

Turf Culture

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United States Golf Association Green Section



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The Service of the Green Section

THE United States Golf Association Green Section presents this issue of TURF CULTURE in the hope of helping member clubs in green-keeping. The Association will welcome comments from chairmen of green committees and greenkeepers regarding this publication and the service of the Green Section.

The assistance of the Association's Green Section is available to all member clubs. Inquiries will be answered as promptly as possible. Inquiries by regular mail should be addressed to: United States Golf Association Green Section, P. O. Box 73, Benjamin Franklin Station, Washington, D. C. Inquiries by telegraph and special delivery mail should be addressed to: United States Golf Association Green Section, Room

4947, South Building, Department of Agriculture, Washington, D. C. Parcels and samples submitted for analysis should be sent to the latter address.

Copies of The Bulletin formerly issued by the Association are available from the Green Section office in Washington. Complete annual volumes issued from 1928 to 1933, inclusive, averaging 250 pages each, may be purchased at \$2 per volume, half the former price. Some issues from volumes published from 1921 through 1927 may be obtained at proportionally reduced prices.

Some of the subjects covered in The Bulletin are:

Issue	Subject
June, 1928	Fairway fertilizing, rates of application, etc.
July, 1928	Watering systems of various golf courses
August, 1928	Construction and planting of golf courses
September, 1928	Putting green maintenance
May, 1929	Lime: its effect on turf diseases; application to turf
August, 1929	Reconstructing greens; topsoil preparation; resodding
November, 1929	Peat and muck for use on golf courses
August, 1930	Weed control on putting greens
September, 1930	Preparation of compost, soil beds, etc.
March, 1931	Fertilizers { use and mixing of dictionary of for putting greens
April, 1931	
May, 1931	
August, 1931	Fairway sprinklers, installation and use of Moisture requirements of grasses, with rainfall figures
September and October, 1931	
January, 1932	Sod webworms, description and control treatments
February, 1932	Watering putting greens
August, 1932	Diseases of golf course turf and their control (contains 104 pages; well illustrated)
January, 1933	Applying materials to turf, rates of, etc.
February, 1933	Kentucky bluegrass growth, greenhouse studies of
May, 1933	Brownpatch, effect of temperature and moisture on Crabgrass and other weed control experiments Library for greenkeepers; Mechanical putter tests
August, 1933	
October, 1933	
December, 1933	Fairway fertilizers, experimental results Weed control with sodium chlorate and other chemicals Weeding Bermuda grass out of creeping bent turf

The Effect of Watering on Brownpatch

THE development of brownpatch on greens is influenced by a number of soil and climatic conditions, including texture and fertility of soil, drainage, temperature, humidity and rainfall. Many of these conditions cannot be controlled, but some which affect this disease can be controlled or at least somewhat modified. Probably the most important of this latter group is watering.

From the standpoint of the health of grass, most greens are overwatered. A good share of overwatering is due to the demands of golfers for excessively soft greens.

A few years ago the Green Section conducted tests on watering greens at different times and with varying quantities of water. Records were kept of the development of brownpatch in connection with the different treatments.

It was found that where only sufficient water was used to keep the grass in good condition, brownpatch could be readily kept in check. Where heavy watering was practiced (five times the quantity used in the lighter watering), the disease was from three to seven times as serious as in the areas receiving the light watering. Where only a small amount of water was used,

twice as much disease developed where the water was applied in the evening as compared with turf watered in the early morning. Where an excessive amount of water was applied, the disease was about equally severe in the areas receiving the water in the evening and in the morning.

Therefore, where greens are watered moderately, early-morning watering is preferable to evening watering. On the other hand, where greens are watered in excess, it doesn't make much difference at what time of day the water is applied.

Much damage caused by brownpatch could be avoided if water were used more sparingly. Reduced watering schedules should be started, however, in the spring. If greens are overwatered early in the season the roots will remain shallow and the greens will therefore quickly suffer in dry periods. On the other hand, if a moderately dry green is tolerated during the spring months there is a tendency for the grass to develop a stronger root system, with the result that less water will be required to keep the turf in good condition during the summer.

Prolonged periods of excessive rainfall during the spring or the summer months make it necessary to adjust watering schedules to take care of the reduced root systems. Contradictory though it may sound, it is advisable to water more frequently after long excessive rains than during periods of normal rainfall.

