

Steam Sterilization of Compost

Report of test conducted by Mr. Everett Jenne, chemist at the plant of the Union Gas and Electric Company, Cincinnati, Ohio, for the benefit of the Makatewah Country Club of Cincinnati.

We are indebted to Mr. James Muirden, vice-president of the National Association of Greenkeepers of America, for sending us the interesting report which follows. Also to the courtesy of Mr. C. W. DeForest, chairman of the Green committee of the Makatewah Country Club, and Mr. George Benwie, greenkeeper, for whom the exhaustive test was made.

In the summary of results it is noted that by wetting down compost before subjecting it to heat from the steam coil, it is possible to secure a more rapid and uniform degree of heat throughout the pile. For several years, the soil used in greenhouses has been subjected to heat in this manner, not only in order to kill weed seeds, but to assist in protecting the plants from diseases, the germs and spores of which may be present in the raw compost.

While steam treatment is proved to be a successful method in eradicating the major portion of weed seeds in compost, it must be remembered that many of the weeds infesting golf greens are present because of weed seeds being blown upon the greens from surrounding rough areas, and in some cases from the water supply and from heavy washes due to rains.—Editor.

THIS test of the compost used on the greens of the Makatewah Country Club was made in order to determine whether enough weed seeds were present in the compost to cause serious trouble, and to determine whether it would be practical to kill these weed seeds by heating the compost with a steam coil.

Method of Testing

The 220 lb. sample of compost received was divided into five lots of 44 lbs. each.

Lot I was placed in an 18" x 18" germination box without heating or adding seeds.

Lot II was heated to 160° F., held at this temperature for 20 minutes and placed in an 18" x 18" germination box.

Lot III was mixed with 60.2 grams of red clover seed, 103.6 grams of timothy seed, and 40.6 grams of mixed weed seeds and placed in a germination box without heating.

Lot IV was mixed with the same amounts of seeds as Lot III, heated to 160° F, held for twenty minutes, and placed in a germination box.

Lot V was similar to Lot IV, except that it was heated as hot as possible with the steam coils used.

The timothy and red clover seeds were known to have a high percentage germination. The weed seeds used were screenings from various seeds. Red clover has a hard shelled, oily seed, and timothy has a dry, thin shelled seed. Most seeds fall in one of these two classes, so that a temperature which would kill both clover and timothy seeds would kill nearly all weed seeds.

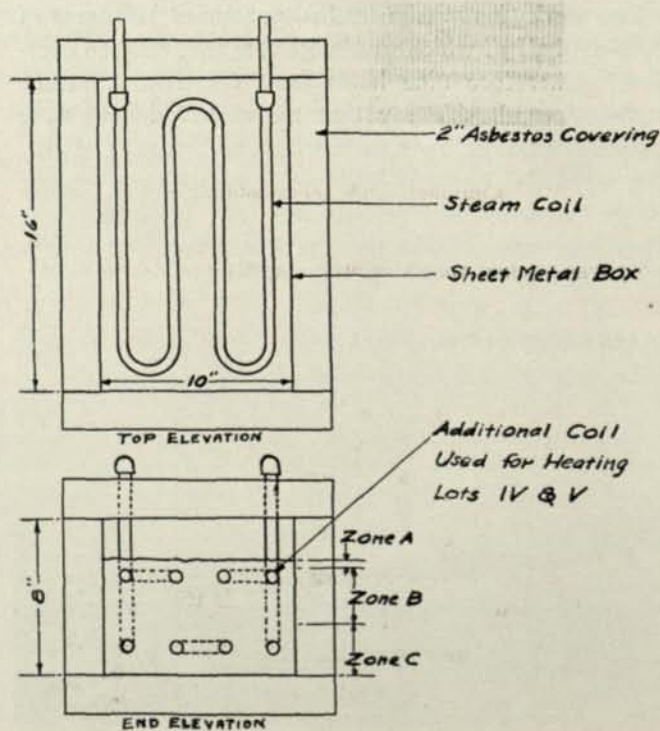
The difficulties met with in heating the compost, the time necessary to heat it, and temperatures actually reached are described under the heading "Method of Heating."

Method of Heating

HEREWITH is shown a sketch of the 8" x 10" x 16" sheet metal box used for heating the compost with a 3/8" pipe coil. Temperatures at the surface were

measured by means of mercury thermometer lying flat along the surface with bulb barely buried. Temperatures at Zones B and C were measured with the thermometer nearly vertical. The asbestos cover was removed only long enough to take a reading.

