THE BULLETIN

of the

UNITED STATES GOLF ASSOCIATION GREEN SECTION

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Contents

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Annual Report of the Green Section for 1931

By Ganson Depew

Chairman, Executive Committee

During the past year several important changes have occurred in the personnel of the three committees of the Green Section. By far the most important was occasioned by the death of Dr. R. A. Oakley, at Monrovia, Calif., August 6 last. Doctor Oakley, with the late Dr. C. V. Piper, was largely instrumental in the establishment of the Green Section, and in its work as chairman of the Research Committee he took a very active part until incapacitated by illness. A great debt of gratitude is due Doctor Oakley for his valuable services for more than 15 years. His place has been taken by Dr. K. F. Kellerman, associate chief of the Bureau of Plant Industry of the United States Department of Agriculture, who is giving the greatest possible cooperation. Wynant D. Vanderpool, who for a number of years was the able and efficient chairman of the Executive Committee of the Green Section, resigned as chairman, but we are fortunate in still having the benefit of his services in his willingness to remain on the committee. To the Research Committee were added three scientists of the United States Department of Agriculture: F. H. Hillman, botanist, seed investigations; Oswald Schreiner, principal biochemist in charge, soil fertility; and W. R. Walton, senior entomologist, cereal and forage insects. Several changes were made in the Advisory Committee, including the addition of the following names: Douglas Call, Richmond, Va.; A. J. Goetz, Webster Groves, Mo.; William Harig, Cincinnati, Ohio; J. McRae Hartgering, Detroit, Mich.; Guy M. Peters, Chicago, Ill.; John Morley, Youngstown, Ohio; Alex Pirie, Fort Sheridan, Ill.; William J. Rockefeller, Toledo, Ohio; George Sargent, Columbus, Ohio; John Shanahan, West Newton, Mass. The last five are greenkeepers placed on the Advisory Committee for the first time and whose cooperation will mean much to the work and problems of the Green Section in the future.

During the year it was necessary for the Green Section to operate on a budget which was much below the budget allowance for 1930. Certain economies were, however, effected and it was thus made possible for the Green Section to function satisfactorily in spite of the handicap of a reduced appropriation.

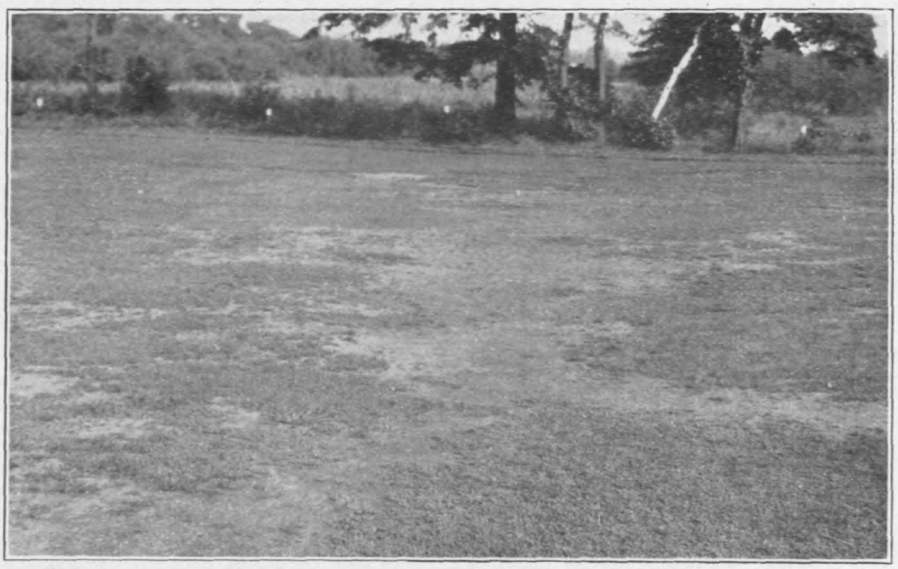
A careful perusal of the following report of the activities of the Green Section prepared by John Monteith, Jr., will show the value of a membership in the United States Golf Association or will prompt clubs to join in order to obtain for the small dues of $30 a year the information and services given by the Green Section in promoting better turf conditions and economy of maintenance.

General Activities of the Green Section During the Year

The summer of 1931 proved to be an extremely difficult one from the standpoint of turf maintenance in many parts of the country. The extremely high temperature prevailing over long periods, coupled with unusual epidemics of diseases and insect pests, resulted in widespread havoc on golf courses over a wide range of territory. The extensive damage to turf brought about an extremely heavy demand for advice

from the Green Section's staff. There was also an increased demand for the Green Section's advice on the relative efficiency of certain materials used on golf courses, probably due to the need for more effective use of limited funds available for golf course maintenance in the past season. The Green Section's staff was able to take care of most of the increased demands for its service.