Spread of the Japanese Beetle

IN THE past 22 years since the Japanese beetle is supposed to have been first introduced into the United States, it has spread until it now continuously infests an area about 11,400 square miles, most of which is in New Jersey but extends into New York, Pennsylvania, Delaware and Maryland. Isolated colonies occur in many other States.

Turf on greens and fairways often has been ruined in the continuously infested areas. Arsenate of lead is applied to the soil either to control this pest or as a safety measure to prevent an almost certain infestation and resulting injury to the turf. This treatment is expensive, costing from \$20 to \$50 an acre, and may have to be repeated after four or five years. In many instances this arsenate of lead has been used as a precautionary treatment against Japanese beetles

on golf courses where there was no immediate threat from these insects. It is therefore important to know something about the distribution of this pest before applying the remedy.

The natural spread of the pest is by the short flights of the adult beetle. Thus, the spread of the continuously-infested areas is only a few miles a year. Isolated infestations scattered in the other States presumably were started by a few beetles that were carried there in shipments of fruits or vegetables.

During the past few years the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture has enforced strict regulations on the shipments of fruits and vegetables from the infested areas. This Bureau also keeps a careful lookout for adult beetles in different parts of the country. Insect traps baited with substances that give off odors attractive to the beetles are set up in various sections. The

traps are not expected to reduce noticeably the number of beetles, but serve to give an idea of the relative abundance of the insects in any particular area. In 1937 111,000 traps were set in 25 States scattered from Florida to Vermont.

On the basis of the past three years of trapping, it seems that the abundance of beetles in several of the locally-infested areas has decreased. This is especially noticeable in the middle western States. In St. Louis in 1934 the catch was 1,351 beetles; in 1935, 1,232; in 1936, 88; and in 1937 only one lone beetle, despite the fact that the trapping was more intensive than ever and that more than 12,000 traps were in use in that one region. In Detroit the catch fell from 128 in 1936 to 67 in 1937. In Chicago there were 3,740 beetles trapped in 1936, but only 384 in 1937.

This great reduction in the number of Japanese beetles trapped is a good indication that the number of beetles and resulting larvae in these particular areas is decreasing.

Treatment of turf with arsenate of lead is a necessary part of turf maintenance in the areas of continuous infestation and isolated places where the turf is definitely known to be infested by the Japanese beetle larvae. However, the above examples of reduced infestation indicate that there need not be any haste in poisoning golf courses as a precaution against Japanese beetle damage merely because the insects have been observed in the neighborhood.

An instructive article on the Japanese beetle and its habits is contained in a bulletin issued by the United States Department of Agriculture in December, 1934.

Chinch Bugs

CHINCH BUG injury to golf course turf has been recognized for many years. Recently this pest has become increasingly troublesome in eastern States, especially in rather restricted areas of New York, New Jersey, Connecticut, Pennsylvania and Ohio.

Three common varieties of chinch bugs—the common chinch bug (*Blissus leucopterus*), the hairy chinch bug (*Blissus leucopterus hirtus*) and the southern chinch bug (*Blissus leucopterus insularis*) — cause extensive damage to turfed areas and farm crops in the United States.

Until a few years ago these were all regarded as one type, but recent work has disclosed that the variety which causes severe injury to turf in the eastern States is more hairy in appearance and more difficult to control than the common one which attacks farm crops in the Middle West. Because of its hairy appearance it is commonly called the hairy chinch bug. This type is more vigorous, less susceptible to insecticides and able to withstand more moisture than the common farm chinch bug.

The common variety which is found in the Middle West, especially in the regions drained by the Mississippi, Missouri and Ohio Rivers, frequently causes severe damage to grain crops. However, injury to pastures and other turfed areas has been reported. The hairy chinch bug has been reported in the States along the Atlantic Coast, being abundant in Long Island and surrounding areas of New Jersey, Pennsylvania, Connecticut and occurring westward to Ohio.

The southern variety occurs in the extreme southeastern United States, especially in Florida, where it severely injures lawns and fairways.

Since the general distribution, life history, habits and methods of control when attacking turf are much the same, they will be discussed collectively.

Description and Habits

These pests are native to the United States and probably infested the native grasses when the white man first settled here. Chinch bugs are probably present in grassland every season, but escape attention because of their small size and habit of feeding near the ground. Unfavorable weather conditions may prevent serious outbreaks, and since the pest is not easily noticed its injury is usually attributed to other factors.

