3" and we recommend that it never be cut lower than 2". If these practices are followed, weeds and crabgrass have never been a problem. The cost of installing a large lawn will vary according to the amount of ground preparation necessary and the ability of the landscape firm to secure the maximum benefits from their equipment. The cost of seed and fertilizer per square foot can easily be computed, but I do not see how other costs, labor and equipment, can be standardized to be able to give the cost beforehand on a set per square foot basis.

One of the greatest potentials that we have is the encouragement of large industrial lawns. I also believe that it is a moral responsibility of the landscape contractor to install these lawns so as not to become a major maintenance problem. The selection of seed, the instructions to the company, the actual installations and the cost are our individual problems.

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ESTABLISHING GRASS SEEDINGS

C. M. Harrison
Farm Crops Department
Michigan State College

Grasses, as a group of plants, are widely divergent in their adaptation to variations in soil, climate and use. World-wide in their distribution, they are classified under 510 different genera of which 159 genera represented by 1100 species are found growing in the continental United States.

With the wide array of species available for use in establishing grass cover, certain factors and practices must be kept in mind.

Adaptation

First, the grass or grasses selected must be adapted

to the use to which the area is to be put. Certain characteristics merit special consideration when selecting a grass or grasses for airfields, highways, parks, lawns, golf courses, skating rinks, playgrounds and other recreational areas. Likewise, the grasses selected should be adapted to the conditions of soil and climate to which they will be subjected.

When the characteristics of grasses in their natural habitat are known, it is quite frequently possible, by means of soil changes, disease control and artificial watering, to grow grasses that would otherwise be unadapted. Knowing the natural habitat and range of desirable grasses frequently prevents failure in attempts at establishment on unadapted sites. Bentgrass used on the green of a golf course is an example of a grass maintained through disease control, artificial watering, weeding and various other treatments. Bermudagrass is outside its natural range in the northern states as is chewings fescue in most of the southern states. Bluegrass fails under an ice rank or long periods of flooding whereas red top and its relatives survive.

Seeding Time

Once the grass has been selected as adapted to its intended use, soil and climate, the next important factor in successful establishment is that of time of seeding. Grass seedings are frequently made without proper soil and seedbed preparation, which needs attention. Also the grass seed is quite generally sown with little regard to periods or type of rainfall, the advent of hot dry weather, competition from annual weeds or low freezing temperatures, all of which affect proper establishment.

The spring season in the midwest is marked by a thunderstorm type of rainfall which is heavy, but it diminishes in June and frequently fails for long periods in July and August. Grass seedings made in late spring, during May, must meet competition from a large number of seedlings of summer annual weeds, and at the same time, get well enough established to withstand periods of limited rainfall and high temperatures. Late summer seedings, made from August 10 to September 1 frequently in dry soil do not have the summer annual weeds to compete with, temperatures are going down rather than up and rainfall is of a type less intense but covering longer periods of time. Grass thrives under cool temperatures and well distributed moisture, much more likely to be prevalent in late summer and early fall than during late spring and early summer.

If sown before September 1, most grasses will become sufficiently well established to withstand the low temperatures of late fall and winter. September seedings are frequently killed by freezing while still in the seedling stage and it is usually difficult to make seedings during periods of continuous rainfall. Consequently, seedings should be made prior to the advent of fall rains or as a second choice, before May 1 in the spring.

Seeding Rate

Rate of seeding has been over-emphasized as a means of securing cover and heavy rates are advised to overcome shortcomings in proper distribution, seedbed preparation, time of sowing and other unfavorable cultural practices. Seedings as low as 15 pounds per acre made at the proper time with good cultural practices and distribution have been much more successful than 150 pounds sown at improper times. Furthermore, heavy rates of seeding frequently fail of successful establishment regardless of time of sowing due to the excessive competition from too many seedlings in too small an area. Low rates of seeding generally make a poor initial appearance in comparison to heavier rates but this initial advantage is of short duration. Unfortunately, tradition calls for almost immediate and complete ground cover rather than successful establishment after the seedling phase is over. Following similar practices by excessive seeding rates with corn and the cereal grasses would result in almost complete failure of crop production due to extreme competition between seedlings. The fields would be much greener in the initial stages of growth than they now appear but the results obtained at harvest time would be far from satisfactory. In addition to rate of seeding, it should be pointed out that grass seeds are small and are supplied with a minimum of stored food. As a consequence, the seed should be planted at or near the surface on a well firmed seedbed so that the young plants may start active growth soon after germination. Most plant roots are admirably suited anatomically to push their way into soil whereas the stem and leaves have difficulty in pushing aside a heavy layer of soil covering, prior to emergence.

Grass Mixtures

Frequently in sowing grasses on a given area, the question arises as to what seeds should be included in a proper mixture. Under certain conditions, mixtures are desirable particularly where soil fertility and structure and drainage vary considerably over the

area. Too frequently, however, mixtures are advised where proper knowledge as to species adaptation is not known or such information is unobtainable. When a particular grass is desired to the exclusion of others it is best to make conditions for the one species as nearly ideal as possible and refrain from mixtures which will add to the difficulties of establishing the desired species. Complete establishment of an undesirable grass in the mixture and the complete exclusion of the grass wanted has frequently resulted. Grasses included in a mixture for the purpose of securing quick initial cover may occasionally be desired but the desired species will be slower in establishment because of the competition from the quicker growing so-called nurse grasses.

Maintenance

Once the grass is established, maintenance practices should be adopted such as mowing, fertilizing and watering which will allow the best turf condition for that particular use. Frequent and close removal of top growth may result in destroying the grass after establishment. Set the mowers as high as the conditions of use will permit and keep them up all during the growing season. This practice will make for a tougher sod with deeper roots and capable of withstanding harder use. Close cutting allows for more weed competition with the grasses less able to withstand the competition. Maintenance of grass cover under intense traffic by people or machines is always difficult and no grass can withstand this pressure over extended periods of time. Popular awareness of this fact on the part of the public would do much to alleviate many of the difficult problems confronting the grass maintenance crews of highways, airfields, parks, golf courses, football fields and other recreational areas subjected to intense abuse. In certain cases, the only answers available at present are to either gravel or hard surface the area or remove the traffic.

In conclusion, it might be pointed out that more care in the selection of grasses for particular uses and sites coupled with a knowledge of the principles of grass growth will do much more than following tradition in the successful establishment of grass seedings.

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THE TURF PROGRAM AT UPJOHNS

Carol Lawrence
Landscape Architect
The Upjohn Company

The way we have achieved our landscape results, I am sure, is quite similar to those of other firms. I feel honored, indeed, to be asked to present this account of the turf program at Upjohns.

In 1944 the Company was forced to make plans for expansion of their manufacturing facilities. It was a decision between expanding in an already crowded city location or to undertake the tremendous job of moving to a country site. After thorough investigation, it was decided to follow the trend of so many industries, that is, decentralization. After a new location was found, about six miles south of Kalamazoo, and sufficient land acquired (1,600 acres), the Austin Company was engaged to design and build a new modern plant.

Construction started on the Antibiotic Building in the spring of 1946, about the same time I started drawing the landscape plans. Three years later the Upjohn Company's "Grounds Department" was organized. The 8 or 10 men in this department have been responsible for most of the actual work which went into the finished grading, the seeding of turf areas and the planting of more than six carloads of trees and shrubs.

When the green light was given us to proceed with this work, the general layout of roads, parking lots and lawn areas had already been determined. The underground sprinkling system pipes were in and the Austin Company had most of the subgrades finished and ready for the final preparation of areas and application of topsoil. A Ford tractor, a disk, a spike-tooth harrow and a Rototiller were purchased and it wasn't long before the first acre or two of land had been seeded. About five acres were planted that first spring and it was the end of June before the last piece was in. Consequently, the coverage was more crabgrass than anything else. The seed used for the first section was purchased locally and the mixture was:

38% Kentucky bluegrass
40% Creeping Red Fescue
15% Red top
7% Inert Matter

Fertilizer used was Vigero and Milorganite. The subsoil under this entire project is composed of coarse

sand and gravel. Six inches of topsoil was used and both the existing soil and that which we purchased had a very low content of organic matter and it was also low in fertility. Therefore, until the sod thickens and organic matter is increased, most of the water now applied drains very rapidly through into the subsoil. The sprinklers are installed on 75' centers and even though overlapping was allowed for complete coverage, it is seldom attained due to wind conditions or water pressure variance. Fortunately an ample supply of water is always available for watering lawns because great quantities are used in the plant for air conditioning and other cooling processes. This goes into the storm sewers and later is pumped into the irrigation system as required.

Experience gained from putting in this first five acres indicated it was a mistake to use the Rototiller in the preparation of the final seedbed. This piece of lawn was so soft and porous it was impossible to get on it for watering or for any other purpose without damaging it. Even a dog would leave tracks. The plank float used was replaced by an improvised grader which we made from two parallel 2" x 10"s, 10' long and 8' wide. Two of the three cross-members, also 2" x 10"s are on an angle, while the center plank is in a vertical position. This piece of equipment, although heavy and clumsy, proved to be very useful and saved many hours of hand labor. During the summer of 1949 more equipment was assembled and preparations proceeded as rapidly as possible to complete the 12 or 15 acres in front of the main manufacturing building. Striving to obtain the best lawns possible, we decided to follow a complete "Scotts" program and found their organization cooperative and helpful. The mixture they recommended was:

65% Kentucky bluegrass
20% Poa Trivialis
10% Highland Bent
5% White Dutch Clover

This produced excellent results and has been used on all lawn areas since. However, in areas where it is impossible to water, such as the driving range, ball fields and those sections which cannot yet be considered permanent lawns, Scotts recommended and furnished an inexpensive seed mix consisting of 30% each of creeping red fescue, Alta fescue and perennial ryegrass and 10% Alsike clover. This too has proven satisfactory for those areas and we always keep a supply of both kinds of grass seed mix on hand. Last July a 15,000 square foot practice putting green was opened. It was built the previous fall according to the best

advice and instructions available. Washington strain bent plugs were purchased from a local golf course that was using a "Nite crawler" over their greens. Results have been reasonably satisfactory and we are hoping to have a more popular recreational spot there this year. There are now approximately 40 acres in lawns around the plant and with a growing and expanding industry, there are always changes being made that keep our Grounds Department constantly on the jump.

