

The cost of a compost heap varies in the different localities. Find cost of materials delivered to your grounds at your particular locality, add to this the approximate cost of labor to turn and work it up, allow about  $\frac{1}{3}$  for shrinkage on method No. 1, 20% shrinkage on method No. 2 and 10% on method No. 3. Divide the amount of cost of materials and labor by the number of cubic yards and you will get the cost for one cubic yard.

Composting has been practiced for centuries in some form or other by market gardeners and florists. There are no set rules to lay down for making compost heaps and composting of materials.

The idea is to use whatever material you can find on the premises, such as stable manure, peat or bog earth, leaves, old sod, etc., etc. Buy the remainder of your materials from the outside, enough and in such quantities to make your compost rich in plant food and humus and equal to rich garden loam, and you have it. Don't delay in making up a good compost heap, if you have not already made one. You will need it.

---

## The Southern Green June Beetle as a Pest on Golf Links

W. R. WALTON

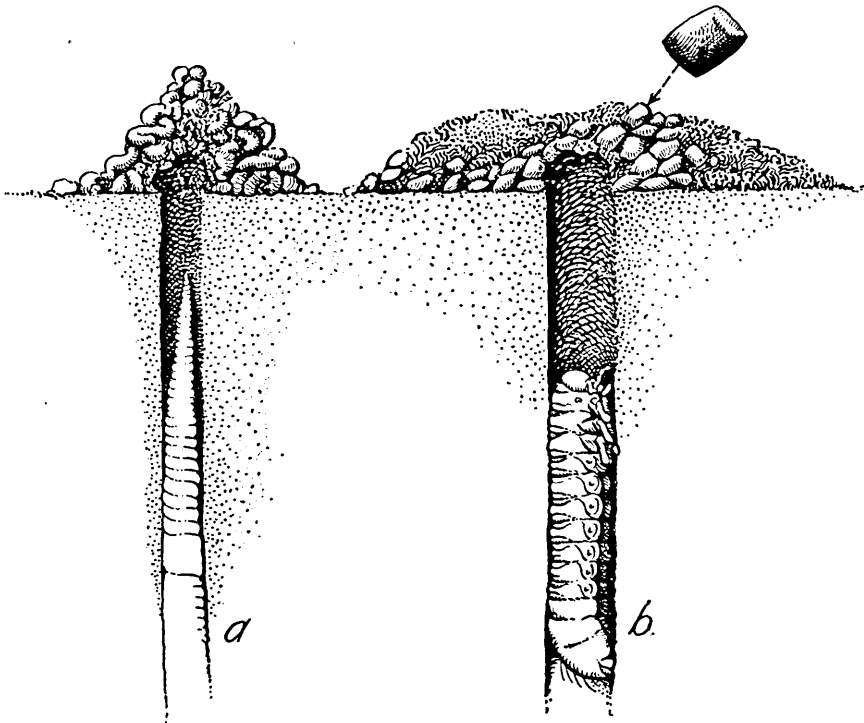
Entomologist in Charge,  
Cereal and Forage Insect Investigations,  
Bureau of Entomology, U. S. Dept. of Agriculture

The large, dirty-white grubs of the southern green June beetle often constitute a great nuisance on golf courses, especially on the putting greens. These grubs are in the habit of excavating deep burrows in the soil and of throwing out at the mouths of such burrows considerable quantities of soil which they remove in driving their tunnels through the ground. In the fall and early winter their burrows are often as much as 14 to 18 inches in depth and almost as large in diameter as a man's finger. The earth removed from the burrow by the insect may be spread out about its mouth in a heap some four to six inches in diameter, thus defacing the greens and interfering seriously with the play. Quite often the work of the June beetle grub is mistaken for the castings of earth worms. It may always be distinguished from the latter by the large size of the hole, large amount of earth ejected about the entrance of the burrow, and the character of this ejected material. The accompanying sketch illustrates plainly the differences to be noted between the burrows of earthworms and those of the green June beetle. The castings of earthworms always consist entirely of earth that has passed through the animal's alimentary tract, while the castings about the mouth of the June beetle's burrow consist in part of the excrement of the grub, but also of loose earth removed from the burrow itself. The excrement of this grub has a distinctive shape, as shown in the accompanying sketch, being formed very much like an ordinary bed-pillow (see enlarged detail) while the dejectamenta of the earthworm is a convoluted mass usually piled in small, more or less, pyramidal heaps immediately over or close to its burrow. The characteristic work of the grub is more easily recognized in the late fall than at any other time. It is important that green-keepers and other interested persons be able to distinguish between these different burrows, because the treatment for

earthworms often is applied under misapprehension, when the real culprit is the June beetle grub. In this case the results obtained are disappointing as the specific remedy for earthworms (consisting of a solution of mercuric bichloride in water) has but little, if any, injurious effect on the grubs of the green June beetle.

*Natural History of the Green June Beetle*

The adult or parent of the grub is a large beetle which flies noisily about in the sunshine, principally during the morning hours, from 8:30 to 11 o'clock. They are most plentiful from the first of July until the first week in August. The beetle is bright green in color, edged with ochre yellow. After mating, the female burrows into the soil and lays her eggs there,



Burrows and Castings of Earthworm (a) and Southern Green June Beetle (b).  
Note the difference in size of the burrows and form of castings.

from two to five inches beneath the surface. The young grubs hatch some three weeks later and at once begin to burrow through the soil. They are not likely to attract notice at this time because their work resembles that of the common lawn ants and the amounts of earth ejected at this time are not large. But when the grubs become nearly full grown in the late fall and early winter, they throw out such large quantities of earth that, on golf courses at least, they are sure to attract attention and unfavorable comment if not actual profanity.