The adult chinch bug is slightly less than one-eighth inch long, and about one-half as broad as long, being oblong-oval in shape. The insect is black in color, with fine white markings. Its general appearance is a black fore part with the rest of its body dark gray. Its legs, beak and antennae are dark yellow to brown. The wing covers are white with brown veins. There are two adult forms, long-winged and short-winged. The short-winged, which is incapable of flight, is by far the more numerous, especially in the eastern variety.

Chinch bugs over-winter as adults under the shelter of grasses, leaves or other cover. In the spring after several days of warm weather the adults leave their winter quarters and settle in turfed areas. After a short period of feeding and mating, the females lay their eggs. Each female is capable of laying several hundred eggs

at the rate of 15 to 20 a day, requiring from three to four weeks to lay her full quota. These are laid on the stems of the grass close to the ground or, if the soil is loose, upon the roots just below the soil surface. The eggs are usually hatched in from one to five weeks, depending on the temperature. The young bugs are extremely small and are reddish in color, with a transverse band of white. As the insect grows it sheds its skin five times, becoming darker in color each time. This immature form has no wings and crawls from one place to another. In an infested area the insects can usually be found in all stages of growth.

There are two generations each season, except in the extreme South, where three to five generations usually develop. The first brood of the eastern and common variety hatches any time from April to the middle of June, and the second from mid-July to mid-September. Chinch bugs are readily distinguished from other small bugs infesting turf by their strong repugnant odor.

So far as is known, chinch bugs feed only on plants belonging to the grass family. They are sucking insects, obtaining their food by inserting a sharp beak-like organ into the plant tissues, where they suck out the plant sap in much the same manner as a mosquito feeds on animals. They never devour the foliage or the roots of the grass, which explains why stomach poisons such as lead arsenate are not effective in the control of the pest.

In the northern States the hairy chinch bug attacks bent grasses in preference to all others. Certain varieties of velvet bent grass, seaside creeping bent and redbud seem to be particularly susceptible to attacks. The southern species prefers St. Augustine grass. It also infests Bermuda and other grasses. Neglected areas such as sod nurseries are usually more infested than a closely-cut green. Approaches and areas surrounding greens often are severely attacked while the turf on the green is only moderately damaged. Injury usually first appears in high, dry or sandy locations that are exposed to direct sunlight. Areas surrounded by gravel drives or pavements are favorite locations for infestations.

Turf injured by chinch bugs somewhat resembles that suffering from soil moisture deficiency. The grass becomes shriveled and brown in many small spots, which enlarge as the injury increases. Usually there is a distinct border of yellowed grass immediately surrounding the browned areas. These spots are more or less circular and therefore are often confused with brownpatch or scald. The chinch bugs are usually found at the border of these areas, feeding on the grass just above the soil surface. Since this pest never attacks clover or broad-leaved weeds,

the death or weakened condition of the grass favors their growth in these areas.

The abundance and activities of chinch bugs are greatly influenced by the weather. They are active and easily found on warm, sunny days, but hide and are not easily detected during periods of cool, cloudy weather. Frequent heavy rains may destroy large numbers of newly-hatched bugs and cover the eggs with mud, which prevents their hatching. These storms may also prevent the female from laying her full quota of eggs. Severe outbreaks of chinch bug injury usually occur during seasons of less than normal rainfall. Warm, damp weather favors the rapid development of a white fungus which is very destructive to this insect. During prolonged or frequent periods of this weather the fungus practically keeps the pest under control.

Natural enemies such as parasitic insects and birds help to destroy the pest, but are not important factors in its control.

Methods of Control

The hairy chinch bug is less susceptible to the effects of the usual insecticides than are other turf insects. Because of its feeding habits, stomach poisons such as lead arsenate give no control. Contact sprays or dusts are usually resorted to with more or less success.

A spray that is frequently recommended consists of one-half ounce of four per cent. nicotine sulphate and two ounces of soap, dissolved in one gallon of water. The grass should be thoroughly soaked with the spray, as the liquid must come in contact with the bugs to be effective. Another spray that has been used consists of nicotine sulphate one gallon, soap three gallons, and water 300 gallons. This particular spray is applied at the rate of 150 gallons to 1,000 square feet.

In general, all dust treatments give a fair degree of control, with tobacco dust being the most satisfactory. Two applications of tobacco dust (one per cent. nicotine) per brood applied at the rate of 25 pounds to 1,000 square feet seem to give a fair degree of control. Certain sprays and dusts of derris, rotenone and pyrethrum are also effective if properly applied.