The general activities of the Green Section were in most respects similar to those of previous years. Those activities naturally fall into three major divisions: research, educational, and advisory service. The principal research of the Green Section has been conducted at Washington, Chicago, and Madison, Wis. The Green Section continued its annual contribution of $1,000 to the turf research work



Dead turf on the fairway of an eastern golf course representing a type of injury commonly found on golf courses during the summer of 1931

being conducted at the New Jersey State Agricultural Experiment Station, New Brunswick, N. J. Our educational work has been carried on through various Green Section meetings and exhibits, publication of our Bulletin as well as material in certain private publications pertaining to golf, and numerous educational programs in which the Green Section's staff has participated upon invitation of sectional greenkeeping organizations and officials of college short courses in greenkeeping. The advisory service has been carried on chiefly through correspondence, but as much as could be handled by the limited staff of the Green Section has been conducted by personal interviews either on golf courses or in the Green Section's office or laboratories. By means of this service member clubs have their individual problems analyzed and special procedures are outlined. During the year a large proportion of the clubs which are members of the United States Golf Association have availed themselves of the opportunity to have the Green Section's staff render reports on seed or soil analyses and give advice as to seeding, fertilizing, watering,

mowing, and innumerable other problems confronting those who care for our golf courses. The special activities of the Green Section for the year are given below.

Arlington Turf Garden

Experimental work at the Arlington turf garden was continued on the old garden and was supplemented with various tests on a new garden planted in a shaded area close to the Potomac River. As the result of the establishment of this new garden an opportunity was provided to make observations on similar grasses and treatments on turf growing on a low protected area in comparison with the turf grown on the high wind-swept locality of the old turf garden. It is hoped that as these tests are continued certain fundamental information will become available as to the best maintenance procedure for golf course turf growing under such distinctly different conditions.

During the year interesting observations were made on different strains and species of grass maintained for putting green purposes. Many of the strains of bent grass were severely damaged during the summer months in spite of every effort to control diseases. The greatest damage of the year among the bents occurred in certain strains of velvet bent. While many of the selected strains of velvet bent were almost entirely destroyed during the summer, there were other selections which withstood the summer remarkably well. Their behavior this year further emphasized the need for continued study of strains of velvet bent before they can be recommended for general planting on putting greens. Some of the well-known strains of creeping bent on the turf garden withstood the summer's tests in excellent condition. The unusual prevalence of diseases on the garden throughout the summer provided an excellent opportunity for experiments on their more effective control. The remedies for brown-patch control, devised and recommended by the Green Section in previous years, continued to prove the most effective remedies for both the large and small types of brown-patch. New information was obtained on the control of leaf-spot and Pythium. Further study, however, is needed before treatments for these diseases can be recommended for general use.

The systematic study of fertilizers and grasses, top-dressing, weed control, and other problems at the turf garden which has been under way for several years, was continued. In conjunction with the turf-garden work a study of the relationship of the acidity of soil to the growth of bent grass was conducted at the Arlington experiment farm. This work was carried on in one of the greenhouses of the United States Department of Agriculture during the winter and spring months and continued outdoors through the summer. Studies in nutrition were carried on with other grasses and much useful information was obtained from this work. It is expected that some of the results obtained from these studies will be published in the Bulletin in the near future.

Mid-West Turf Garden

The Mid-West turf garden, which is now three years old, is located at Everett (West Lake Forest), Ill. The work at this garden

was carried on in much the same manner as the work at Arlington, but there are on this garden different sets of tests to supplement the work conducted at the Arlington turf garden. Various tests with different fertilizers and grasses, as well as the height-of-cut experiments and other studies under way at that garden, were continued throughout the year and furnished additional information of value in the general understanding of turf problems, particularly those of the Middle West.

During the year the Botany Department of the University of Chicago continued its cooperation with the Green Section in providing laboratory and greenhouse facilities for a member of the Green Section's staff. The study of the effect of cutting grasses to different heights was continued at the University of Chicago and also at the Mid-West turf garden. Some of the preliminary results of these studies have recently been published in *Plant Physiology,* as well as in the Bulletin for November, 1931.

Demonstration Gardens

A series of demonstration turf gardens which was started in 1928 on golf courses in several states continued to provide much information for those interested in turf maintenance on courses in the vicinity of these gardens. Another garden of this series was planted in October, 1931, on the course of the Pine Valley Golf Club, Clementon, N. J. The Green Section had the opportunity during the season to render assistance to the Royal Canadian Golf Association in establishing one of these demonstration gardens on the course of the Royal York Golf Club near Toronto. The Green Section has had splendid cooperation from those in charge of the courses where these demonstration gardens are located. Extensive reports of the condition of 19 gardens have been received regularly this year and the main features of these reports have been consolidated and published in the Bulletin, where they are available to all member clubs of the United States Golf Association. The demonstration gardens continued to attract much attention from local turf enthusiasts and have been examined by large numbers of visitors during the year. Well-attended gatherings of golf club officials and greenkeepers have been held at the gardens and the behavior of the different grasses, fertilizers, and other treatments has been discussed on the grounds. At many of these meetings members of the Green Section's staff have been present to explain the work. It has been found that discussions of turf problems are much more valuable where such demonstrations are at hand than are discussions of similar problems indoors, where direct examples of results cannot be exhibited.

Green Section Meetings

The Green Section held no regular indoor meeting during the winter, as was customary in previous years. Instead an exhibit of the Green Section's activities was presented at the annual meeting of the United States Golf Association held in New York on January 10. This exhibit included a display of different types of fertilizers, seeds, soils, and other materials of interest in turf maintenance.