On the first trial, Lot II was placed in the box dry, and only slightly packed. Steam at atmospheric pressure was turned into the one pipe coil used. The temperature at the surface, initially 70° F, rose very slowly. After two hours this temperature had only reached 108° F, and after 5½ hours it had ceased to rise, the



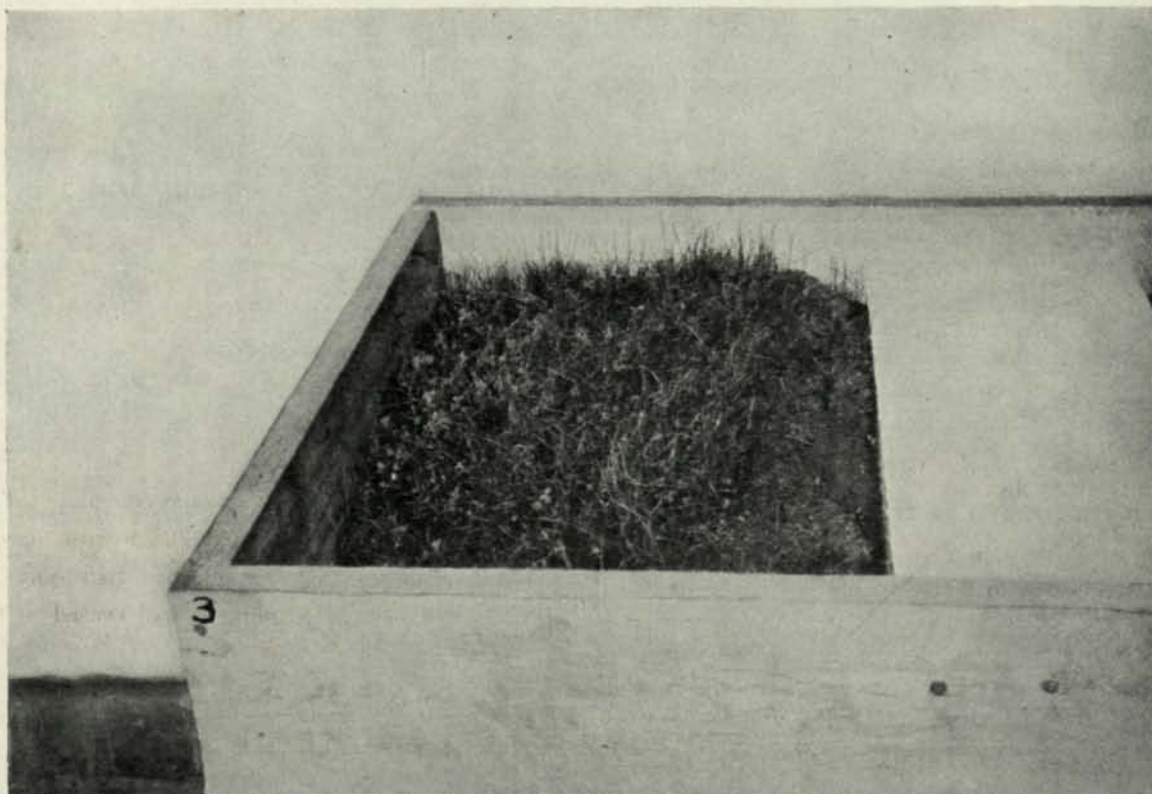
Diagrammatic sketch of steam coil installation

surface temperature then was 120°-130° F and other temperatures are shown in the table.

After cooling overnight the box was emptied to the level of the pipe coil. This remaining compost was then thoroughly wet down but not worked to make a mud, then the remainder of the compost was added dry. In two hours the surface had reached a temperature of 160°-165°F and the remainder 165°-180°F, as shown in the table. After holding for twenty minutes at this temperature the compost was emptied out and found to be uniformly moist but not wet or lumpy.

lighted room, the temperature of which varied from 70° to 80°F, and were then watered daily.

On March 14, three days after the start of the test on Lots I, II, III, and IV there was one blade of grass and one dicotyledenous weed showing in Lot I. No seeds had germinated in Lot II. Lot III showed a thick stand of both grass and clover, but no plants which could be definitely recognized as weeds. Lot IV showed some clover and a few blades of grass. The first plants in Lot V appeared on March 15, but not as many as in Lot IV on the 14th.



LOT III

Compost with seeds added, but not heated, photographed one month after start of test

Two coils were used in heating Lot IV but the compost was packed well and only slightly moistened around the coils. This took longer to heat than Lot II but finally reached about the same temperature. The compost when emptied was dry and friable.