None of the treatments developed so far completely eradicates the pest. Its rapid reproduction and migration from untreated areas soon result in renewed heavy infestations, so that treatments must be repeated. The cost of these treatments limits their use to comparatively small areas.

The Use of Arsenate of Lead

THE larvae of Japanese and other beetles of Oriental origin as well as the larvae of our native June beetles often cause extensive damage to turf at this season of the year.

In areas where the Japanese and Oriental beetles are very common, such as in the seaboard States surrounding New Jersey, the safest practice to employ in protecting the turf is to apply lead arsenate to the turfed areas. Where the damage is caused by the larvae of some of our native beetles, it may be advisable to treat only the small infested areas. In either case, the question of how much lead arsenate to apply is raised.

Since the lead arsenate treatment is expensive, money is often wasted in applying much more than is necessary to definitely control these pests. On the other hand, money is sometimes wasted in not applying enough arsenate to control the larvae effectively. Often too light a treatment is of no value in controlling the pests, as the poison is not concentrated enough to control them. One-half a treatment will not kill one-half the grubs and may not even have any noticeable effect on lessening the injury.

The larvae of the native beetles usually do not reinfest an area year after year, but only cause damage in certain favorable years. This infestation is usually localized in relatively small spots on fairways and other turfed areas. The damage caused by these larvae is frequently remedied by merely fertilizing the infested areas.

The larvae are killed by taking the poisoned soil into their alimentary system while they are feeding on the grass roots or burrowing through the soil. The age and the activity of the larvae and the concentration of the poison in the soil determine the time required for the larvae to consume a fatal dose.

If there is too light a concentration of the lead arsenate in the soil the larvae may cause considerable injury before ingesting sufficient poison to kill them. However, very little damage is caused after the arsenic begins to affect the larvae, as they practically stop feeding and become flabby and discolored.

The lead arsenate only needs to be distributed through the upper few inches of soil. Some of the deeper burrowing larvae may live for several months before becoming poisoned, but they cause very little damage when they are not within three or four inches of the soil surface.

There seems to be a great variation in the amount of lead arsenate required to control these pests. Some greenkeepers report good control with a treatment of five pounds to 1,000 square

feet; others have not obtained control with as high as 15 pounds to 1,000 square feet.

Tests conducted by scientists of the United States Department of Agriculture have indicated that the amount of lead arsenate required to give effective control varies with the soil type. Soil texture seems to be an important factor. In general, control is obtained with lighter applications on sandy soils than soils of the heavier textures. The total and water-soluble plant food and the acidity or alkalinity of certain soils have been tested to determine their effect on the arsenate of lead treatments. The amount of water-soluble phosphates, calcium and magnesium in the soil are the most important factors other than texture influencing the effectiveness of the treatment. The greater the concentration of water-soluble phosphates and calcium in the soil when the lead arsenate is applied, the more effective is the treatment. Increasing concentrations of soluble magnesium decrease the effectiveness of the arsenate.

Inorganic fertilizers have generally been avoided when lead arsenate has just been applied. Investigations show that certain inorganic phosphates do not decrease but actually increase the effectiveness of the treatment. Any possible toxic effects of the arsenate to the turf may also be overcome by the application of inorganic phosphates.

Applications of lime except to correct excessive soil acidity should not be made, as the lead arsenate is more effective on acid soils and the direct effect of additional calcium is not known.

The application of other inorganic materials should be avoided until more definite conclusions are made as to their influence on the effectiveness of the lead arsenate treatment. These effects are now being studied by the workers in the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture.

The results obtained in some of these investigations indicate that the type of soil to be treated should be given consideration when an application of lead arsenate is to be made. The soil types usually vary greatly from one course to the next, making it difficult to state definitely the least expensive treatment that will give effective control. A safe and economical practice is to make an initial application at the rate of five pounds to 1,000 square feet. This amount gives effective control in the majority of cases. If control of the pest is not secured, repeated five-pound applications should be made until the larvae cause no further injury. The heavy-textured soils, those high in magnesium, or very alkaline soils should be the only ones needing treatments in addition to the original application.

Seasonal Reminders

Remove Excess Stolons

When creeping bent is growing vigorously during the spring months, an excess of stolons is produced on the surface, particularly in the case of certain undesirable strains. Unless the excess growth is removed or covered with top-dressing, the turf will develop an objectionable grain which will cause many complaints from players during the summer.