The Company is convinced that well-designed and well-kept landscaped grounds produce many benefits. Happy employees do better work, property values are increased and community pride expanded. There are no "Keep Off The Grass" signs!

The slides, I hope, will give you a clearer picture of the "Turf Program at Upjohns".

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YARD PARKS PROGRAM IN INDIANAPOLIS

R. B. Duke
Landscape Supervisor of Indianapolis
Indiana Plant, Western Electric

A few years ago John Gunther, a writer of considerable repute, included Indianapolis in his series of cities of the United States which was appearing in a well-known weekly magazine. His remarks were derogatory in the extreme. In effect Gunther branded Indianapolis a dirty community.

This was the spark that started what is now known as Yard Parks. Several civic minded people joined hands with the Indianapolis Star, the Indianapolis Chamber of Commerce, and the city administration to promote this idea and I quote,

> "The objective of Yard Parks is to inspire and to nurture the active interest of all the people of Indianapolis in the beautification and improvement of all property and alleys. In the case of dwelling places, it is particularly desired to make people aware of the possibilities of making full use of their home lots by living outdoors in the privacy of their back yards during favorable seasons.

> Further, it is desired to inspire not only the attainment of the objective of cleanup and beautification, but also to instill in all of our people the resolve to maintain all such improvements once they are accomplished."

Responsibility for the program rested on an 18-member Executive Committee with Mrs. B. Lynn Adams as Executive Director, and a 33-member auxiliary committee headed by Noble P. Hollister, of the City Planning Commission, to furnish the technical knowledge.

The first project was a model back yard in University Square followed by a permanent exhibit in Union Station as part of the Industrial Exhibition. Residents of a block of new homes, with help from the Technical Committee, united in developing the entire block. Flower seeds were distributed to school children. Awards are given for the best annual improvement in individual back yards. Exhibits are placed in the Hobby Show, the State Fair and the Dairy Exposition. All seven high schools include a six week's "Yard Beautiful" course in their regular Botany and Biology courses. Another model Back Yard was installed at the Hillsdale Nursery in conjunction with their annual Rose festival. Several areas populated primarily with colored folks were given help and results were quite satisfactory. The Indianapolis Star gave away 10,000 pine trees to the first 2,000 people to call at the office. The supply was exhausted in two hours time. The Star was, and continues to be, responsible for a tremendous amount of newspaper publicity which helps immeasurably to focus attention on the entire program. This spring will see the program enlarged to cover apartment owners and dwellers.

In the fall of 1951, Yard Parks created an Industrial Division with the aid of Mrs. Adams, Mr. Hollister, Mr. E. E. Martin of the J. I. Holcomb Company and Judge Saul Rabb. My boss, Norman Conrad, was selected as chairman of the group.

Letters were sent to all large and small industries in the town, from which representatives of the engineering, maintenance or public relation groups were chosen to represent their firms. The early meetings were of an organizational nature with the first serious meeting in December. Meetings are held monthly with the Speaker an expert on some phase of the big problem of making our factories more attractive. Men such as Arthur Lindberg, Superintendent of Buildings & Grounds

at Butler University and Dr. Daniel from Purdue are speaking to the group.

Usually the meeting will include time for an informal question and answer period. Discussions are somewhat technical and increasing interest has been shown. From the discussions, one of the biggest problems confronting most industries is how to develop and maintain a good turf. All of the firms feel that good grass is the one most important item and certainly the starting point of their beautification program. The program committee is paying considerable attention to proper timing of the subject in order to achieve maximum benefit from the topic selected. Most of the meetings become a technical workshop for exchange of information and ideas. It is too early to evaluate the effect of the program but all in attendance are enthusiastic and felt that much good will come from participation in the program.

As you can see, the Yards Parks program is ambitious and will reach, through some medium directly or indirectly, the majority of the citizens in the city. Again this spring an all-out and over-all campaign will be pushed to clean-up, paint-up and fix-up. Evidence of the effectiveness of the program may be slow in showing up and difficult to evaluate. However, I feel Indianapolis may well take pride in this program. Certainly it might be a model for other cities in the Middle West.

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PRACTICAL TREE CARE

Carl Fenner
Assistant Forester
Lansing, Michigan

The seven principal phases of shade tree selection and maintenance will be dealt with in chronological order, as follows: Species, good and bad; planting and care of young trees; mechanical injury and treatments; tree troubles due to abnormal environment; diseases and insects; removal of trees, and tree pruning practices.

Best Species for This Area

Before recommending what kinds of trees to plant we will show some colored slide photographs of seven species that are quite generally unsatisfactory for golf

course use. First, walnut and most other common nut trees-- too susceptible to chewing insect damage, therefore, too expensive to maintain. The other six-- moline, elm, sycamore, box elder, soft maple and chinese elm each qualify as "weed" trees by being either too likely to litter turf with debris or are soft wooded trees.

The varieties we prefer, because of cleaner habits and greater life span, are American elm, hackberry, sassafras (where it grows naturally-- being difficult to transplant), sweet gum, black maple, Norway maple and sugar maple. In addition to these "regulars" we love to see, in their proper setting, such upright or columnar types as upright bolleana poplar, upright Norway maple and upright English oak.

Outline of Planting Practices

Ten photos covering this phase were shown to illustrate various steps. We believe it best to select trees grown in commercial tree nurseries because the more condensed root systems transplant easier. At planting time for trees with bare roots, all of the large branches are usually pruned off back to the main stem and all the small branches left on to grow out to form a new top or "head" of the tree. Trees over three inches in diameter should be "moved" with large ball of soil. In the planting hole the top soil should be worked in among the roots and the hole filled with the soil that was left. All maple and elm trunks should be wrapped with heavy paper for two years to prevent borer infestation. Watering newly set trees should be heavy, but infrequent-- once a month.

Repair of Mechanical Injuries

Trees sometimes injure themselves by allowing a near-surface root to encircle the trunk and strangle its life away. A thin or yellowing foliaged top coupled with a trunk that emerges from the ground without normal buttress are main clues.

Mechanical damage to bark by humans or machines should be repaired mainly by knifing off ragged edges, shallacking edges and painting all exposed wood. The "sunshade-- no paint" method can often be used if wound is shaded (not wrapped) before hit by sun rays. In all repair it is of importance to "point" both top and bottom ends of wound to facilitate healing.

V-shaped tree crotches should be strengthened with 3/4 inch bolts before splitting occurs. Wires, cables,

etc. should not be wrapped around tree trunks or branches.

Environmental Troubles

Most all varieties mentioned today live naturally in forest conditions where soil is not subjected to underdrainage, compaction, removal of forest floor decaying vegetation. Twelve photos shown illustrated the handicaps placed upon trees when placed under golf turf conditions. General symptons of this type of trouble are leaves that show partial drying of surface (a wilting or browning of those areas of leaf surface lying farthest from the veins or water system). Chlorosis, or food element deficiencies, also often occurs.

Recommendations to partially correct these types of tree troubles include (a) artificial fertilizing. (b) retention of leaves (by development of hammer mill type leaf picking machine), (c) research in supplementation of lacking food elements by addition to soil around root system of affected trees and by application of food elements to leaf surfaces.

Disease and Insect Angles

Some diseases are deadly-- therefore not to be treated to cure. An example is Dutch Elm Disease. However, when this disease is discovered (identification cannot be made in the field) the tree should be destroyed by burning to prevent spread to sound trees.

Other diseases, as "wetwood" and "wilt" can often be controlled, if not eradicated. Pruning and feeding of "wilt" trees is often practicable. Drainage of "wetwood" affected trees is nearly always feasible and easy to do.

Spraying for leaf eating insects is very effective and your own state agricultural experiment station can furnish you with very adequate bulletins describing insects and spray mixtures.

Removal of Dead or Unsafe Trees

Some kinds of trees, notably red oak and basswood, can appear perfectly healthy but be completely decayed inside and likely to fall. Tapping trunks lightly with a mallet will easily identify this heart-rot. There is no cure and the trees (and dead or nearly dead trees on the course) should be removed-- but in a safe manner. If near wires, fences or buildings they may have to be removed by "topping" or roping down one

branch at a time. Chain saws greatly facilitate felling, bucking and transportation of wood. Removal or partial removal of stumps still must be done by hand or mechanically-- no chemical method of value!

How to Prune

This activity ranks high in the golf man's tree care program-- so we have 16 photos showing right and wrong methods. There are many reasons for pruning. These, principally, are (1) to allow use of turf under branch spread, (2) shaping tree (or rather letting it take its natural shape or form), (3) clearing branches away from buildings, driveways and overhead wires, and (4) removal of dead limbs and branches. Avoidance of excessive root pruning for underground installations should be practiced. Removal of lower branches should be carefully planned in order to retain natural form, symmetry and beauty. Clipping of branch ends away from wires should be done as lightly as possible, therefore, more often in order not to whack off and disfigure the tree tops. In some cases water lines or tile runs can be tunneled under root systems of especially prized specimen trees. Suckers or water sprouts or "whiskers" on tree trunks should be left intact. Pruning to "shorten" or "lower" the tops of high trees always causes trouble through decayed end cuts in five to 15 years.

The removal of limbs should always be accomplished by first cutting the limb off a foot or two out from the trunk (to prevent tearing down into side of tree). Then the stub can be removed flush with the parent limb or trunk and painted. This flush cut method is the most important factor in proper wound healing with least damage to future life of the tree.

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NEW WATER LINES AT WESTWOOD COUNTRY CLUB

Stan Graves
Westwood Country Club
Rocky River, Ohio

Westwood Country Club is located on the west side of Cleveland in the village of Rocky River. The club property contains approximately 175 acres. The soil is of a heavy clay loam nature. The turf on the greens are of mixed bents. The fairways and tees have bent and Poa annua for turf. Water is piped to the course

through an 8-inch main from a street ¼ of a mile to the west of the golf course. The club house is supplied water from Detroit Road at the north entrance to the club. Water pressure at the point we tie into the 8-inch main that supplies the course is 110 to 120 pounds, when the water supply is normal.