Two coils were also used in heating Lot IV, but the compost was thoroughly wet around each of the coils and packed well in place. This reached 160° in about the same time as Lot II but in an attempt to heat it to 200°F the steam was left on until, after 6 hours, there was no further rise in temperature. When emptied, the compost was dry but slightly lumpy.

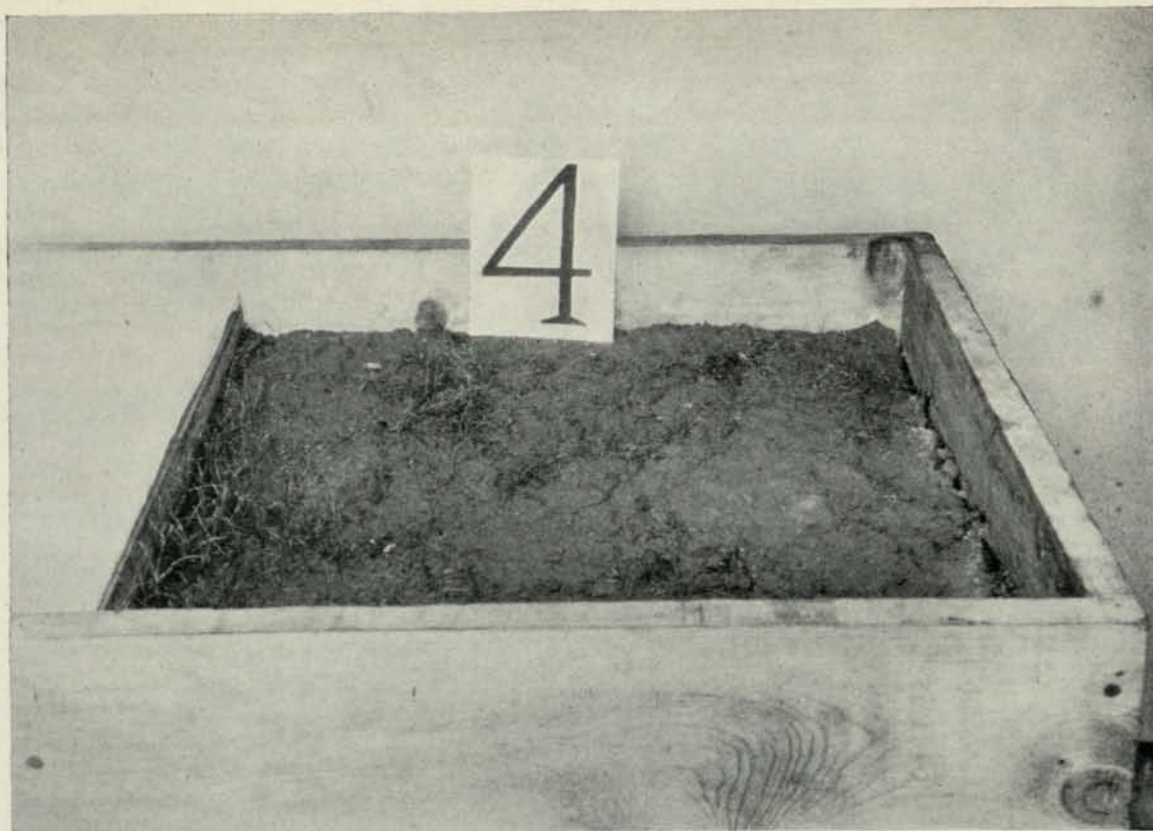
Germination Results

THE germination test of Lots I, II, III and IV was started on March 11, 1927, and that of Lot V was started on March 12. The boxes were placed in a well-