The best way to remove this excess growth is by raking or severe brushing, followed by close mowing. Such severe raking or brushing should be done not later than the end of May, while the grass is still growing vigorously and therefore is able to cover up scars quickly. Greens that have a tendency to produce objectionable grain should be given light brushings frequently throughout the summer. However, severe treatments should not be attempted during mid-summer.

Dollar spot

Dollar spot usually first appears during May in most bent-growing districts. Often the first attacks are neglected and make bad scars before fungicides are applied. The first attack of dollar spot should be the signal for applying a heavy dose of mercury fungicide. Even though the first attack may be slight, it is wise to use a heavy treatment of fungicide. If turf is protected by a generous dose of mercury in May, the succeeding attacks of dollar spot and brown patch are less likely to cause serious damage before additional treatments can be applied. The most economical and lasting of the mercury fungicides used to control dollar spot is calomel. The May treatment with calomel should be at the rate of three ounces to 1,000 square feet.

Excessive Watering

On most courses the watering of turf is begun in late April or May. Therefore, this is a good time to warn clubs that much serious damage to turf on putting greens during the summer is directly or indirectly attributable to excessive watering. If putting greens are kept soaked during May and early June, a shallow root system, which results from this practice, is almost certain to give the greenkeeper plenty of trouble during hot, sultry periods throughout the summer.

Crabgrass

Crabgrass usually starts its season in April or May. This pest is encouraged by a liberal supply of water and fertilizers if they are supplied between now and August. Therefore, to keep

crabgrass from smothering out permanent grasses, it is advisable to use fertilizers and water as sparingly as practicable during the next three months on areas where this weed is prevalent.

Brown patch

During the latter part of May or early June brown patch usually begins to appear. Whether or not it shows up in May, most greenkeepers can feel sure they will see it at least in June. Therefore, it is well to have a supply of fungicides on hand to use when this disease appears. In purchasing fungicides it is well to remember that the effectiveness of the group of mercury fungicides is primarily dependent on the amount of mercury each contains. The more soluble ones are more quickly effective and therefore more desirable for the control of brown patch. For this purpose, corrosive sublimate is the most effective and economical of the large number of fungicides that have been tested by the Green Section.

To prevent burning by any of the mercury fungicides during periods of unusually hot, sultry weather, it is well to reduce the dosage greatly. In the early-season treatments the dosage with corrosive sublimate (bichloride of mercury) may be as heavy as 3 ounces to 1,000 square feet, but in days of unusual heat and excessive moisture it is well to reduce the rate to 1 ounce and in some cases as low as one-half ounce of corrosive sublimate to 1,000 feet. Other fungicides should be reduced accordingly wherever they show a sufficient supply of mercury to permit of such reduction. Upon inquiry the Green Section will be glad to advise member clubs as to the relative effectiveness of the various brown patch fungicides on the market.

Turf Nurseries

Where a golf course is not equipped with an adequate turf nursery to provide sod for patching purposes, it is well to remember that there is no time like the present for breaking a piece of land and cultivating it during the summer months to have it ready for starting a nursery in early September. Turf nurseries may be considered a form of turf insurance. If something happens to a patch of grass in a putting green, it is very convenient to have readily available a piece of sod which has been maintained like the putting greens and which can be lifted and placed in the injured patch.

White Grubs

In May and June the adult beetle (May beetle or June bug) of the common white grub is

active and laying eggs for the next brood of white grubs. These well-known beetles spend the night in trees, where they feed on the young foliage. The females fly down to the turf particularly in the early-morning hours just before daylight, immediately burrow into the soil and deposit eggs. In a comparatively short time these eggs hatch and the young grubs start feeding on the grass roots, and become most destructive the following year. If they are sufficiently abundant, they greatly weaken or even kill the turf grasses.

These beetles seem to prefer the white or burr oak foliage and therefore are most abundant in groves of these trees. They are also found in such trees as hickory, poplar, elm, willow, locust, ash and walnut. The females ordinarily

do not fly far from the trees they inhabit. Therefore, the area of greatest grub infestation is invariably in the immediate vicinity of trees which have been heavily populated by beetles.