Back in 1948 the club members began to realize that it would be necessary to replace the pipe of the water system, as leaks were beginning to appear. By the fall of 1950 the Board of Directors felt that new pipe must be installed as soon as possible as water line breaks were becoming more frequent. At a meeting in December 1950, the Directors voted to go ahead with the replacement of the old pipes with some kind of new pipe. A member of the club, Mr. E. W. Gray, who is an engineer, was appointed as a committee of one to act for the directors and to work with the Greens Chairman and the Superintendent in securing materials and installing new water pipe over the entire course.

It was decided to get clearance for installation, obtain the materials needed and contract the job so that installation could start in the fall of 1951. Permission was obtained from the government to replace our worn out pipe with materials not of a critical nature to the war effort. A country club has many thousands of dollars invested in their course turf and a great loss would result if the grass could not be watered.

Pipe selected for use was Johns Manville transite pipe for the 6, 4 and 3 inch sizes. This pipe is made up of an asbestos - cement material. For the smaller sizes to be used for the short runs to the tees and greens, a steel pipe in the 1½ inch size at a weight of 2.717 pounds per foot and 1¼ inch size at 2.272 pounds per foot was selected. A map of the course water system was studied. A few changes were made. The map was scaled for the estimated amount of pipe in the various sizes needed for the job. A listing was also made of the amount of cast iron connections that would be needed-- such as tees, 90 degree and 45 degree elbows, etc. Orders were then placed for September and October delivery of this material.

A contractor from a near-by town was selected, Mr. C. P. Gilgenbach. He was chosen on the strength of his past record on various types of construction work and in particular tiling and pipe work at the Cleveland Airport and the Westwood Club. Mr. Gilgenbach was to supply all equipment and labor to install the pipe. The only work to be done by the course crew was to

lift sod on the trench lines, unload delivered pipe from trucks, haul pipe to the trenches as needed, rake out top soil on trenched areas after being tramped into place and replacing of the sod. The course Superintendent was to stake out all pipe lines and mark location of snap valves. The Superintendent was also to work with the contractors general foreman on the overall installation.

Work started on October 6, 1951. Weather was good and the course not too wet. It was decided that it would be best to concentrate on laying pipe in the fairways only, so as to get as many of them done as possible before fall rains set in. The feeling was that the equipment would cut up the fairway turf if too wet. Fairways were worked on, leaving areas in the rough between fairways until later. If a heavy rain fell over night, the crew would work on the piping in the roughs on the following day as the ground was firmer where it had not been watered the past summer. This method also helped the contractor. About 1000 feet of pipe was laid on a good average days work. The man running the trencher would keep but a short way ahead of those laying the pipe. This prevented any cave-ins if a rain came up. Each night at quitting time all pipe was laid, trenches filled and dirt air tamped into place as far as trench had been dug that day. Equipment was placed in rough overnight. Course crew removed no more sod than would be trenched that day. After pipe was laid in place, soil was hand tamped around and under pipe so all pockets would be filled. Additional soil was then put in trench by tractor with draw board and was then air tamped. Remainder of dirt was then put in trench and air tamped. Top soil was added, raked out and sod replaced. Where larger pipe was used, some soil was loaded by trencher on to trucks and hauled away to location designated by the course Superintendent. When you place a 6-inch pipe into the ground, you do not get all the soil back in the trench.

By November 3 all fairways but two were finished. On that date we had an early snow. Rains followed the snow. Work was slowed up. It was December before all the trenches were dug and pipe laid. The pipe will be tested in the spring as soon as it is warm enough to safely put water into pipes. Main line pipes are 20 to 30 inches underground and will be drained each fall.

Valves for snap on sprinklers in the fairways were placed 90 feet apart over the 4 and 3 inch lines and 120 feet apart over the 6 inch pipes. A larger valve

and sprinkler will be used on the 6 inch lines as there will be more water available. Three gate valves have been placed on the 6 inch main line that loops the course. This gives us a chance to shut off various sections if trouble appears such as a leak in a pipe or connections. Valves were placed along side of greens as directed by the course Superintendent.

All drain tile lines were repaired wherever the trenches cut through them. Old water pipe was left in the ground. Most of the valves on the old lines were taken off and used on the new pipe. New valves were purchased to replace worn out ones.

The following amount of pipe was necessary to complete the job.

6 inch transite pipe		8186 feet
4 " " "		6205 "
3 " " "		5786 "
6 " steel pipe		500 "
1½ " " "		1340 "
1¼ " " "		3700 "
Total footage of pipe used		25717 feet

At the outset it was estimated that an expenditure of $45,000.00 would be necessary to do the job. It is estimated at this time that when final payment is made to the contractor following the testing of lines this spring the club will have spent approximately $52,000. Mr. Sterling N. Farmer, club president, states that the higher cost is due to a 10% increase in materials cost during the planning stages and the use of more material than first estimated. Contractor will gross nearly $28,000 while materials will cost the remaining $24,000.

It is my personal feeling that the successful and speedy installation of the new pipe at Westwood is due to careful early planning and the full cooperation between all persons engaged in its installation.

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1951 NATIONAL COOPERATIVE TURF FUNGICIDE TRIALS

Charles G. Wilson and Fred V. Grau
Extension Agronomist and Director, USGA Green Section
Beltsville, Maryland

The disease problem has been attacked in many ways since the USGA Green Section and the progressive golf course superintendents initiated a control program in 1925. Research pathologists with agricultural experiment stations and chemical manufacturers have developed effective fungicides and research agronomists and plant breeders have selected resistant grasses and developed intelligent management practices in an effort to control turf diseases.

Today it is known that good management is paramount if the fungicides we use are to perform to the best of their ability. Fertility levels, water management and drainage, aeration above and below the turf surface, mechanical damage and compaction, and the degree of mat formation have considerable bearing on the ability of a proven fungicide to prevent or cure an infection.

Cooperative fungicide testing, established in 1949, has been responsible for increased knowledge concerning the effectiveness of fungicides on a local as well as on a national scale. Results of these trials in the past have shown that cadmium compounds and mercury chlorides are most effective against dollarspot and copperspot; mercury chlorides and Tersan adequately control brownpatch; and mercury chlorides are effective against snowmold. In addition it has been noted that Cohansey and Arlington bent are highly resistant to brownpatch, Elk 16, Arlington, Congressional, Highland and Velvet bents were least susceptible to dollarspot; and Congressional bent was highly resistant to snowmold.

Results of the cooperative testing in 1951 again indicate that the trends remain the same with regard to our most effective turf fungicides. The following charts contain the tabulated results from the cooperators.

NATIONAL COOPERATIVE TURF FUNGICIDE TRIALS

Dollarspot in 1951
(Seasonal Average*)

Treatment**	Calif.	Iowa	Mich.	Rhode Island	Spring Mill C.C. Philadelphia, Pa.
Check	127.9	3.1	130.2	21.0	586.0
Cadminate	2.93	0.2	0.07	0.0	26.0
Calo-Clor	20.07	0.29	0.47	0.0	371.0
Crag 531		0.14	0.63	0.0	83.0
C & C 1025	20.3	0.29	0.0		135.0
Puraturf 177	22.8	0.31			24.0
Puraturf GG		0.58			
Actidione			0.23	0.13	
M 258 T		0.52			
Calo-clor & Vancide				0.0	
Calo-Cure	41.13	0.44	1.8	1.7	253.0
Vancide				3.7	251.0
PMAS	18.6	2.11			235.0
Tat-C-Lect			3.97		
Puraturf		2.55			
Tersan 75		1.81	5.07	5.8	
Special Semesan			5.9		
Orthocide 406	68.53			32.1	519.0
Shell X P50					368.0

* Variance in figures due to method of recording. Calif. and Mich. recorded the actual number of dollarspots; Rhode Island the % area grade; Iowa used a 0-5 classification with 5 indicating a general infection; and Philadelphia recorded the average number per 100 square feet.

** In accordance with the manufacturers recommendations.

NATIONAL COOPERATIVE TURF FUNGICIDE TRIALS

Brownpatch and Copperspot
Rutgers, 1951

Treatment*	Brownpatch %	Copperspot #
Check	19.1	39.4
Calo-Clor	0.0	7.2
Calo-Cure	0.1	2.2
Tersan & Calo-Clor (1-oz. of each per 1,000 square feet)	0.3	1.0
Orthocide 406	5.8	26.8
Cadminate	5.8	0.2
Puraturf	10.0	3.8
Puraturf 177	15.1	0.8
PMAS	10.9	1.6
Crag 531	14.5	2.6
C & C 1182	11.4	32.6
C & C 1207	12.5	48.0
Tersan 75	17.0	16.8

* In accordance with the manufacturers recommendations unless otherwise specified.

In comparing the materials it will be noted that organic and inorganic cadmium compounds, and the mercury chlorides gave the best control of dollarspot. Actidione showed promise at Michigan and Rhode Island, although Rhode Island reported that with the advent of cool weather, a uniformly off-color yellow cast developed on the plots where Actidione was used.

Investigations at Rutgers showed that the mercury chlorides gave the best control of brownpatch with a slight discoloration on the bentgrass during mid-summer. Tersan, when used alone, gave poor control, but when used with Calo-clor, control of brownpatch was excellent with no turf injury. Calo-Cure, which was easier (no discoloration) on the bentgrass, also shows promise for the control of brownpatch. Rutgers also reported that "with all applications rates of Milorganite the brownpatch was less than with the 8-6-4 fertilizer on both Colonial and Seaside bents".

As in the past, cadmium compounds and mercury were effective in controlling copperspot.

The Green Section believes that our knowledge of turf diseases is sufficient to suggest management practices which may prove helpful to superintendents. Not all of the cooperators are in complete agreement concern-

ing the suggested management practices which indicates that considerable work remains to be done in the years ahead. Only those fungicides which have stood the test of time are listed under chemical control.