A series of outdoor meetings was held during the year as follows:

April 3. Bay Shore Golf Club, Miami Beach, Fla.
July 7. Lochmoor Club, Detroit, Mich.
July 20. Arlington Turf Garden, Arlington, Va.
July 27. Charles River Country Club, Boston, Mass.
Aug. 3. Philadelphia Country Club (Spring Mill Course), West Conshohocken, Pa.
Aug. 4. Oakmont Country Club, Pittsburgh, Pa.
Aug. 10. Century Country Club, White Plains, N. Y.
Aug. 17. Sedgefield Country Club, Greensboro, N. C.
Aug. 19. Country Club of Virginia (James River Course), Richmond, Va.
Aug. 26. Hyde Park Golf and Country Club, Cincinnati, Ohio.
Aug. 28. Indian Trails Golf Course, Grand Rapids, Mich.
Aug. 31. Mid-West Turf Garden, Mill Road Farm Golf Course, Everett, Ill.
Sept. 8. Westwood Country Club, St. Louis, Mo.
Sept. 10. Tulsa Country Club, Tulsa, Okla.
Sept. 24. Municipal Golf Course, Niagara Falls, N. Y.

The Green Section's first southern meeting. Held at the demonstration garden on the Bay Shore Golf Course, Miami Beach, Fla., April 3, 1931

Nearly 1,200 persons interested in turf maintenance attended these meetings. The attendance at these outdoor meetings exceeded that of any previous year and there are ample indications that this type of meeting is becoming more and more valuable in carrying the Green Section's work to its member clubs, where it can be applied to the general betterment of playing conditions. The meeting on the course of the Bay Shore Golf Club, Miami Beach, Fla., marked the first Green Section meeting of this type held in the South. When its finances permit, the Green Section's staff will visit the Pacific Coast to organize meetings in that part of the country.

In addition to the above meetings sponsored by the Green Section, members of the staff of the Green Section were present at various other local gatherings of chairmen of green committees and greenkeepers.

Greenkeepers' Short Courses

Last winter the Green Section's staff took part in the programs of the greenkeepers' short courses which were given by the Pennsylvania State College, State College, Pa.; University of Wisconsin, Madison, Wis.; and Michigan State College of Agriculture, East Lansing, Mich. The Green Section welcomed the opportunity to cooperate with these institutions in connection with their constructive educational programs in turf maintenance.

The scarred surface of a St. Louis putting green, indicating the damage occurring on turf in the Middle West during the past season

Correspondence and Service to Member Clubs

During the year the Green Section's office in Washington conducted an unusually large amount of correspondence and service to member clubs. The usual difficulties experienced this past summer in maintaining turf throughout much of the country, particularly throughout much of the Middle West and southern portions of the bent-grass region, resulted in an exceptionally large number of inquiries from member clubs. The increased demand on the time of the Green Section's staff in attendance at the summer meetings resulted in an accumulation of unanswered correspondence in the Washington office, with the result that some delay was occasioned in replying to many of our member clubs which sought information. As far as it was possible, however, these requests for service were handled promptly. A good many samples of soil and seed were examined and reports rendered to member clubs. The Green Section's staff visited a large number of courses on request and gave advice on numerous turf problems. Due to the limited staff of the Green Section and the increased demand for advice through correspondence it was found necessary to refuse many requests for personal visits to courses to give advice on turf maintenance problems. During 1931

members of our technical staff visited courses located in Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Virginia, West Virginia, and Wisconsin. On the invitation of officials of the Royal Canadian Golf Association brief visits were also made to Montreal and Toronto. Steps are now being taken which will bring the green sections of our associations in much closer touch and cooperation with each other in the interests of better turf conditions and the more economical maintenance of golf courses.

GREEN SECTION BULLETIN

During 1930 the publication of the monthly Bulletin of the Green Section fell behind its regular schedule, due to illness of the editorial staff and certain increased demands on the time of the Green Section's personnel. Since the Bulletin does not pretend to be a publication for news items but is devoted primarily to information which is of permanent value, it was felt advisable to allow its publication to be delayed rather than to delay the more pressing needs of experimental work and service to member clubs. At the beginning of 1931 the publication was several numbers behind schedule. During 1931 the remaining numbers of 1930 were published as well as the complete volume for 1931, containing the usual number of pages. The plan of the publication this year has been the same as in the past three years; that is, related material is grouped in the individual numbers and in some cases in consecutive numbers. This system of grouping articles on related subjects makes the Bulletin much more convenient for ready reference at later time for readers who wish to look up material in back numbers. It also facilitates the work of the Washington office in answering correspondence, because when some one writes for information on a subject such as fertilizers, water systems, golf course construction, and the like, he can be furnished with a copy of the Bulletin containing a thorough discussion of the subjects by both practical and scientific men.

Cooperative use of equipment is being practiced by farmers and may possess advantages for golf courses. Farmers with relatively small acreage in fruit or vegetables find that the purchase of expensive spraying equipment results in an overhead charge scarcely justifiable for the short period of the year over which the equipment is used. Groups of farmers have accordingly cooperated in the purchase and use of spraying equipment. Eight or ten farmers in one of these groups may by this means secure the benefit of the best modern equipment handled by men who are thoroughly competent, at a fraction of the original cost. Considerable advantages are derived from such a system, and the small producer is enabled to increase his crop yields by means of efficient spraying, at a reasonable expense and at the proper time. The idea suggests possibilities for neighboring golf clubs, where the burden of expense can be shared by several clubs rather than individually in the purchase and use of expensive equipment which is only occasionally needed.