After the insect has prepared its winter burrow, it necessarily is more difficult to kill than before it has gone so deeply into the ground. The grubs remain in their burrows all winter, in a more or less inactive state, but again resume activity as warm weather approaches. They become

full grown in June when they enter the resting or pupal stage, changing into beetles during the last of June or first of July. Thus it will appear that the entire life cycle of the insect consumes exactly one year.

#### *Methods of Destroying the Pest*

As the grubs of the green June beetle have the habit of coming up to the surface of the soil at night and crawling about on the ground, it is possible to destroy them by the application of contact insecticides, such as kerosene emulsion, of seven and one-half per cent strength. The following is the formula recommended by Mr. J. J. Davis, a well-known investigator of this and related species of insects.

One-half pound of hard or one quart of soft soap, preferably fish-oil, rosin-soda, or rosin-potash soap, is dissolved in one gallon of boiling water; while hot two gallons of kerosene are added and the mixture thoroughly emulsified. This may be done most easily and thoroughly by churning for about ten minutes with a spray-pump, the nozzle being turned back into the liquid. When thoroughly emulsified it will have the consistency of thick cream, and the oil will not separate out. There is great danger of injuring plants if the mixture is not well and thoroughly made. For a 7½ per cent emulsion add 24⅓ gallons of water to the above stock solution and thoroughly mix. It is desirable to use soft water both for the stock and as diluent, but where this is not obtainable the water should be softened by adding lye or sal-soda.

The kerosene emulsion should be applied as soon as the presence of the insects is noticed or at least as soon as injury becomes apparent. This may be about the middle of August or later. For small areas a sprinkling can may be used in applying the emulsion, but for larger areas the use of a force pump will save time and labor, using a "rose" type of nozzle so that the turf can be uniformly drenched in the shortest possible time. Immediately after the application of the emulsion, the treated area should be thoroughly sprinkled with water in order to wash the emulsion from the foliage, which otherwise may be burned and also in order to convey the insecticide into the soil. If this be done many of the grubs will come to the surface and die while others will die in their burrows.

On putting greens where the grass is very tender, the application of kerosene emulsion may cause injury and for such areas the injection of carbon disulfid, hand picking or other measures may be adopted. A method used by Dr. Walter S. Harban, of the Columbia Country Club, Washington, D. C., is as follows: Prepare a tool consisting of a straight piece of heavy iron or steel wire, somewhat smaller in diameter than the burrow of the insect, and about twenty-eight inches in length or somewhat longer. Form a handle in the shape of a ring of convenient size at one end and sharpen the wire at the opposite end. The operator then inserts the sharpened wire into the aperture of the tunnel and forces it quickly to the bottom of the tunnel, thus crushing the grub. This method is said to be quite effective, but of course it involves a great outlay of hand labor and cannot be used except on limited areas such as putting greens, etc. Neither is it possible to kill all of the grubs in this manner because frequently the burrow is not straight but contains an offset due to the presence of stone or other obstacles, and in this case the grub cannot be located from above ground. The application of the foul-smelling and explosive carbon disulfid is an equally tedious but reliable method of destroying the grubs. Since the burrows of this grub are open they are easily reached by this chemical, the poisonous fumes of which are heavier than air, and the bur-

rows can easily be located by the mounds of earth thrown up by the grubs during the night following a heavy sprinkling the evening before. Carbon bisulfid injures vegetation when applied directly to it, a funnel should therefore be used, inserting it into the hole before pouring in the required amount of liquid bisulfid, or an oil can having a long spout is convenient. Approximately one teaspoonful of the liquid per burrow gives satisfactory results.

It should be said that some slight injury may result to the tender grass of putting greens even where these precautions are taken.

The opening of the burrow should be plugged with soil after making the application to prevent the escape of the fumes. Care should be exercised in the handling and use of carbon bisulfid for it is inflammable, and the fumes, when mixed with air, explosive. There should be no fire of any kind near when handling the liquid.

A chemical compound having similar properties but which is not explosive is paradichlorobenzene. This substance is not a liquid but a powder which when placed in the ground, gives off a heavy, poisonous gas which penetrates the soil. It has proved quite effective as a remedy for the peach-tree borer but its virtues as a remedy for other subterranean insects are as yet largely undetermined. It volatilizes much more slowly than does carbon bisulfid and probably would not be very effective except during the warmer season of the year. In case green keepers desire to experiment with this substance it may be placed in the soil among the burrows of the insects in quantities not to exceed  $\frac{1}{4}$  ounce, here and there over a limited area. It will be most necessary to experiment cautiously with the chemical as it has shown a rather high toxicity toward some forms of vegetation and may be found to injure the sod too severely to be of any great service on the greens.

The grubs of the green June-beetle frequently come out of their burrows during violent showers and have the curious habit of crawling over the ground upon their backs. It is said that this habit has been utilized in destroying them by thoroughly drenching the ground with water from a hose and gathering the grubs as they appear above ground. This is a simple method and one well worth trying, although I can not personally vouch for its effectiveness.

---

## Dear Bill Letter I

Richland Center, New York,  
April 2, 1921.

Dear Bill:

So you're going to build a golf course and are so befuddled by all the experts you want my advice. I'm sorry for you, old man, because I'm afraid you won't have the courage to reason your own way out and you'll be like the vacillating old party who insisted on having but one bath room in his house so his indecision wouldn't trouble him in an emergency—if he had more than one he was afraid he'd be unable to decide which was nearest. You'll be apt to shut your eyes and draw cuts to decide which expert is expert.

Don't you know that a self-styled expert is commonly an ordinary guy away from home?