Disease	Fungicide	Nitrogen
Dollarspot	1. Cadmium Compounds (Cadminate, Crag 531, Puraturf 177)	Adequate feeding up to 1½ # of actual nitrogen per 1000 sq. ft. per month of growing season.
	2. Mercury Chlorides (Calo-Clor)	
Brownpatch	1. Mercury Chlorides	Organic source may lessen severity of an attack.
	2. Cadmium compounds in dollarspot weather, Tersan Calo-clor combiation in brownpatch weather.	Bulk of nitrogen applied in cool weather. Total same as for dollarspot.
Dual Season Dollarspot-Brownpatch	1. Mercury Chlorides	Overall feeding same as for dollarspot
	2. Cadmium in dollarspot weather, Tersan-Calo-Clor combination in brownpatch weather.	Bulk of nitrogen applied in dollarspot weather, turf allowed to become slightly nitrogen hungry in brownpatch weather.
Copperspot	1. Cadmium Compounds	Insufficient information.
Snowmold	1. Mercury Chlorides	Avoid heavy nitrogen feeding as cool weather approaches.

Failure to obtain disease control with these proven fungicides indicates that cultural requirements may beat investigation. Freedom from mat; adequate fertility level; intelligent water management and good drainage; regular close mowing; aeration, brushing and raking, good surface air circulation; and the use of improved bentgrasses contribute to economical and effective disease control.

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NEW MATERIALS AND THE COMMERCIAL DEALER

Paul E. Burdett
P. E. Burdett Company
Lombard, Illinois

Since the war we have seen a tremendous pick-up in the number of new materials available to the turf superintendent, and new uses for old materials to the end that many of the old jobs now seem to be done with miraculous ease and at ridiculously low costs. The beautiful dandelion, the narrow and broad leaved plantain that in the late 30's and early 40's were partly controlled by drastic practices and resulted in burned fairways and shocked golfers, are now so delicately removed that members are hardly aware of their passing and at costs that run in fractions of the cost of the old time methods. Refinement in fairways has become so inexpensive and easy that now even the worm casts in fairways are being removed and result in greater pleasure for the golfer and a thickening of the turf for greater beauty. There are, however, many problems unsolved and as each one is solved, the one of next importance steps into the stage center to hold its place and become the focus of attention. I believe that at this time the easy control of chickweed, the control or ability to live with Poa annua are the next fortresses that will fall. As we know, these problems are being attacked from many angles and it is logical to assume that these problems will be solved in the near future.

The great rapidity of new developments naturally has posed some problems for the dealer for I find that the materials we offered for weed control have largely disappeared from our lists and are replaced by items that did not exist 7 years ago.

The area I serve--the Midwest and the Chicago District--is a progressive district and our superintendents have reached a high level of golf course maintenance. Yearly the attendance of Midwest members here and on the national level grows and since these are the places where new materials and practices are freely discussed, our customers are well informed. I often learn of the characteristics of a new product from a superintendent rather than the manufacturer. In a definite effort to be well informed, I personally attend as many meetings at different universities as possible during each year. Serving the Chicago Metropolitan area in which many of the chemical companies maintain headquarters and stocks of the newer materi-

als, our problems of supply have not been great. Supplies of materials, new and standard, from the larger companies are usually available and it is possible to quickly get the latest information from their research departments by teletype if that information is not available in the Chicago office. I find that other fields of Horticulture, based on high soil fertility, have similar problems and that helpful information can often come from that direction. I believe that I will try to pay more attention to those fields for it looks to me as though the same type of a day that brings scab to an orchard and leafspot to a tomato field is the kind of day that brings dollarspot to our greens. I think the weather that brings late blight to tomato fields is the same kind that brings big brownpatch to the course. There is probably 100 times more money spent in scientific disease observation of canners tomato fields and apple trees in Illinois than is being spent in scientific observation of turf problems. Some things that have been found good in these fields should be applicable to our field also.

I am on the conservative side and have urged the use of new materials first on a trial basis. However, sometimes the need of using new materials on a more than experimental basis to solve a problem where the pressure from the golfing memberships seems unbearable has resulted in very quick acceptance of newer materials and methods. The use of 2,4,5-T for clover control gained much impetus because clover got out of hand on several fairways in the district. 2,4,5-T proved to be effective the first fall it was used on a wide scale and was far less expensive than older methods. The Midwest Association publishes a little paper or magazine called "The Bull Sheet" and the editors of this sheet have made its columns available for the discussion of members experiences with the new materials. It is felt by the editor that a record of the use of new materials showing the time of application, condition of the soil, condition of the weather and of all the factors that might affect the result during and after the application, the rate and type or method of application and the evaluation of the results by the user could be an important contribution to the general knowledge of the men of the district. In the past year or so the "Bull Sheet" has contained a discussion of the use of 2,4,5-T for clover control, of Chlordane for the control of worms in greens and fairways and usually has a discussion of a new material and its possibilities.

The last issue reported a talk by C. E. Arnold of the Department of Horticulture of the University of Illi-

nois on Krilium. We hope to be able to know what this material will accomplish for us under actual playing conditions on greens after a Saturday evening rainfall followed by 400 rounds of Sunday golf. So far we have received stories of its use only in non-traffic areas. It is quite possible that the "Bull Sheet" serves in keeping well informed those who cannot attend the short courses and meetings.

Throughout our district almost every superintendent has a new seed under trial-- a bent selection that has been under observation for years, a new material under trial examination, an easier method of doing an old job-- and within the district we can watch a test of almost every new thing. The advantage of these projects is that they are being conducted under the actual conditions that exist in the playing area, in the weather that is usual in the territory of its ultimate use. It is possible to find a tee partly of Merion blue and partly of Astoria bent and another containing Merion and regular bluegrass. One of our men has a three year old planting of C-115 and Zoysia, and U-3 bermuda is still struggling along on another of our courses, and all the new materials are on trial in one place or another. The "Bull Sheet" has played a part in reporting these activities to the membership.

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ONE DEALER'S PROBLEMS

A. S. Baker
A. S. Baker Equipment Company
Dayton, Ohio

First of all EXPERIENCE, when supplemented with the teachings of others, is the key to the maximum accomplishment. Over in Dayton, we used to see painted on the outside walls of one of our larger industrial buildings such phrases as "We are a part of all we have met". And to the cub salesman in training one would say, "Remember in receiving a complaint the customer is nearly always right".

This brings us to the point - When a club, a client or a superintendent is sold some material in good faith, some material from a reputable house which spent a lot of effort, time and money to prove itself and the product only to learn that under your local conditions it does not work to your degree of expectancy, what should one do? How shall we compromise and adjust for this seeming failure?

As a definite experience, prior to about 1950, most greenkeepers relied upon just one or two materials in combination, 2/3 mercury and 1/3 Calomel. We would try to control all fungi attacks in one broad phrase, calling it "little and big brownpatch".

Most of the older greenkeepers will recall the extreme hazard and injury when making the application of this material, the burning of the grasses and the risk involved when the material came in bodily contact. I like to recall a personal experience I had last spring after selling a green chairman on one of the safer fungicides for application and control of brownpatch. The gentleman was so sure of Calo-Clor that he returned the milder and safer material because as he put it, "You ain't making no guinea pig out of me!"

Along about 1940, the DuPont Company marketed an organic mercury compound called Special Semesan. I recall how we used to demonstrate by taking a bucket of the solution and dumping it on one part of the green without flushing it in after application with the definite assurance one could not burn the turf. However, the applications in most places were made with the old type hand-pump barrel sprayer with the paddle agitator and the material did not stay in suspension too well, so a power driven spray tank soon found its way on the market.

Not until such pioneers and such unselfish men like Dr. Dickerson of Amherst and Massachusetts Agriculture College came forward with courses which lasted for 13 weeks, I believe, did the greenkeepers find much help except by the school of hard knocks. I understand Dr. Dickerson would take a limited number of men who would prefer a book to a pint and before starting a semester would personally interview each man, the only qualification being that he had an earnest desire to solve his own individual problems irrespective of the degree of schooling or limited education the greenkeeper may have had. That is true fellowship.

We now find the broader school of thought supplemented by the untiring research and extension of the Experiment Stations with leaders like Drs. Grau, Musser, Mott, Sharvelle and Noer, just to mention a few, and we have Dr. Payne and Dr. Daniel carrying the ball for M.R.T.F. Please reflect on this thought. "Your experimental colleges and our Midwest Regional Turf Foundation get a limited support from the state; they depend largely on your support. They in turf have graduated the greenkeeper upstairs and the superintendents have gained much through their cooperation."

With mercuries at a premium price, with correlated information being given to us, one is now able to distinguish the various attacks, even to the point of anticipation by observing the quick thermal changes, humidity and the time of the year and decide which materials to apply.

With the development of the newer power sprayers coupled with the high cost of labor came the urge to apply 3 or 4 materials in one application. I sometimes wonder if some of the failures of certain materials being used to control a certain attack do not lie there! For the past 3 or 4 years Cadmium solutions seemed to hold dollarspot well in control, so a newer material known as Cadminate (a high concentrate) was developed and distributed last year with the thought in mind that application periods could be lengthened from 10 days to 3 or 4 weeks. I am sorry to say it had its repercussions. One of my best clients took me to task last fall when control of dollarspot got beyond his control. After 2 applications 3 to 5 days apart with no response, in desperation the client turned back to Special Semesan and had the desired results. I am frank to say I am at a loss to know the reason. I did consult the chemist at DuPont Company and received this cautionary remark: "You may mix Torsan with a small amount of Special Semesan but do not mix F-531 (Cadmium base) with Special Semesan; the result-

ant product is an insoluble compound".

Some of you gentlemen may recall Dr. Daniel's article in the October issue of "Midwest Turf News & Research". In his article on the Fall Field Day he stated that on the check plot (those plots which were not sprayed) dollarspot was much worse at low than at high nitrogen levels. At low levels-- 4 pounds N per 1000 square feet per season-- fully 80% of the plot was affected. On the adjoining check plots where 10 pounds per 1000 square feet per season were applied, higher nitrogen feeding, only 30% of the unsprayed plot was affected. On treated plots the period of attack of dollarspot was also prevented ¼ longer by higher nitrogen feeding. What shall we deduct from this? Is only Cadmium or Cadminate more effective when combined with high nitrogen feedings? Or have we rendered our materials ineffective by combining it with other materials when we are not familiar with its reactions. Can we condemn the material when they are not used and applied separately?