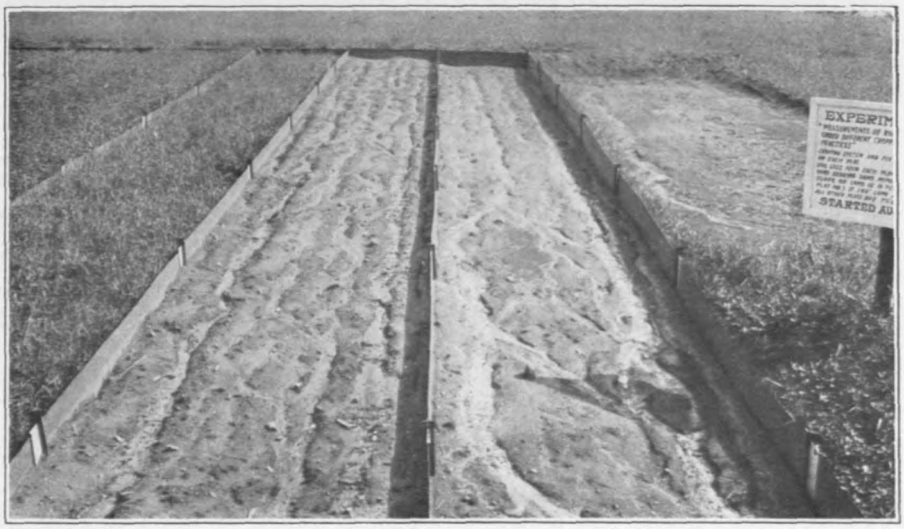
Checking Gully Erosion on Golf Courses

By R. E. Uhland
Superintendent, Soil Erosion Experiment Station, Bethany, Mo.

No one will deny that good greens and fairways are essential to a good game of golf. It is unfortunate to find numerous ditches or gullies of variable sizes crossing golf courses, yet we find many of them. These washes not only provide unwarranted and annoying hazards, but are objectionable because they increase steadily, both in size and number, unless they are constantly watched. Many originally attractive courses have been practically ruined because these gullies were not checked when they were small.

Although soil erosion has been going on since the beginning of time, it is only recently that the United States Department of Agriculture and the state institutions have inaugurated a thoroughgoing program of research relating to ways and means for controlling this costly, man-induced evil. Fully 75 per cent of the agricultural lands in the United States are suffering in some degree from erosion. Cultivating the soil intensifies erosion in much the same manner that stirring a fire hastens its burning.

This unsightly gully on a golf course was caused largely by the runoff from a 12-acre cultivated field located above the course



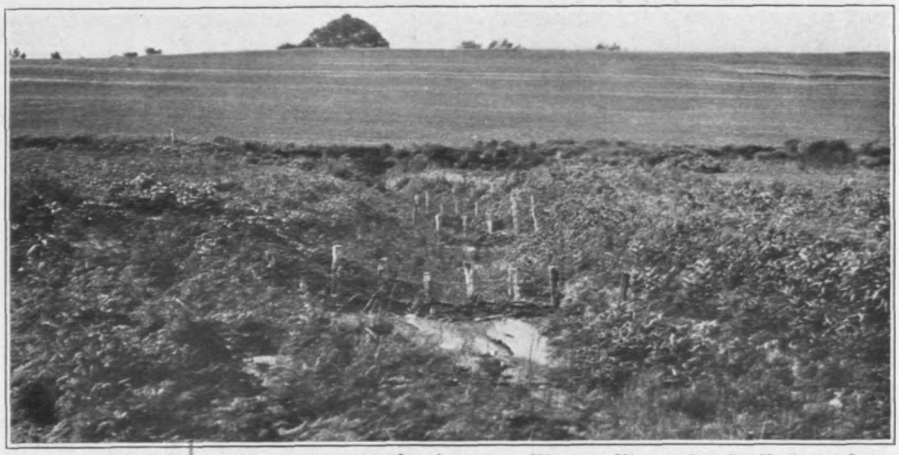
The small plots on the right indicate how severely soil erodes when it is cultivated in the absence of a crop. In four months' time (June 1 to October 1) one of these plots lost soil at the rate of 86 tons an acre. During the same period grass plots lost less than ½ ton an acre

It probably can be safely estimated that at least 80 to 90 per cent of the golf courses of the United States and Canada are located on land which, if cultivated, would quickly suffer seriously from erosion. Many of the slopes are so steep that they would surface-erode and gully badly. Fortunately, however, golf courses are kept sodded. Grass has proved to be one of the most effective instruments we know of for controlling sheet erosion. Not only is the percentage of runoff from good grass land much lower than the loss of rain water from cultivated land, but the soil loss is extremely low, whereas on cultivated land it is alarmingly great. It is perhaps unnecessary to state that the better the growth of sod the more effective it is in checking runoff and erosion. Liberal fertilization of the course, particularly on the thinner spots, will aid materially in establishing a better mat of turf grasses, and at the same time decrease erosion. The particular fertilizer and rate of application will, of course, vary with the section of country and the kind of grass used, since the different grasses and the different types of soil may require different kinds of fertilizers.

