motor connected to an ordinary lamp socket. The screens are interchange­able, so that any degree of fineness can be obtained, and the apparatus is so built that the coarse and refuse material is automatically separated from the fine stuff. Such a machine costs about $200, and will enable one man to do the work of five. A yard or so of material can be prepared in less time than it takes to talk about it; and with reasonable forethought, top­dressing material can be prepared on rainy days and a supply can be kept available in good condition for use at any time. Such a machine should save its cost in a year if the proper amount of top-dressing is done.1

Damage at Pine Valley From Grubs of the Southern Green June-Beetle

ALAN D. WILSON

In August, 1920, we began to notice small mounds of earth scattered over the greens and fairways. We knew these were caused by a grub, as we had had them in small quantities in previous years, but never until 1920 had they come in serious numbers. Then, however, we began to find them very generally throughout the course, and at once took steps to ascer­tain what they were and how they could be destroyed. The Department of Agriculture identified them as the grub of the southern green June­beetle. This species has only a one-year life-cycle. The beetles appear late in June or early in July, lay their eggs, which a few weeks later turn into grubs, which become active and begin to do damage in mid-August. This continues until cold weather, when they cease operations until early spring, and then again do some damage, but not to the same extent as in the fall. In June the grubs go into the pupal stage, to emerge as beetles late that month, or early in July, and so complete the cycle.

These grubs, which are nearly as big as one’s little finger, and which make mounds of earth at the entrance of their burrows, must not be con­fused with the small white grub barely an inch long of the May-beetle, or June-bug, which has done so much damage at Merion and other golf courses in this vicinity this year.

The Department of Agriculture in their circular letter E-84 recom­mends a 7½ per cent kerosene emulsion as an effective cure. This we tried, with little or no success, due probably to the fact that our soil is so light and sandy that the grubs burrow easily and are apt to go down too far for the emulsion to reach them; we have found them six feet below the surface.

The use of carbon bisulphide squirted into the burrows with a long­nozzled oil-can was also recommended. This we tried, but not with much success until, after the injection of the bisulphide, we plugged each hole with clay to prevent the fumes from escaping.

We further tried picking the grubs by hand when they came to the surface morning or evening or after heavy rains; and also killing them by sticking a sharp iron implement down the burrow; but this latter was not very effective, as the burrows were not always straight. All in all, we succeeded in protecting our greens fairly well during 1920 by the use

1 Information as to the types and cost of gyratory and other riddles can be obtained from any foundry supply house.
of carbon bisulphide; but it was not practical to use a hand-method of this sort on the large fairway areas.

We kept constantly experimenting, in plots two feet square, with other things, such as bichloride of mercury, cyanide of sodium, applications of lime, nicotine, and flooding heavily with water, with the idea of bringing the grubs to the surface and picking by hand; but none of these gave us any practical result.

The theory is that these grubs live on decaying organic matter and that they like a light soil in which to burrow. We had the light soil naturally, and in order to grow grass on what was to all intents and purposes sea-sand, we have for years fertilized heavily with cow-manure. In some portions of the course this was applied as a top-dressing, but wherever possible it was spread heavily and plowed in; and it is interesting to note that this latter method, which undoubtedly grew better grass, also seemed to produce areas which were particularly attractive to the grubs. In the fall of 1920, therefore, we were brought to a realization of what looked to be a fact,—that we were building up an absolutely perfect environment for these grubs; so we accordingly determined to stop using animal-manure and to try to get our result, for some years at least, by the substitution of a chemical fertilizer (bone-meal), which routine we have since followed.

With the first warm days of early spring in 1921, the grubs which were hatched in August, 1920, began work again. But we suffered very little damage until the middle of August, when the new crop, hatched from the eggs laid in July, began to appear. Since then they have been all over the course, in numbers which made anything we had had before seem perfectly trivial. Whole fairways were almost uprooted by them, and it was easy in many places to count five or six mounds to the square foot. They have kept pretty constantly at work up until the present writing, December 2.