Permit me to interrupt at this point. It is my personal thought that no dealer or representative who has built up a clientele among business friends can brush aside the thought he has a dissatisfied customer. I will always go the other mile to satisfy any errors made unconsciously or otherwise.

I can only assure you the manufacturer's chemists are only too willing to hear your complaints and results obtained, be it good or bad. After all, it is you fellows in the last analysis which present your headaches to the extension departments of the Midwest Regional Turf Foundation.

How do we handle machinery repairs? I find the golf course superintendent is the finest fellow to deal with on the matter of cooperation when and if repairs are necessary. In fact, most of their fairway and greens mowers are already returned to them. Seldom do they wait until January 1st, but set their plans for delivery to the dealer as soon as the last cutting is finished for the year. In the matter of fertilizers and seeding they are the first to have their materials on hand, usually in late fall when aerification is being done. The greatest headaches are from the public; that includes the landscape gardeners as well.

I find it a good policy to invite the green superintendent to attend the one day regional school held by the manufacturer in our place of business where illustrated talks and actual work is executed that each man

will be able to help himself on all points of major care and operation of his equipment. The big headache comes when a piece of machinery is brought out too soon without all the bugs being eliminated entirely in self defense. This holds true on practically everything we buy today, be it television, power glides, deep freezers, most anything being made today. For that reason, I still believe it is wise to "Stick with the lines having most experience and background". They generally can and will make good. Of course, we fellows on the firing line generally get the jolt.

There is so much to be had for the asking that I urge and help make arrangements for my friends to attend the turf conferences as this one. I like to think of the present group of green superintendents as a body of men of whom "Boss" Kettering, the retired General Motors organization, would say, "The poor fellow did not know it could not be done; so he went ahead and did it".

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QUESTIONS FOR RESEARCH

W. H. Daniel, Turf Extension
Department of Agronomy
Purdue University

Recently a group of us were talking about turf maintenance and changes that had occurred. Since 1942, there have been several new material and practices very evident on turf areas. The following is a list of ten in ten years which vary in importance.

1. 2,4-D-- It is expected to be used by all now.

2. Aerifying tools-- Aerifiers, nightcrawlers, and soilaires do a needed job.

3. Turf Conferences-- Mass attendance and interest shown in them.

4. More Golfers, Longer seasons of play-- causing pressure on the superintendent for top maintenance.

5. Less topdressing-- Didn't it used to be monthly-- the present cost is terrific.

6. Less personnel-- And, of course, more pay per hour.

7. Wide adoption of C-15, C-1, C-19 and C-52 etc. for quality putting greens.

8. Merion bluegrass-- the beginning of high priced seed, the forerunner of several to come.

9. Cadminates and specific chemicals for specific diseases.

10. Crabgrass control-- a coordinated effort to test and find value in them.

You likely can name several more that in ten years have become quite important. Of course, short courses were given for many years, but the size, sincerity and number of them has greatly increased.

Now let's guess at some things to come in the next years.

1. Polycross bentgrass seed for greens-- cheaper than stolons, easier and faster to bring under play.

2. Soil conditioners-- as Krilium-- which is the first of many perhaps. What will they do and not do?

3. Polycross fescues-- other bluegrasses--all high priced due to extra care, time, their value for turf and seed demand-- just like hybrid corn.

4. Soil moisture blocks and meters to tell if irrigation is needed.

5. Unionizations of more courses-- labor, higher wages.

6. Chemical mowing-- part-time-- Paul Weiss described his monthly sodium arsenite treatments.

7. Heavier use of turf in all its phases.

8. Preventive emergence of Poa, crabgrass, goosegrass, etc., by root toxicants.

9. What about disease control-- systemics.

All of these are guesses, many are already evident, but each of them mean changes and variations of business for the suppliers of turf maintenance materials. All of these things create pressures and problems for you and your salesmen.

What shall we in the experiment station work on? How shall we work? To what extent should we test this or that? In other sections today you'll hear some of what has been done at various places.

Recently I wrote a leaflet on Merion bluegrass designed for the home-owner, your customers and golf courses. How should this be written? A copy of the material was sent to Mr. G. T. Vaughan for his suggestions. Every suggestion he made was accepted. For example, he suggested that in mixtures, Merion and Kentucky bluegrass should not be mixed for easier inspection and to reduce the ease of substituting Kentucky for Merion. That is a very practical approach. Mr. Linkogel of Link's Nursery advised on the U-3 material in a similar manner.

Some of you received a letter from our Foundation recently. It sums up the idea of this talk very well. We have problems to solve, and it will be done much faster by working together.

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CHEMICAL POA ANNUA CONTROL

Lawrence Munzenmaier, Graduate Assistant
Department of Agronomy
Purdue University

A program for the chemical control of Poa annua was started at Purdue University in the fall of 1951. Since Poa annua is an annual grass and such a profuse seeder, it was decided that a pre-emergence treatment of this plant would be the most satisfactory method of control. A series of pilot or screening tests were set up at the Lafayette Country Club on pure Poa annua turf. The following chemicals were used at the dealers' recommended rates: pre-emerge, potassium cyanate, lead arsenate, calcium TCA, 245-T, Chloro IPC, dinitro general, sodium arsenite, endothal, CMU, Actidione and dichloral urea. These materials were carried in either water, fuel oil or standard crabgrass oil. Observations were made of foliage burn and inhibition of germination of the annual bluegrass. The plots in which no apparent results were obtained after one month were sprayed again with the same chemicals at the same rates. In all cases where dinitro general at the rates of 0.1 and 0.2 gallons per acre in fuel oil was used, there was an inhibition of germination and at least 95% of the area sprayed was severely burned. Chloro

IPC at the rate of 2 quarts to the acre gave a good control of germination without burning the Poa annua turf. CMU and pre-emerge also looked promising for the control of Poa annua. Lead arsenate definitely injured the annual bluegrass turf but after three months, the lead hadn't inhibited any Poa annua germination.

The chemicals that gave good control at the Lafayette Country Club were sprayed at the same rates on the Purdue Experimental Green to determine the effect of the chemicals on bentgrass. The bentgrass area was seeded with Poa annua seed three days before spraying. Observations were made on the germination of the Poa annua and the injury to the bentgrass. Chloro IPC and CMU severely burned the bentgrass.

Now, greenhouse studies are being made to determine the best rates of the most promising chemicals to use which will give the desired Poa annua control and the least amount of injury to the bentgrass. The three chemicals that were selected to carry out these studies were chloro IPC, dinitro general and CMU. Thus far, IPC at the rate of one quart per acre and dinitro general at the rate of 0.2 gallons per acre gives good control of Poa annua germination and the least amount of injury to the bentgrass. Dinitro general at all rates up to 0.2 gallon per acre didn't retard the bentgrass at all. Further experimentation is being carried out to determine the minimum rate of IPC that will inhibit Poa annua germination and to determine the maximum rate of dinitro general that will not give injury to the bentgrass. Also, leaching experiments will be conducted in the greenhouse to determine how long it takes to leach the chemicals out of the soil.

Experiments are going to be run this spring to check the rates and best chemicals to use in the field and to confirm the findings in the greenhouse. Also, the best treatments will be tried in the different areas of the Mid-West this summer.

This information is being presented at this time to show you how we are attacking the Poa annua problem at Purdue. Since only a limited amount of information has been collected no recommendations are being made at this time.

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THE SUPERINTENDENT, THE GREEN CHAIRMAN,

THE LOCKER ROOM

J. Porter Henry, Green Chairman
Algonquin Golf Club
Webster Groves, Missouri

In my 15 years as Green Chairman of Algonquin Club, St. Louis, I have learned that on account of the differing whims and fancies of the members, there is no royal road to a wholly satisfied membership. During this time I have been impressed with the varieties and difficulty of the problems confronting the superintendent. Without disparaging his excellent work and that of turf foundations, it seems to me that our progress comes so much through trial and error. What we learn seems to be somewhat of a negative character. We learn what not to do. If we try one thing, we wish we had tried another. We are like the bachelor who married late in life and having gained a knowledge of both single monotony and matrimonial torments concluded, whether you marry or not you'll regret it. The difficulty stems from the time elements. Our experiments are year to year affairs. It takes several years to determine the success of any venture. We have acquired answers to some problems, to others not. Our experiences make skeptics of us. We recently spent $4000 on a reseeding program at Algonquin preceeded by burning the fairways with magnificent results, but being a little skeptical, I said to the superintendent, "Suppose all this new grass disappears this summer and leaves the same old crabgrass, goosegrass, etc., and the members come to us with the inquiry 'What are you going to do now', what is our answer?" It came very quickly-- take to the woods.

In the strenuous effort to try anything once, one of my predecessors tried yarrow on the fairways. During the hot dry summers the experiment seemed justified, but the third hot wet summer proved disastrous. Only a few patches survived thereafter, and when Miss Joyce Weathered, the English woman champion, was playing an exhibition match at our club and noticed the yarrow, she said to her partner. "I see you are also troubled with yarrow over here".

While the superintendent's job is precarious, let no one contend that the path of the Green Chairman is strewn with roses. If a footprint in the sand costs the player a stroke, he rarely fails to tell the green chairman about it. If the topdressing on the green is

too heavy, or the cut of the green too short or too long to suit his style, or if long and continuous rain in hot weather seems to justify the closing of the course, or if he loses his ball in the leaves or the too high rough, it is the green chairman who invariably hears about it.

The green chairman can be an asset to a club or a liability. If he thinks he knows too much about grass culture and maintenance and insists upon putting his ideas to work, the Lord help the golf course. On the other hand, if he knows nothing about the subject and, therefore, is unable to appreciate the problems of the superintendent, he is worthless as a liaison officer between the superintendent and the locker room. Likewise, if the green chairman hasn't the courage to risk the displeasure of members when the situation requires he is failing in an important aspect of his job.

The green chairman is smart who adopts a program of keeping his Board and membership well informed in advance of his various moves and he must have sufficient knowledge to answer capably questions asked of him by the Board and the members.