The formation of gullies can be checked by sodded dams constructed by placing burlap bags filled with sod in any depression which serves as a channel for conveying the runoff from a field terrace on a higher slope. This is a wide depression and thus required a great number of bags

In the early spring when the frost begins to leave the ground and when the frequent rains occur, small gullies will form even on courses with such grasses as Kentucky bluegrass and the various bent grasses, especially where the slopes are steep and where large volumes of water accumulate. The use of barriers made of burlap bags filled with good sod of grasses similar to those used on the golf course will prove effective in checking these small gullies that have already developed and will aid in preventing others from forming. This is proving a cheap and effective method of checking washes in meadows, fields of small grains, and pastures in the Corn Belt, and should prove equally beneficial on golf courses of the same region, and probably also in many other parts of the United States. Old burlap feed or fertilizer bags are filled about one-third to one-half full of sod containing plenty of soil on its roots. The sod can best be cut in 8- or 10-inch squares 4 or 5 inches thick. The soil and roots should always be placed down and the grass up. After the bags are filled and securely tied they are

ready to be placed in the small washes or depressions where the water accumulates and where erosional cutting is likely to occur. The number of bags needed to form one of these barriers will vary with the size of the wash, but usually from three to five bags will make an effective barrier. In placing the bags in the washes, care should be taken to place the center bag or bags slightly downstream from the adjoining bags so as to be sure to keep the water in the center of the cut rather than send it around the sides. The best time to use these bags is in early spring. The grass soon grows through the coarse meshes of the bags and in a short time a dam is formed. By midsummer the bag will no longer be noticed, as it will soon rot and waste away, leaving a sodded living dam which, if watched, will continue to hold the wash in check. This method of erosion control is discussed in United States Department of Agriculture Leaflet No. 82.



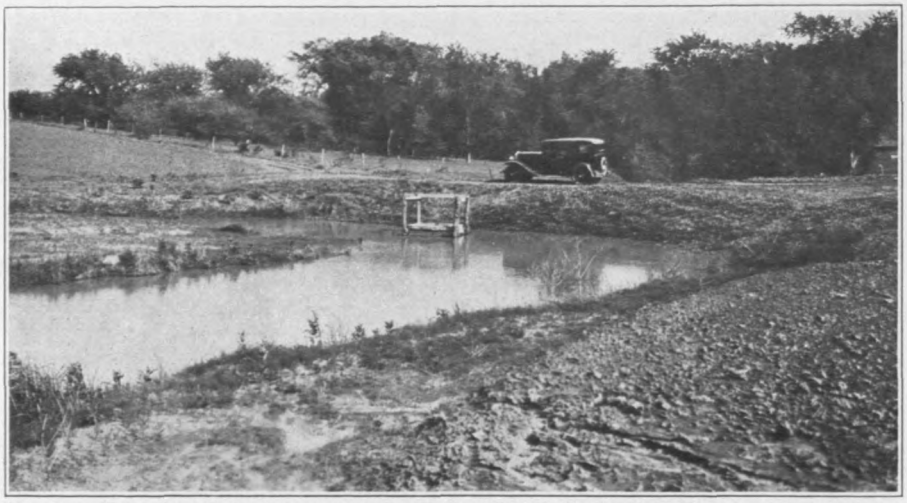
Woven-wire checks prove very effective in controlling gullies. Good fills have been secured above each of these barriers

There will be washes, however, which are too large for effective control with these sod barriers. In such instances barriers made of woven wire can be used effectively. As in placing the sod barriers, these woven-wire checks when finished should be V-shaped so the water will be directed to the center of the gully. A little straw or trash placed above will fill the meshes sufficiently to collect the soil that would otherwise be carried down the channel. If these checks are properly constructed and the posts painted, they need not detract from the appearance of the golf course.

Effective woven-wire barriers can also be made by simply stretching a heavy wire cable across the gully and attaching to it one end of the woven wire. The other end is placed upstream a few feet, where it is buried in the ground. The cable is left loose enough to allow the center to sag slightly and thus keep the water to the center of the gully. This type of gully-check is cheaply constructed and is an effective method of filling and stabilizing gullies.

If the gully has already attained such size that woven-wire checks obviously would not prove satisfactory, a soil-saving dam made of earth and supplied with a drop-inlet and culvert should be used. The

dam causes the water to pool above it and thus deposit its load of silt before the water flows into the upright entrance to the culvert. In constructing such a dam it is essential that the drop-inlet and culvert be of sufficient size to carry the maximum runoff to be expected from the watershed drained by the gully. By making the dam broad enough it can easily be used as a bridge. If a small drainage tile is run up the gully, along the bottom, some distance from the intake culvert, adequate drainage will be provided to allow grass to grow on the alluvial filling caught above the dam. In some places, especially where a dam is located near the boundary of a golf course, it may be preferable to allow the water to remain as a pond above the dam, since pools of this kind may actually add to the attractiveness of the grounds.