We have kept after them most actively on the greens, with carbon bisulphide, and have succeeded in controlling them reasonably well, but with great labor and expense. We have not, however, been able to find anything with which to destroy them on the fairways. We have kept the course in fairly good playing condition by constant rolling; but while this has done away with some of the results of their work, it has in no way injured the grubs.

The only real guardians of our fairways have been a flock of eight Canada geese which live on our lakes. In some unknown way they seem to know at just what hour of each day the grubs will come to the surface. At the appointed time you may see the old gander put his head on one side as if listening. When he seems to hear a noise like a grub, he swims majestically to the shore, followed by the flock, and they all solemnly leave the lake, waddle to the bordering fairway, and catch and eat grubs literally by the hundreds. Unfortunately, they will not go to the higher fairways, and now they have also become fat and lazy from overeating of grubs. If nothing better offers, we may have to buy more geese; but they have their disadvantages. Twenty movable goose-hazards on the run-up ground to a green might annoy a membership even so amiable as that of Pine Valley.

The whole purpose of this article is to emit a loud cry for help, the hope being that some one who reads THE BULLETIN may have had similar experience and may have discovered some remedy which will kill the grubs
and which is practical to use over large areas, and will not kill the grass. If any one has such a remedy, we trust he will be good enough to give us the benefit of his experience.

Producing Turf on Poor Land at Pinehurst, North Carolina

LEONARD TUFTS

The following account is in the nature of a history of our troubles and our attempts to overcome them. I am in hopes, however, that it may have suggestive value to all who are confronted with similar problems of turf-growing.

The first thing we discovered was that our soil at Pinehurst, N. C.—wretchedly poor sand-hill land—was not made for growing turf grasses. At the suggestion of Mr. Frederick Law Olmstead we engaged the services of a scientific German experimenter from the Emperor's gardens in Berlin, whom we brought to this country for the purpose of conducting experiments with grasses and other plants for our course; this was over 26 years ago. This man was employed for a good many years. As a result of his experiments it was learned that Bermuda grass and Texas bluegrass were the only grasses that would live through our summers, even with the assistance of watering and fertilizing. Our early experiments with Bermuda in our fairways, however, were so unsuccessful that it was seriously considered by some of the well-known golfers that it would be better to keep the fairways clear of grass and keep the sand smooth by the use of rollers. Frankly, it looked to me as if that was about the only solution. We did not, nevertheless, abandon our efforts with Bermuda grass at this point, but started in to use a mixed fertilizer at the rate of 200 pounds to the acre, and on some of the greens we applied clay which we shipped in from the Piedmont section, into which the fertilizer was mixed; this was on the advice of the State experiment station and Federal soil experts. We also used the local clay (which is 75 per cent sand) with the soil, and we hauled 6 inches of what is known as muck here onto some of the holes. The grass slowly improved under this treatment, but it was far from satisfactory.

Our first real step forward was the application of nitrate of soda. We used 200 pounds to the acre, in two applications during the summer, and the course began to improve. After a few years, however, the turf went back again, notwithstanding these applications. We discovered then that the grass roots were very close to the surface. We next started in with applications of barnyard manure, plowing it into the turf, and we found that after two or three years of treatment in this manner and continuing the use of the nitrate of soda at the same time, we would get a fair stand of grass; during the first one or two years, however, the crab-grass took everything, which, dying in the winter, would leave bare sand spots. We then began the use of a spike-tooth harrow on the land immediately after applying the manure, plowing and rerouting. We continued the use of the harrow until the Bermuda grass had completely covered the ground. At first this is a very discouraging thing to do, because it seems as if you are raking out every root that had been planted; but it keeps the crabgrass down and it produces a nearly perfect mat the first year. This solved our problems temporarily. Our custom was to manure very heavily, and plow every three or four years, and keep the harrows going. A new invader, however, appeared in the form of nut-grass; and as the use of a