Two experiments illustrate the importance of publicity. For many years our greens had thinned out badly in the summer. Our superintendent was of the old school who was reluctant to pay much attention to the agronomists, the agricultural departments or the Green Section of the USGA. He felt that these theorists could not improve on his wide experience. In spite of my efforts this attitude continued and so did our troubles. Finally, I found it necessary to find a new superintendent, who discovered that our greens were so heavily compacted that nothing short of violent treatment could improve the situation. He concluded that mere tining would not be sufficient unless we tined with very heavy forks. To this end he built a heavy instrument capable of puncturing the green with very large holes. Before the program started, we illustrated the problem to our Board and to a good many members who were present. We showed with bricks taken out of the green how compact the soil was and with bricks made with suitable soil how supple the soil should be. Consequently, when the work began, the members had been fully warned, were conversant with the problem and were willing to endure the temporary inconvenience.

A contrary experience occurred when we had decided back in the time of Dr. Monteith that we should experiment with five or six of our fairways by chemical

burning and reseeding. I had asked a reluctant Board to permit the experiment but no publicity was given to it. After the application of the chemicals and these fairways were denuded of grass, the green chairman came in for a tremendous amount of condemnation. The members were going to take special delight in replacing him at a coming election. Fortunately, before the election occurred, with our watering system and with a favorable season these fairways were so far superior to the others and so pleasing to the members that they forgot their determination to relieve the chairman of his job and re-elected him by almost a unanimous vote. The condemnation and criticism could have been avoided by means of adequate publicity.

Another publicity expedient adopted by us was to have a dinner meeting at which a grass program was presented to the membership in order to acquaint them with the problems. At this meeting the green chairman gave a little talk about the grass plant, the function of the leaves and the roots, about soil conditions and fertilization, and then turned the meeting over to the superintendent for a question period. Most members having lawns were highly pleased and they had become acquainted with the course problems.

A serious problem with the green chairman is closing the golf course when weather conditions demand. In our district sometimes our greens suffer heavily unless this is done. Here the green chairman must assume the responsibility upon the advice of the superintendent and he must not waiver in his determination.

We have had difficulty in getting the high handicapped players accustomed to slick greens, but after several years of education they would not change now for anything.

The green chairman must insist that the superintendent has only one boss, not 300, and any criticism or suggestions must come to the green chairman and not the superintendent.

Another difference which has been resolved is the desire of the low handicapped man to lengthen the holes or tighten the greens with traps and the desire of the 100 shooters to either leave the course as is or make it easier. This has been resolved by eliminating all traps that merely penalize the 100 shooter, which I call dub traps, and installing traps at the greens which penalize a bold shot gone wrong. If a scratch player wants to attempt to reach a green on his second shot, a trap requires a shot to be perfect. But the

100 shooter who is satisfied to reach the green in three or four is not handicapped particularly by the tight green.

A conscientious chairman must be mindful of the fact that he and the superintendent must exert every effort to provide the best possible course for the pleasure and pride of the membership. But he has learned from experience that most members are somewhat myopic. He is interested primarily only in the immediate. He finds it difficult to understand, for example, why we should spoil a beautiful green and his game in the early spring by brushing and top dressing. Naturally he knows nothing of the consequence of matting and therefore it means nothing to him. He is thinking in terms of today's play and not the many tomorrows.

The green chairman must support the superintendent in his programs when known to be beneficial even though they risk the displeasure of members. Like the surgeon who may amputate a leg to save the patient, the green chairman and superintendent must be willing, however reluctantly, to displease and be criticized and spoil a few days play rather than multiply the bad days of the future.

For the superintendent and chairman to do a good job and succeed in giving the most pleasure to the members they must not be appeasers in order to postpone criticism. They must not be thin skinned and permit the jibes and taunts of a few or even many of the members to get under their skins and tempt them to entertain the idea of throwing in the towel.

Acting from a genuine motive-- to do everything to build better turf for the members enjoyment-- the superintendent and green chairman must pursue their efforts, willing to be replaced than to let possible criticism induce them to avoid a necessary, if annoying, practice.

It must not be inferred from the above observation that constructive criticism and suggestions should not be welcomed. Indeed they should be invited. In our interest and absorption in our work we often neglect many details of grooming the course, or some detail or inconvenience, when a suggestion or criticism of a member may be a welcome reminder. I have profited by many constructive suggestions over the years.

The Midwest Turf Foundation is providing valuable assistance to the Green Superintendent's Association in St. Louis, organized about 8 years ago, which has re-

sulted in greatly increased efficiency in course maintenance and a marked reduction in the complaints from the locker room.

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EXTENSION LOOKS AT TURF

Charles G. Wilson, Agronomist
USGA Green Section
Beltsville, Maryland

What is extension?

Extension is teaching by placing information developed by research into the hands of the person who can use it. It is concerned primarily with interpreting research results in terms of practical application and attempts to make the person who requested the information more satisfied and better able to do his job.

Where does the extension specialist get his information?

The extension specialist gathers his information from research, publications and observations or the same sources available to the turf superintendent. The superintendent should carefully examine these sources of information in order to make certain that he is taking full advantage of the facilities offered.

1. National Coordinated Decentralized Turf Research Program. Essentially this has been a USGA development sponsored by Dr. Fred V. Grau. When Dr. Grau became Director of the Green Section in 1945, only 5 states were actively engaged in turf work. Today 27 state experiment stations are doing some work on turf problems. Information gathered at these decentralized stations is available to the superintendent through turf conferences and in many local and national publications such as the USGA Journal, Turf Research Review, Golf Course Reporter, Golfdom and the Midwest Newsletter.

2. The Book Turf Management.

3. Scientific Findings in Related Agricultural Fields.

4. Practical Observations of Progressive Superintendents.

5. Correspondence.

6. Commercial Interests Which Have Well Trained Men in Turf Culture.

7. On the Scene Visits. USGA Advisory Service Visits, local meetings of golf course superintendent associations and the County Agent or extension specialist from the state experiment station. These are your sources for on the scene visits. Yet how many of you have called on your county agent? Has the local G.C.S.A. visited your golf course? Have you asked the Green Section for a visit? Extension never forces information on a person or a group. You must ask for information before extension can serve you. You may be certain that when an extension man calls, he looks just to the superintendent because the specialist knows that the superintendent is the most stable influence in the club and that without the superintendents cooperation, the best suggestions are made in vain. Further, the Green Section is committed to the policy of service to its member clubs, and we realize that such service is most effective when made through the superintendent.

How can Taking Advantage of Service Visits Benefit You and Your Turf Installation? Of course, the superintendent is supported, and yet many clubs are denied service visits because of local prejudices and misunderstandings.

Often an outside authority may provide the stimulus in obtaining needed supplies and equipment. Most club officials are business men who make use of outside authorities in order to make their business more profitable. They readily understand that turf is a highly specialized field requiring the knowledge of many scientists, and that suggestions from the extension specialist is not limited to one source of information. Agronomists, entomologists, pathologists and engineers all contribute to the county agents or Green Section representatives knowledge and suggestions. Certainly, the Green Section does not believe that it is "losing face" by making full use of the knowledge of many scientists in related fields of Agriculture, and yet some superintendents seem to feel that if they request a visit from an outside agency, the club officials will think that the superintendent doesn't know how to do his job.

What does a Green Section Representative look for on a Service Visit?

1. Looks for basic fundamental problems which may be the primary cause of poor turf-- tree roots; traffic and compaction; unadapted grasses; poor drainage; etc.-- may tell us why the weed is present or why a proven fungicide won't control the disease. Spraying with weedicides and fungicides is supplementary to good physical soil condition, the proper grasses and an intelligent feeding and watering program.

Lack of equipment and labor to do the job are primary causes of poor turf. Budget limitations also may be responsible for poor turf although we are all familiar with some courses that maintain good turf on a low budget. The answer is that low budget courses have eliminated most hand maintenance jobs and are so constructed as to be easy to maintain with power machinery.

2. Looks for practical inovations which may be helpful to other superintendents. Unit tool sheds, tree root pruners, power rakes for traps, and edging around trees with fuel oil are but a few of the many practical inovations developed by golf course superintendents.

3. Looks for ways to have better turf at lower cost. We are careful to emphasize the difference between true and false economy measures. Often a long range program of economy requires additional expenditures at the start. Extra fairway mowing units; smoothing out steep contours; and providing adequate storage will cost money in the initial outlay. However long term savings in labor may make such expenditures economically feasible.

4. Looks for new problems and new selections. Cultivating the soil beneath an existing turf used to be a problem and Merion bluegrass and several bentgrass selections now in wide usage were made on golf courses.

5. Looks for an exchange of ideas preparatory to drafting the written report. In the case of a Green Section visit, notes are checked, maintenance methods and materials are investigated and a rough draft of the final written report begins to form in the minds of the inspection committee. It is essential that the report be a joint cooperative venture between superintendent, club officials and the Green Section representative. In its final form the report mailed from the Green Section office emphasizes this cooperative effort by avoiding the use of the first person singular. It is always: The inspection committee believes

... We concur with the superintendent that.... should be done.

As the visit ends it is always our hope that new friends have been made; that the turf, the golfers and the superintendent will benefit from the visit; that we have passed out some worthwhile information; and that we have increased our knowledge which will benefit the next club that we visit.

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THE TURF MANAGEMENT COLLEGE COURSE AT PURDUE UNIVERSITY

W. H. Daniel, Turf Specialist
Department of Agronomy
Purdue University

There are, of course, many phases of technical, liberal and professional training offered by any institution as large as Purdue University. Even within the School of Agriculture, it probably would take a life time for a student to attend all the courses offered. The Turf Management program is a college level curriculum utilizing the basic science courses chosen for their relationship to problems in turf production and utilization.

A student, in order to obtain a Bachelor of Science degree, must complete approximately 150 semester hours of course work equal to four years of normal work. Approximately 100 hours of these are required, the student must take them as basic training in his specialty, as Turf Management. Also from a large list, 50 semester hours of elective courses are chosen by the student and his faculty advisor.

The Turf Management course has been developed for training for golf course superintendent, landscape and lawn service, fertilizer and equipment salesmen, sod nursery and seed producers, and institutional and industrial grounds supervisor. However, since it is a regular college course, it provides a background of training useful in many fields of work.