Large soil-saving dam in use on the Federal and State Soil Erosion Experiment Station near Bethany, Mo. A fill of more than 4 feet of soil has already formed above this dam

On soils which have soft substrata, gullies often work their way up the slopes into the golf courses from lower-lying adjoining areas. It is this type of gully that can not be controlled, usually, by processes of sodding, so that other control measures must be resorted to. The use of black locust trees in such washes proves quite inexpensive and effective. The banks should first be plowed off so that the slope is sufficiently reduced to allow the setting of the small seedling trees. These trees grow rapidly and if properly pruned will not only stabilize these steep and unslightly banks but will also allow grass to grow between them, which is not possible with most types of trees when they are set closely. By thus stabilizing the steep, unsightly banks, the progress of these gullies will be arrested. The checking of such large gullies will aid materially in preventing the formation of numerous smaller branching gullies.

On many golf courses the problem of erosion control is much more complicated because of the fact that areas adjacent to the course may drain down upon them, supplying sufficient extra water, flowing at

an accelerated velocity to cut out bad gullies, which are decidedly difficult to control. An example of such erosion is indicated by the picture on the first page of this article. A rather steep slope of about 12 acres which lies above this golf course had been cropped to corn annually for a number of years. As might be expected, this area had been eroded severely and the runoff water from the cornfield had been to a large degree responsible for the formation of the deep gully. This same difficulty has been noted on numerous courses throughout the Corn Belt states.

Use of black locust trees for stabilizing a bad gully on the Federal and State Soil Erosion Experiment Station near Bethany, Mo.

An effective way of preventing or checking such damage is to terrace the area above the golf course. A complication arises here, in that the field is seldom owned by the golf club. Many of the farmers who own land bordering golf courses can, however, be induced to terrace their land. Such a measure would not only render direct service to the farmer, by lessening the washing of his field, but at the same time would go far toward controlling excessive washing on the golf course. Undoubtedly there are many golf courses where the local club can profitably encourage such control measures. The club may even find it advisable to help finance the terracing of the adjoining field in order to divert any inflow of water which may greatly increase the hazard of gully formation on its grounds.

There may be cases in which it is impossible or at least impractical to get the cooperation of the landowner adjoining the golf course, thus making it necessary to resort to some other means of erosion control. In some places the construction of a diversion ditch inside the property line may prove advisable. The method for the control of this type of erosion trouble will naturally have to be worked out for the individual courses.

Rake up the dead leaves in the woods at the end of winter and put them in the compost piles.

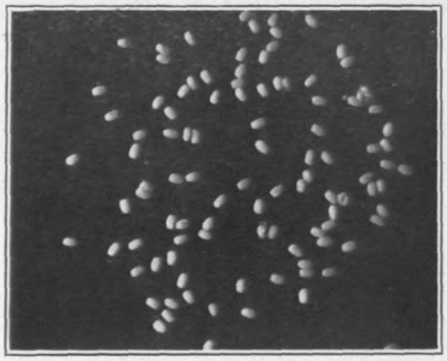
Sod Webworms and Their Control

By W. B. Noble

Bureau of Entomology, United States Department of Agriculture

The serious and widespread injury to golf greens and lawns by sod webworms during the summer of 1931 aroused much curiosity as to the source of these worms, what they are, and measures for getting rid of them. They are present every year, but ordinarily not in sufficient number to attract attention. It was thought that their unusual abundance in 1931 was probably due to their gradual concentration in artificially-watered areas of grass during the recent dry summers and the unusually high survival of overwintering forms as a result of the mildness of the weather of the preceding winter. It may be that there will not be another such extensive outbreak for years. At any rate, during the summer of 1931 at least two very promising treatments were discovered for the prompt and effective control of these webworms should another outbreak occur.

Sod webworms are the larvae or young of certain small, whitish moths or millers frequently observed flying about over grass-covered areas, particularly during the early evening. There are some 60 to 80 kinds of webworms in the United States, all similar in both the young and the adult stages. The moths have a characteristic habit of folding their wings close about their bodies when at rest, this peculiarity having earned for the entire group the name "close-wing moths." Scientifically, they are known as members of the genus Crambus.



Eggs of the webworm moth (Crambus teterrellus)

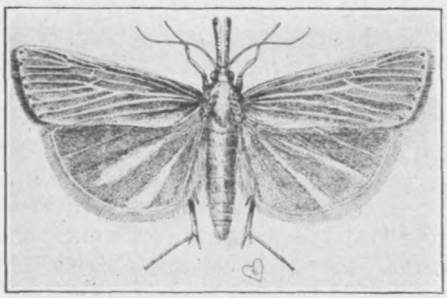
Pupa of bluegrass webworm (Crambus teterrellus)

Practically all of the webworms feed on grasses. Only about a dozen species, however, are of economic importance, the remainder either attacking unimportant wild grasses or occurring so rarely as never to become pests.

Their eggs resemble tiny cream-colored beads and are dropped at random by the female moths as they fly about over the grass. They fall among the grass stems and there hatch in a week or 10 days. The young worms feed on the grass leaves and start at once to form protective silken webs or nets; within these they remain during their larval life and from them derive the name "webworm." As the worms become larger they construct, close to the surface of the soil, little

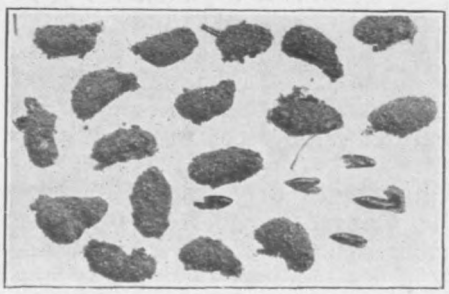
burrows or tunnels covered with bits of dirt, lined with silk, and reinforced with their excrement and with pieces of grass. They now cut off the blades of grass entirely and drag them into the burrows, where they feed in safety and at leisure.