At this season of the year it is well to have members of the greenkeeping staff on the lookout for these beetles. The beetles fly to the trees about dusk and, if numerous, with the aid of a flashlight they may be seen flying around the trees during the early evening. Wherever they are observed in large numbers, it is well to anticipate grub injury within the next few months. Important turf in such infested areas may be treated with arsenate of lead at the rate of 5 pounds to 1,000 square feet during the summer to poison the young grubs before they do serious damage to the turf.

Questions and Answers

While most of the answers are of general application, it should be remembered that each recommendation is intended specifically for the locality designated at the end of the question.

Fairway Mowing Height

Q.—Shall we set our mowers as close as one inch for cutting fairways and lawns? (Ohio.)

A.—In general we find that bluegrass and fescue on fairways have been cut too close. Our recommendation is that mowers be set as high as the golfers will permit. The higher the fairway grass is cut, the better it will withstand adverse conditions. There naturally is a limit to the height that can be tolerated on fairways. Since this height is below that which is best from the standpoint of the grass, we make no specific recommendation as to height but simply urge that the mowers be raised as far as the players will allow, realizing that this will be decidedly different on various golf courses. Our experience has been that as the mowers are gradually raised, the players will tolerate longer grass and will actually find that the playing conditions will be greatly improved even though the roll of the ball will be less.

Old and New Stolons

Q.—Are stolons from a creeping bent nursery two years old as satisfactory as those from a new nursery? (Delaware.)

A.—Our experience has been that stolons from old nursery rows are somewhat slower in becoming established than stolons from new nursery rows. When once established, however, there is no apparent difference between the turf produced from stolons from old and new rows, provided there has been no heavy growth of seedling bent.

Home-Mixed Fertilizers as Compared with Commercial Fertilizers

Q.—What is your opinion as to the advisability of our mixing our own fertilizers? We are thinking of using a 6-12-4 fertilizer this season and are anxious to reduce its cost as much as possible. We are told by dealers that our own mixing will not be satisfactory, since prepared fertilizers sold by dealers contain many chemicals which grasses need which cannot satisfactorily be supplied when one attempts to make his own mixtures. (New York.)

A.—Apart from nitrogen, phosphorus, potash and calcium, plants use only minute quantities of other elements which commercial fertilizers contain. Except in special cases, soils throughout the northern humid area contain plenty of these rare elements, and hence they need not be considered in fertilizer practice in your part of the country. We have used a 6-12-4 fertilizer in our demonstration gardens and found it did very well for general fertilizing of both fairway and putting green turf.

Control of Pearlwort in Putting Greens

Q.—We are seeking information on the extermination of pearlwort in our putting greens. We should like to know what chemicals to use to kill this weed and the best method of applying them. (Oregon.)

A.—Pearlwort is common on courses with poorly drained greens. However, it is sometimes found growing under a wide variety of conditions and may occasionally prove trouble-

some where the best of drainage is provided. If pearlwort is found in a few scattered patches, it can be removed by replacing these areas with clean sod. Where it is growing rather generally over the greens, it would be impractical to plug it out. It would be well under the latter condition to attempt to burn it out with sulphate of ammonia. Pearlwort is more easily injured with this nitrogen fertilizer than turf grasses are, so that by applying enough of the sulphate of ammonia to give a slight burn to the grass the pearlwort will be badly injured. Such treatments repeated from time to time entirely kill out the pearlwort and will not permanently injure the greens, since the grass will quickly recover after each treatment. It is well to watch the progress of the burning closely so that water can be applied in case the turf shows signs of more than mild injury.

Green Dye for Turf

Q.—I should like to try the green dye I saw demonstrated at the Arlington turf garden on greens and should appreciate any information you can give me. (Ohio.)

A.—The use of dye for grass is still in the experimental stage. The dye consists of a combination of Malachite Green, Auramine O and Crystal Violet. The separate ingredients are obtainable from several chemical manufacturers. This dye is apparently perfectly harmless to grass and is not poisonous to man or to animals. Ordinarily one-half ounce dissolved in from two and one-half to 5 gallons of water will be found to give good coverage when sprayed over 1,000 square feet of turf. The dye comes off on balls when it is wet; therefore, it should be applied only at a time when it will dry fairly rapidly.

Chickweed in Putting Greens

Q.—Our putting greens contain many spots of chickweed. We have applied arsenate of lead recently for the control of earthworms. Will arsenate of lead control chickweed? (Indiana.)

A.—In many cases an application of arsenate of lead applied at the rate of five pounds to the 1,000 square feet has been sufficient to check chickweed. The action is a slow one, requiring at least two weeks. This treatment, however, is not always effective.