Subjects are selected from several departments which give a wide background in the principles of plant nutrition and growth. The subject matter is indicated on the following page.

AGRICULTURAL ENGINEERING

Required
Elementary Drawing
Basic Surveying
Farm Surveying and Drainage

Electives
Farm Motors, Trouble Shooting
Agricultural Power Units

AGRONOMY

Required
Introductory Crop Production
Forage and Pasture Crops
Introduction to Soils
Soil Fertility and Management
Turf Management
Intermediate Soil Science

Electives
Pasture Crops and Management
Soil Analysis and Testing
Soil Physics
Soil Classification
Thesis Problems in Turf

CHEMISTRY

Required
General Chemistry for Agriculture
General Chemistry, Part 2
Organic Chemistry for Agriculture
Chemistry of Plants and Animals

Electives
Introductory Qualitative Chemistry
Introductory Quantitative Chemistry

ENGLISH AND SPEECH

Required
English Composition
Expository Writing
Principles and Practice in Speaking

Electives
Agricultural Writing
Group Discussion
Business and Professional Interview
Grammar and Usage
Business Letterwriting

BIOLOGY AND BOTANY

Required
Fundamentals of Plant Science
Agricultural Application of Plant Science
Principles of Biological Science
Biological Principles of Animals
Plant Diseases, Hosts and Causes
Principles of Plant Physiology
Bacteriology, Basic Concepts

Electives
Anatomy of Plants, Food Transfer
Bacteriology of the Soil
Plant Growth and Processes

HORTICULTURE

Required
Plant Propagation
Garden Flowers, Use of
Landscape Development and Appreciation

Electives
Floriculture, Greenhouse & Field
Plant Protection, Fungicides
Nutrition of Horticultural Crops

MATHEMATICS AND ACCOUNTING

Required
College Algebra
Trigonometry
Physics for Agriculture Students

Electives
Elements of Accounting Methods
Cost Accounting and Analysis
Farm Accounting and Business
Motion and Time Study or
Agricultural Work Simplification

MISCELLANEOUS

Required
Principles of Genetics
Physical Training and Education, 1 Yr.
Military Training, 2 Yrs.
Introductory Entomology

Electives
Geology of Soil Development
Business Law and Principles
Insects of Greenhouse & Outdoor Ornamentals
Other Subjects of Interest to the Student

Inquiries concerning the program may be addressed to W. H. Daniel, Department of Agronomy, the Registrar or Dean of School of Agriculture, Purdue University, Lafayette, Indiana.

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COMPACTION AND MOISTURE PROBLEMS IN TURF

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Pennsylvania State College
State College, Pennsylvania

Compaction is a critical and persistent problem in turf soils primarily because of the effect which it has on that portion of the soil in which plant roots live and perform their necessary functions. Plant roots live and grow in the spaces between the solid particles of the soil. These spaces are referred to collectively as the pore space of the soil. Not all soils have the same amount or type of pore spaces. The individual pores within any soil may differ in size, shape and arrangement. It is on the basis of these three pore space characteristics that compacted soils differ from those which are porous, resilient and highly productive.

What is the nature of the soil pore space? Why is it so important? What actually determines the characteristics of the pore space in the soil? A great many different pores may be found in any soil, but in general two types are recognized because of differences in their size and function. The large or non-capillary pores are responsible for providing the infiltration capacity, the drainage and the air conditioning system of the soil. It is on these three important characteristics that compaction has its greatest effect. Because of the influence which these pores have on the air-moisture-temperature relations in the soil, root activity is directly influenced by non-capillary porosity. The small or capillary pores serve primarily as water holding reservoirs, from which the roots of turf plants secure not only their moisture but also their essential nutrient elements which are dissolved in this capillary moisture. A compacted soil is characterized by a small amount of non-capillary porosity. Depending upon the type of soil, compaction may or may not decrease the amount of capillary porosity. Soil porosity is regulated by the size, shape and arrangement of the particles which make up the soil. A loose uncompacted soil, consisting of a high proportion of

grape-nut like particles or aggregates, usually has sufficient non-capillary porosity. One of the characteristic features of many compacted soils is the manner in which the particles have been compressed into flat plates which are layered together in an overlapping arrangement. The pores between these plates are not only small and narrow but are offset from one another so that air and water movement through them is very restricted.

Compaction can be measured in different ways. Many times a simple determination of the volume weight or the bulk density of a certain soil layer will detect a compacted condition. Penetrometers have been used extensively by turf specialists to measure apparent differences in soil compaction. It must always be remembered that the stone, moisture and root content of the soil have a considerable influence on the accuracy of any penetrometer measurement. Because of the effect of compaction on the moisture relations of turf soils, rate of water intake and runoff are often used as indirect measurements of compaction. Since the most direct effect of compaction is on the non-capillary pore space of the soil, this property is frequently measured and used as a direct indication of a given degree of compaction.

Dense impervious conditions may occur anywhere in the soil. Many turf areas are underlain by heavy compact subsoils. These often create water problems not only within these impermeable layers but also in more permeable soil layers above from which surplus water must often be removed through tile drainage. In a great many normally well drained turf soils, compaction is greatest at or near the soil surface. This is the cause of many troubles in turf management.

Practically all soils are capable of being compacted. There are many factors which determine the actual amount and extent of compaction in any soil. Compaction is caused for the most part in turf soils as the result of the application of mechanical pressure to the soil, by trampling, wheel traffic and to some extent by rolling. It is a well-known fact that the greater the amount of pressure applied per unit area, the greater will be the degree as well as the depth of compaction to the point where other soil conditions modify the effect of pressure alone. Compaction studies in turf soils have demonstrated this fact. The greater the forces used in compressing the soil, the greater has been compaction.

The moisture content of the soil has a great influence

on the degree to which it can be compacted at any time. Results of the study of the effect of moisture on soil compactibility indicate that most soils appear to be most easily and thoroughly compacted at moisture contents closely approaching their field capacity. Very dry or saturated soils are not as easily compacted as those whose capillary pores are filled with moisture but whose non-capillary pores have been drained thus providing near optimum conditions for maximum compaction.

The texture of the soil would appear to have some influence on its compactibility, but experimental results show that the non-capillary porosity of sandy soils can be decreased to almost the same degree as with clay soils. In sandy soils, compaction appears to decrease both non-capillary as well as capillary porosity, whereas in clay soils compaction many times merely increases capillary porosity at the expense of non-capillary porosity.

Studies have shown that most compaction takes place in unirrigated turf soils in the spring or early summer. This condition persists throughout the remainder of the summer and fall. Winter conditions, through the effect of frost action, will tend to loosen compacted layers somewhat.

What can be done to prevent or at least minimize serious compaction conditions? Protection of the soil surface with a dense, vigorous growth of vegetation is an effective means of reducing compaction. One of the simplest ways of getting proper growth of turf is to provide the grass plants with sufficient nutrient elements by adequate fertilization. Fertilization can have important indirect effects on the structure of turf soils. As growth is stimulated, more organic matter is produced which along with increased root activity will tend to loosen the soil. It is very significant that many of the turf grasses are numbered among the best soil improving plants known. Given an opportunity, they are capable of doing an excellent job of soil improvement. A soil with an ample supply of organic matter which is filled with actively growing roots will compact must less readily than one lacking these things.

Water management is also extremely important. Turf soils that are continuously watered will have moisture contents which render them most susceptible to compaction. Irrigation studies have demonstrated that as little as 4 inches of water applied at the proper time during the dry portions of the summer will do every

bit as good a job of sustaining satisfactory turf as 24 inches improperly used. Unnecessary traffic of any kind over recently watered turf should be avoided as a further means of reducing compaction.

The correction or improvement of compacted turf soils can be done with the use of such tools as the Aerifier or Terferator. These implements are capable of opening up compacted layers near the surface by puncturing them and leaving small holes which perform as non-capillary pores. As their names imply, they improve the aeration of compacted soils. In addition to serving as ventilator shafts these openings increase the intake capacity of the soil for water, they provide a means of getting top dressing down into the soil as well as fertilizer. Recent studies have shown that aerification will very significantly increase the absorption capacity of compacted bentgrass turf soils. Investigations of the effect of aerification on fertilizer penetration have shown that 25% more available phosphate is to be found in the 3 to 6 inch layer of aerified turf soils than in that which has not been so treated. The most effective job of aerification can be done when the moisture content of the soil is at about field capacity.

Compaction and moisture problems in turf soils go hand in hand. Because of the great influence that compaction has in creating water problems which are reflected in poor turf, every possible effort should be made to minimize its occurrence. Since one must generally accept the fact that some compaction will result from normal turf use, corrective measures should be carried out regularly to prevent a really serious situation from developing.

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KODACHROME REVIEW OF 1951

O. J. Noer
Milwaukee Sewerage Commission

At Ames, Iowa, last year Ralph Bond of Madison asked about midget grass being promoted by a Milwaukee resident. His grass never needed to be mowed and needed no attention. From the description it sounded like pearlwort to me. When I got back to Milwaukee and inspected the lawn on 53rd street, I found my suspicion to be correct. This enterprising resident was selling blocks of sod at $3.00 per square foot. This is the lawn as it looked in May. I didn't get back to see it later in the year.

In early spring and again in September I visited Cincinnati. About 12 years ago the fairways at Clovernook were renovated and seeded. The first ones were seeded with Kentucky bluegrass only and after that about 10% Colonial bent, Astoria, was used in the mixture. The fairways have been good and are not watered although you can see some crabgrass. It has been dry and the grass is just beginning to recover after a little rain. This fairway had been narrowed down. The fairways are cut at between half and three-quarters of an inch.

Last May on my way to Florida I stopped at Augusta and took this picture on a green composed of the common cotton patch bermuda. Notice how coarse and stubbly it is because the nitrogen level was skimpy. The nature of the grass wasn't good either.

The next picture was taken in Miami on a green of Tifton bermuda which was a local selection taken from one of the greens either at Bayshore or LaGorce. Notice the difference in the texture of this fine-textured strain as compared with common bermuda.