When the larvae have completed their growth and become about three-fourths of an inch in length they leave their burrows and construct silken cocoons just beneath the surface of the soil. In these cocoons the worms change to the chrysalid or pupal stage. They may do this within a few days, or not for several months, depending on the species. The pupa is a narrowly oval, reddish-brown, helpless object which remains quiescent in the cocoon until the adult moth is fully formed. Usually in from 10 days to two weeks the moth emerges from the pupa or chrysalis and forces its way from the cocoon to the open air. Within a few minutes the moth's wings are spread and dried and it is ready to mate and thus beget a new generation.

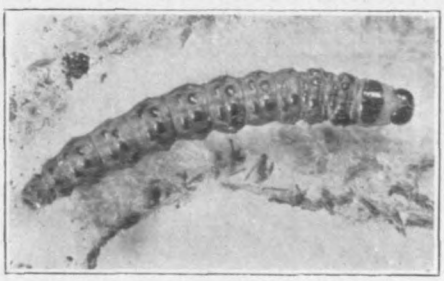


Adult of the black-headed sod webworm (Crambus mutibilis)

The adult moths live but a few days, and as they feed only on dew, it is in only the larval or worm stage that these insects are harmful. While the worms are small the injury resulting from their feeding is apt to pass unnoticed, but as they grow larger and begin to cut off entire blades of grass, the infested turf, where they are very numerous, takes on a ragged, patchy appearance, and large areas of it may be killed.



Cocoons and pupae of the striped webworm (Crambus mutibilis). Reduced



Caterpillar of the black-headed sod webworm (Crambus mutibilis). Enlarged 2½ times

Severe injury may be caused in a few days' time when the infestation is heavy; hence immediate steps must be taken to effect control.

Natural enemies as well as weather conditions play a rather important part in the control of webworms. Sometimes the worms are quite heavily parasitized by small wasplike insects and by two-winged flies. These parasites lay eggs in or on the webworms. The small

maggots hatching from these eggs burrow into the bodies of their hosts, feed on their internal tissues, and eventually kill them. Birds, particularly robins, flickers, and blackbirds, are attracted to the infested areas in large numbers and eat many of the webworms. Chickens also have been observed to dig them up and eat them.

Two treatments were worked out by entomologists of the United States Department of Agriculture during the summer of 1931, either of which promises to be both practical and efficient. Extensive tests were made with commercial pyrethrum extracts and home-made kerosene emulsion, both of which were found to be highly effective.

Two commercial pyrethrum extracts were used in these tests. One of these compounds, when used in dilutions as great as 1 fluid ounce to 5 gallons of water, gave a kill of practically 100 per cent. The other gave a kill of approximately 100 per cent when used in a dilution of 1 fluid ounce to 4 gallons of water. This latter compound, although costing less than the former, seemed to be less uniform and rather unstable. Some have reported unfavorable results from it. In these cases the extract may have lost its strength through its having previously been opened or through the finished solution's having been permitted to stand for several hours before being used. When using pyrethrum extracts it is imperative that the solution be made from freshly-opened stock and applied at once after being mixed. In our tests the solutions were applied with an ordinary sprinkling can or watering pot and about 1 gallon was required to treat 1 square yard of surface. Within a minute or two after the solution was applied the worms came on top of the turf and wriggled about, apparently in great discomfort, much as earthworms do after an application of corrosive sublimate. Soon their movements became more feeble, and within a few hours they died without going back into the grass. Expense is the chief objection to the use of pyrethrum extract in the control of webworms. At a cost price of $17.50 a gallon for pyrethrum extract, the cost of material when the extract is used in a solution of 1 fluid ounce to 4 gallons of water will be about 3½ cents for a square yard of treated area, or about $19.50 for a putting green of 5,000 square feet. However, these extracts are nonpoisonous and do not injure the grass. If good extract is obtained and it is properly applied, control is assured.

Several other artificial control measures are available. Some workers report good control with lead arsenate applied as outlined below; others report indifferent or poor results. In the course of experiments conducted by the Bureau of Entomology during the summer of 1931, the use of lead arsenate was carefully tested and a maximum kill of only 30 per cent was obtained. We, therefore, do not feel free to recommend lead arsenate. It may, however, be used as follows: dust the grass with lead arsenate at the rate of 12 ounces to 100 square feet (7½ pounds to 1,000 square feet); brush it into the turf with an old broom or similar instrument; wet the turf thoroughly with a direct stream from a hose, using at least 20 gallons of water to 100 square feet; allow the turf to remain unwatered for 48 hours. With lead arsenate costing 15 cents a pound, material for this treatment would cost about 1 cent for a square yard of treated area, or about $5.50 for a putting green of 5,000 square feet. It is possible that the apparently good results reported by other investi-

gators were due in part to the fact that many of the worms had practically finished feeding at the time of the treatment. At such stage in their life the worms would begin pupation very shortly, this naturally reducing the number of feeding worms and making the treatment appear more beneficial than it really was. Some workers have recommended a spray of 2 pounds of lead arsenate in 15 gallons of water on 1,000 square feet of surface, applied with sufficient force to drive the mixture well down into the grass. The writer has had no experience with this latter method of control.