Repairing Turf Injured by Grubs

Q.—In some of our fairways there are many patches of dead turf where grubs have eaten the roots. I should appreciate your suggestions for repairing this damage and preventing similar grub injury in the future. (New York.)

A.—The injured areas should be seeded as soon as possible and rolled with a spike roller or raked lightly to work the seed into the soil and to aid in germination. If the beetles are abundant generally it would be well to poison all the fairways with arsenate of lead. A rate of five pounds to 1,000 square feet (200 pounds to the acre) is recommended. On some soils this is ample, but on other soils heavier applications may be necessary. If the grubs are found to be active after the treatment, it is an indication that the rate was insufficient for your soil. However, another application may be made before serious injury to turf develops. The effectiveness of the first application may be determined by lifting sods in several places in areas where the beetles have been numerous.

Controlling Annual Bluegrass in Putting Greens

Q.—Several of our bent greens are badly spotted with annual bluegrass and each year this grass is spreading. How should we treat these greens? (Kansas.)

A.—Annual bluegrass (*Poa annua*) is probably the hardest of all grasses or weeds to remove from a putting green; in fact, when it becomes pretty well distributed throughout a green it is less expensive to remove the turf entirely and replant than to try to weed it from the green. When it first appears, turf containing spots of annual bluegrass should be removed and pure bent turf replaced. This is a good method for keeping greens free from it, but is an expensive procedure where conditions are favorable to annual bluegrass. If, however, in the meantime the annual bluegrass has gone to seed, countless seeds will germinate the following spring and fall. In order to prevent a putting green from becoming infested with annual bluegrass, in constructing the green, care should also be taken to see that the compost used for topdressing is free from the seeds of this grass. Methods of obtaining topdressing material free from weed seeds are outlined in The Bulletin of the United States Golf Association Green Section for August and September, 1930. In some places many old greens which are full of annual bluegrass are giving satisfactory results.

Inexpensive Fertilizing Material

Q.—I have recently been fortunate in obtaining a good supply of hen droppings from a neighbor close by the club for the cost of carting it away. To date I have worked them in the compost pile. I plan to spread the droppings on the fairways, let them dry, and then drag a mat by means of the tractor to work them in. Will there be any danger from a burn? (Massachusetts.)

A.—The hen manure you have been mixing in your compost pile should give you a good grade of compost. Fresh hen droppings when applied to fairway turf are likely to burn if used in excess. By going over the fairways with a mat, as you suggest, it would be possible to break the material into finer particles, but you still might observe considerable burning. However, the grass would soon recover and you would get decided benefits from the manure. Probably you should make a trial of this material on a small scale until you have determined what

is a safe amount that can be used. We suggest that you apply it only at times when the grass is thoroughly dry and during cool weather, especially in early spring. If you could run the material through a shredder, you no doubt could distribute the material with less likelihood of burning. However, the cost would be greater and, after all, the small amount of burning you may experience may not be objectionable. There is also the likelihood of objections to the feathers and other litter on the course, but the final beneficial effect on the grass should offset this temporary inconvenience to the players.

Report of the 1937 Green Section Committee

FRANK M. HARDT, *Chairman*

DURING 1937 a large amount of correspondence was handled and many reports were made to member clubs on visits to courses and on materials submitted for examination, including samples of soils, grasses, fertilizers, seed, insects and peat. A considerable amount of technical information in literature was located for various clubs and organizations, and consultations were had with technical workers in the United States Department of Agriculture on special questions raised by club officials or through experimental work. Many conferences were held with greenkeepers and chairmen of green committees. A number of articles were prepared for golf magazines and publications interested in turf culture.

Dr. John Monteith, Jr., Chief of the Green Section staff, visited 59 clubs in 19 States from the Atlantic to the Pacific, attended the Fourth International Grassland Congress in Wales, and inspected turf improvement work in Europe.

During the visits to courses here a great variety of conditions requiring special attention were found, which included:

On Putting Greens

Problems arising from disease, insects, earthworms, rodents, weeds, poor physical condition of soil, layers of different materials, poor drainage, faulty watering methods, unsuitable grasses, improper fertilization, grain or nap, unsuitable topdressing methods, etc.

On Fairways and Tees

Problems arising from disease, insects, earthworms, rodents, weeds, poor or thin soil, faulty fertilizing practices, inadequate or excessive watering, unsuitable grass mixtures, poor drainage, etc.