On my way home I stopped at Nashville and went out to Charlie Danner's course. I saw a pile of well-rotted hardwood sawdust which is being used as the source of organic matter in the top-dressing used at that club. It appeared to be an excellent material. This is one of the bermuda greens on the course at Nashville showing the slow recovery of the bermuda after the rye disappeared after winter play. Usually the rye tends to delay the recovery of the bermuda. Some say it is due to depletion of the soil supply of nitrogen. Others think there must be some other reason. This is a picture of the C-1 Arlington bentgrass green at Nash-

ville. It went through last summer very nicely without any trouble. Of course, Nashville had a Milwaukee summer instead of the normal summer. It was very encouraging to say the least and Charlie Danner is very enthusiastic about the performance of the grass on that green.

In Milwaukee all our parks are operated by a County Park Commission. They have supervision of all the parks not only in the city, but in the villages around Milwaukee. In many of the parks there are athletic fields for football or baseball or for other sports. This happens to be a field where the turf was extremely poor. I was asked to go out there. They had used some fertilizer. My feeling was that the soil was so poor that the rate had been altogether inadequate. So we used from a ton to a ton and a half of fertilizer to the acre on these strips. The picture was taken about mid-June. The next picture was taken about three weeks after the dry weather started. I noticed the grass was greener along each one of the lime lines. So I thought that we had made a mistake in not making a soil test, by assuming that the soil was not acid. I picked up a sample from where the grass was green and one along side of it where the turf was turning brown. Much to my amazement, the soil away from the lime lines had a pH of 7.3 and over the lime lines it was 8. It was a very heavy soil. I had a hard time putting the sampler down in this area but it was quite simple to get the sampler into the soil where the grass was green. Granulation was improved by the lime. In other words, lime improved the soil tilth.

In August I was in Troy, New York. Ten years ago I took a picture of the very same man on the exact same spot. At that time the grass along a straight line was greener than on either side of it. About ten years ago there was a rule on this course that permitted the player to lift the ball on the downhill slope of this hill. Lime was used to mark the boundary. After ten years the effects of lime are still visible.

In June I was in Cleveland and visited Shaker. While I had seen Tom Mascaro's new Aerifier demonstrated in Memphis, this was the first time that I saw it actually in operation on a golf course. They started using it at Shaker on the practice green instead of on the greens proper in order to judge whether it was suitable for the greens. The next picture shows Mal McLaren and Colin Smith measuring the depth of the holes with a pencil. After aerifying they waited a few minutes until soil plugs crumbled nicely. Then the green was poled to break up the casts.

When I went to Oakwood, Mal showed me some spots on several of the greens. Of course, I was curious as to what was wrong. "Dry spot" Noer said the soil underneath was dry. To prove it we used the profile sampler and I think you can see that the soil is dry. It is dry because the spot happens to be a little patch of a more dense type of creeping bent. Despite the fact that these greens had been cut close, notice the mat close to the surface.

In July Fred Grau and I were in Billings. The practice putting green at Hilands was not up to par. Of course, "Tree root" Noer said it was the cottonwood trees in the background. I asked the groundsman to lift the sod. The next picture shows the tree roots immediately underneath the turf.

This is something that was common in Wyoming, Montana, Colorado and also in western Nebraska. I think this picture was taken on a bluegrass lawn in western Nebraska. To me it is a case of iron chlorosis. In the far west it is sometimes referred to as calcium chlorosis because a high calcium content in the soil tends to depress the solubility of the iron.

The next picture is a picture of fairway turf in the Denver area which has that yellowish or chlorotic condition scattered all over the bluegrass fairway. These fairways are flooded. That is the way they are irrigated and most of the spots where the grass was yellow was in the low depressions where water seeped away more slowly than it did on the high areas. It is my belief that part of the clover problem there is the result of thinning due to chlorosis. Some of you may not agree but I feel convinced that that is the case. This is on the same golf course along a fence. You can see how yellow the bluegrass is. I believe that is a temporary iron deficiency.

In September while I was in Cincinnati I went out to one of the golf courses. The greens were rather bad. This is what I saw. To me it is another example of iron chlorosis. The next picture shows the same thing on one of the other greens where the chlorosis has been so bad that you might blame too much water--which is actually true. I got this man to put on a half pound of iron sulfate to a green and had him cover one spot with an empty bag so that the iron would not come in contact with the grass. He called me the next morning, twelve hours later, and told me there was a definite improvement in the color where the iron was put on. Where the turf was covered, the grass was still yellow. When this kind of thing occurs, iron sulfate

isn't going to bring the grass back after it is already dead. The treatment must be made promptly when turf starts to become yellow. Then there will not be any serious loss of turf.

This is a picture of the new version of the Jim Haines tree root pruner. I saw it when I was in Denver when he operated it for me. The next picture shows the root pruner in operation alongside one of the tees where cottonwoods surround the tee. The next picture is a close-up. I turned the turf back to show you the diameter of the roots that had been cut. You can see the pruner will cut roots of considerable size.

In August I saw some bad turf on some fairways in Cleveland which I thought was due to tree roots from trees alongside the fairway. In October when I got up to Minneapolis they were extending the water line on one of the fairways at Interlachen. This is what I saw along the edge of the trench. These are tree roots from the elm in the background. I paced off 35 yards from the trench to the tree.

I said there had been a wet season and it was, generally speaking, although in Troy-Schenectady area it was very dry in August. When I got on this green I was curious because of the brown overall cast due to localized drying. Yet the velvet bent was beautiful and showed no evidence of wilt, water shortage. The next picture will show that the soil under the creeping bent was bone dry. Notice the moisture underneath the velvet bent. I have felt for some time that many of the velvet bent greens have been overwatered and that part of the iron chlorosis was due to excessive watering. This tends to support that contention.

In August I went from New England to Philadelphia. Farnham took me to this fairway which he thought needed special treatment with sodium arsenite followed by seeding. I noticed this strip along the edge of good dense turf without any clover. It was excellent playable turf. I asked Marshall about it. Before the last time the National Open Tournament was played at Springmill course ten years ago, the outline of this fairway was changed. Before that time the strip had been rough. He cut it close, used a spike disc, tore up the surface and seeded with a mixture containing a little Astoria or Colonial bent. You can see how fine this turf is as compared with the clover infested Poa annua alongside.

In Grand Rapids one of the courses had very bad watered fairways. They started to do some renovation. Only

the worst areas were treated and seeded. On part of this fairway the turf seemed good enough so nothing was done to it. Now there is complaint about the lies because the renovated area was so much better. I think you can see the dense turf free of clover on the renovated part, and the clover, Poa annua and thin stand of bluegrass on the other part of the fairway.

I was at Joe Ryan's course in August, soon after my visit to Grand Rapids. He showed me a small plot of Merion bluegrass which was seeded in April. This is a plug of the turf. The picture shows the large number of vigorous new rhizomes developed by August.

Two years ago I was on this course in the Minneapolis area. This happens to be No. 1 tee. There were many complaints about the condition of the turf, rightly so as you can see. I ventured the opinion that no greenkeeper could keep grass on that tee due to the tree roots and traffic along the back edge. The next picture was taken this fall. It is the same tee. They did some thinning and pruning of trees in the background and trenched to stop the tree roots. Our suggestion to put down a strip of black top along the back of the tee was followed. You can see that turf conditions improved as a result of doing these things.

The next picture shows 2,4-D damage to bent on a fairway. It was taken in the New York metropolitan area several years ago. I had seen other similar examples and am sure at times 2,4-D is bad for bent in fairways. A test was started at Milwaukee Country Club in June. The fairways are mostly creeping bent. They have never used 2,4-D because of injury to the grass on some of the first plots we established there one September right after 2,4-D was discovered. The bentgrass fared badly. As a result, Ted Booterbaugh and his chairman were hesitant to use it. The plots this June were placed on the approach to a par 3 hole. The sodium salt of 2,4-D was used at the ½, 1 and 1½ pounds of actual 2,4-D per acre. When Charlie Halloweil came during late June, I took him out to the course and he took a picture as I did. This is the line along either the one pound or the 1½ pound rate. We saw no discoloration on the bent at any rate below one pound.

I left for the west the day after July Fourth. Just before leaving I told John to watch these plots for another two weeks to see what happened. If there was no further discoloration, I suggested spraying the approach to No. 8 with 3/4 of a pound of actual 2,4-D to the acre. This rate gave good control of the dande-

lion. When I got back in August I could see no injury to the bent. In September we established another series of plots in which we used the sodium salt, the butyl ester, the amine and morpholine type of 2,4-D. The rates were 3/4 of a pound and 1½ pounds of actual 2,4-D to the acre. I took the picture you see in October. At the 1½ pound rates it looked as though the 2,4-D would thin out the bent. I left town and when I got back in November the ground was covered with snow. It has been that way ever since. So I can't tell you more about these plots until next spring. Where fairways are composed almost exclusively of bent, as these are, it would seem unwise to use 2,4-D at rates exceeding 3/4 of a pound actual 2,4-D per acre. I would be inclined to spray in June rather than in the fall despite Musser's emphasis of fall. I think bent is the exception that proves the rule. It is just a matter of avoiding possible injury to the bentgrass.

This is an example of sabotage damage to a green in the Chicago area. It is pretty well established that the damage was done either with sodium arsenite or arsenic acid. The next picture is another one of sabotage damage. It occurred at Winged Foot. When I was in the Westchester area on the second day of November, I went out to Winged Foot and took these pictures showing the sabotage damage. Fuel oil was used on these greens.

You hear me talk about Milwaukee Country Club. This fall I took a few pictures there. This is No. 1 tee, No. 1 fairway and No. 1 green. Fairways are mostly creeping bent. It came in naturally under the program of watering and feeding. They have Washington bent greens. The grass has never given any trouble because it is handled properly. The next picture is a close-up showing the character of the turf on No. 3 fairway. I think you can see that the weed population isn't serious enough to make spraying a must. The next picture is a close-up on No. 16. From this picture you can get an idea of what the dandelion population is. There are scattered plants through the turf. These fairways are cut just as close as the mower can be set. In other words, probably under a half an inch. Here is the approach to the last green, No. 18. It is quite typical of what the turf condition is on the fairways and greens.

I put this in as the last picture. I took it when I was in Minneapolis. It seemed to me that it is a striking example of what native plants can do to enhance the beauty of the golf course.

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