Excellent results were also obtained with kerosene emulsion. The formula for the stock solution was worked out so that it is satisfactory even in those cases where hard water must be used. Kerosene emulsion is cheap, comparatively harmless to handle, and easy to make by following the directions given below. Further tests may indicate some changes in the formula or treatment, but in our experiments the procedure given here killed practically all the worms without apparent injury to the grass.[1] A stock solution is prepared as follows: dissolve 1 pound of laundry soap in 1 gallon of boiling water; add ½ gallon of kerosene; stir rapidly until a creamy emulsion is obtained. This stirring may be accomplished by pumping the mixture into itself through a spray pump or by churning in an inexpensive household butter churn. Small quantities have been prepared with an egg beater. For use as a spray, 1 part of this stock emulsion should be mixed with 50 parts of water and this mixture applied to the infested turf at the rate of about 1 gallon to a square yard (555 gallons to 5,000 square feet). In our tests it was applied with a sprinkling can. As in the case of the pyrethrum extracts, the worms came to the surface within a minute or two after the application was made and wriggled about until they died. This point is of interest, inasmuch as it gives the user definite and readily accessible information as to the intensity of infestation and the number of worms killed. The cost of materials for this treatment is about 1/6 cent for a square yard of treated area, or about $1 for a putting green of 5,000 square feet.

From the standpoint of cost and effectiveness, kerosene emulsion seems to offer the most practical control for sod webworms in putting greens and lawns. The principal drawback, of course, is that many people do not want to go to the trouble of preparing the emulsion. To such the pyrethrum extracts offer a rather more costly but equally efficient substitute.

Soil erosion takes a huge toll of plant food. Recent estimates are that a total of 126,000,000 pounds of plant food are washed out of the fields of the United States every year. This is 21 times as much plant food as that which is used by the crops themselves.

Nitrogenous fertilizers leach out of the soil rapidly. It is therefore imperative that the supply of such fertilizers in the soil be replenished frequently and regularly.

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[1]As in the case of any new treatment, some care should be exercised in applying kerosene emulsion, since under somewhat different conditions than those to which Mr. Noble refers slight injury to the turf might result. Also care is necessary in preparing the emulsion to prevent the occurrence of fires.—EDITORS.

Questions and Answers

Comparative efficacy of mercury compounds of certain kinds in control of brown-patch.—A new mercury compound has been offered to us for the control of brown-patch. It is said to contain 6 per cent mercury. This is claimed to be in a not completely soluble form and therefore superior to other mercury fungicides in that it does not wash out of the turf so readily and therefore is effective for a longer period. The claim is made that this preparation has resisted attacks of brown-patch for a period of 42 days. The names of 11 golf courses are given where the preparation has been successfully used. Have you any information that would indicate that such a preparation should be superior to other mercury fungicides used in the control of brown-patch? (Virginia)

ANSWER.—Having tested so many mercury compounds and found that they behave very much alike when placed on the percentage of mercury basis, we feel confident that the preparation you mention would prove to be no exception to this rule. The common success in the use of preparations for controlling brown-patch during the 1930 season, is due in great measure to the fact that the dry weather of that season made brown-patch much less of a troublesome pest, and it is entirely possible that injury from brown-patch during that season in many instances would have been no more extensive had no chemical remedies whatever been used. The fact that the preparation referred to has been known to remain effective for a period of 42 days does not constitute proof of its superiority over fungicides which have been known to be effective over shorter periods, since it is well established that the same treatment put on at two different periods in the season may vary in its lasting effect all the way from 2 days to 2 months.

Use of river sand on putting greens.—We are sending you a sample of river sand which we are using for top-dressing our putting greens; also a sample of turf from one of them. Do you think we should continue to use this sand on the putting greens? (Louisiana)

ANSWER.—We find that your river sand is alkaline in reaction and may be classed as a fine sand. By using this sand you supply considerable lime to the putting greens, which probably accounts for the fact that the soil in the piece of turf you send is also quite alkaline. We would recommend that you continue to use this sand in mixtures for top-dressing purposes since it serves a good purpose in breaking up and making more porous your local clay soil. The plug shows that the topsoil on the putting green has been considerably improved due to the mixture of sand and organic matter with your native clay as top-dressing material. Your local clay soil would be inclined to pack if used alone. We advise against the use of large quantities of pure sand for top-dressing purposes. Since the soil of your putting greens is alkaline we would suggest that you use sulphate of ammonia as a fertilizer from time to time. This should be applied at the rate of 5 pounds to 1,000 square feet in the spring and 1 or 2 pounds to 1,000 square feet in the warmer weather. It may be applied mixed with soil to insure even distribution, and watered into the turf after being applied.

Seventh hole (185 yards) Spring Mill Course of the Philadelphia Country Club, West Conshohocken, Pa.

Nothing is true forever. A man and a fact will become equally decrepit and will tumble in the same ditch, for truth is as mortal as man, and both are outlived by the tortoise and the crow.

James Stephens