Various tested methods for remedying the defects mentioned above were recommended. Ap-

proximately 2,000 letters were sent to member clubs with reports on courses visited, materials examined or methods advocated.

Experimental work at the Arlington turf garden was considerably expanded. The areas devoted to tests of various strains of putting green grasses as well as the old putting green fertilizer series which had to be abandoned a few years ago were planted again in the spring. A new series of plots was also planted to test the relative value of special strains of Kentucky bluegrass, fescue and rough bluegrass for use on tees and fairways. Another section was planted to test the merits of different strains of Bermuda grass and Zoysia grass. Experimental work on chemical weed-killers was continued this year at Arlington and on nearby golf courses. Experiments were conducted with new methods to destroy weed seed in compost.

Grasses

Various species and strains of grasses suitable for turf are tested at Arlington under comparable conditions. Most of these grasses were newly planted in turf this year and will have to be observed at least three years before we will feel safe in recommending them. The number of plots devoted to these tests is listed below:

Creeping bent	186
Velvet bent	117
Colonial bent	28
Kentucky bluegrass	48
Zoysia	25
Bermuda	8
Fescue	8
Poa trivialis	8
Timothy	2

430

In addition to the above plots, a co-operative test has been planted by our staff on a local golf

course using 11 of our most promising creeping bent strains. The test will enable us to observe them under actual playing conditions without any maintenance cost to us.

Grass nurseries have been established for growing the necessary supply of planting material and for the elementary test of many grasses. One large greenhouse unit has been placed at our disposal by the Bureau of Plant Industry for grass work. Last winter it was used and again this winter it will be used for speeding up the propagation of planting material of our most promising grasses. We have also supplied planting stock from our nurseries to numerous member clubs. The following different varieties and strains of grasses are grown in nurseries and greenhouse:

Fescue	83
Creeping bent	32
Kentucky bluegrass	38
Velvet bent	22
Poa trivialis	28
Zoysia	5
Bermuda	5

213

Fertilizers

The effect of fertilizers on putting green and fairway turf is studied on 120 plots. This work includes not only observations as to immediate response of grass to fertilizers but also the effect of accumulations of harmful or beneficial residues of fertilizers or materials applied with them.

Weed Control

In response to increased interest in weed control with economical chemical methods, we have conducted 85 series of experiments at Arlington this year. Each of these tests involves from four to 100 plots with different treatments. A large number of samples of chemicals was prepared at Arlington for shipment to member clubs co-operating with us in these weed control investigations.

On many courses it is difficult to obtain weed-free topdressing for putting greens at reasonable cost. Therefore, this year we have conducted a number of experiments to develop more eco-

nomical methods for destroying weed seed in compost.

Disease Control

The amount of disease control work at Arlington had to be curtailed this year. Nevertheless, 48 plots were devoted to tests with different chemicals. Most of these plots received several treatments.

Soil Improvement

The soil improvement series, consisting of 50 plots, which was started several years ago, was continued this season.

The Green Section took part in a number of educational programs ranging from greenkeepers' short courses to informal gatherings of greenkeepers and others interested in turf maintenance. Such programs were held in Los Angeles, San Francisco, Portland, Seattle, Denver, Kansas City, St. Louis, Chicago, Lansing, Mich., Detroit, Cincinnati, Cleveland, Bridgeport, Conn., Albany and Tuckahoe, N. Y., New Brunswick, N. J., Haverford and Valley Forge, Pa., Baltimore and Washington.

A turf garden was planted at Atlanta, Ga., in co-operation with the Atlanta Athletic Club. The planting material for the garden was prepared at Arlington. The planting was supervised by us.

Since facilities at Arlington are not adequate nor sufficiently varied for all our tests and as some types of tests can be more economically handled on golf courses, we have conducted a large number of tests on golf courses in Washington and other cities. These tests include grasses, fertilizers and weed control methods.

In February, 1937, Mr. A. E. Rabbitt joined the Green Section staff, coming to us from the College of Agriculture of the University of Maryland. Mr. H. F. A. North, who joined our staff in 1936, left our organization in October to take up other activities. In October, Mr. John W. Bengtson, a recent graduate of the College of Agriculture of the University of Nebraska, was added to our staff.

Continuation of experimental work now under way is assured by the size of the Green Section Reserve Fund, which is composed of unexpended portions of annual appropriations by the Executive Committee to the Green Section.