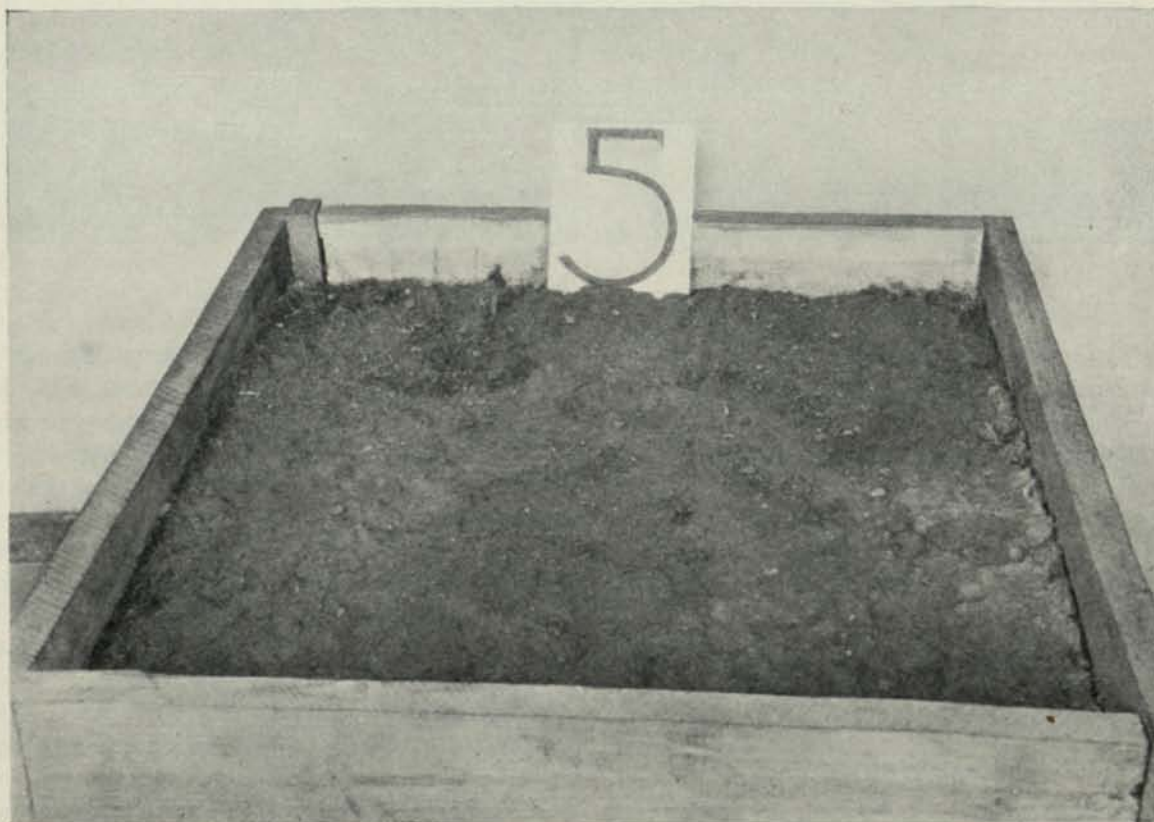
During the following week nothing appeared in Lot II, and only a very few additional plants in Lot I. Much additional grass came up in Lot III and some additional clover. Some additional grass and clover appeared in Lots IV and V but very much less in IV than in III and less in V than in IV.

On March 21 there were in Lot I five blades of grass, five clover plants and seven dicotyledenous plants other than the clover. Nothing had appeared in Lot II. In Lot III, there was a thick stand of grass and clover, too many plants to make an estimate of the number. In Lot IV there were about 500 blades of grass, 150 clover plants and a very few plants which could be definitely recognized as weeds. In Lot V there were about 75 blades of grass, 25 clover plants and a very few weeds.

In Lot III the growth of roots was thick enough to keep the soil fairly loose, and plants shaded the soil



LOT IV
Compost with seeds added and heated to 160°, photographed one month after start of test



LOT V
Compost with seeds added and heated to 180-200°, photographed one month after start of test

enough so that it did not dry out very rapidly, but in the other lots the surface had become quite hard due to alternate watering and drying. This poor mechanical condition of the soil was probably the cause of the slow growth of the plants in Lots I, IV and V. Many of these plants finally died, leaving some patches growing fairly well in Lot IV and leaving only a few scattered plants in Lot V. In Lot I only one blade of grass and one dicotyledenous weed were left on April 14, 1927.

On March 22, the only seed which germinated in Lot II appeared.

Lots III, IV and V were photographed on April 12, and Lots I and II on April 14.

The more important data on the treatment and germination of the various lots is tabulated in the accompanying table.

Discussion of Results

MANY weed seeds are extremely slow to germinate, but, unless a very large percentage of the seeds present in Lot I were dormant, this test shows that there were very few live weed seeds in the compost.

Lots II and IV show that heating to 160°-180° killed many of the seeds present.

Lot V shows that most of the seeds were killed by heating to 180°-200°F. Many of those which did germinate were probably on the extreme surface which could not be heated to 180°F.

Summary of Results

SO few weed seeds germinated in the check lot No. I that unless there were a large number of slow-germinating or dormant seeds present, the value of attempting to kill them by heating the compost appears doubtful.

Table Showing Heated Hours and Temperatures Attained

| | Heated Hours | Temperature Attained | | |
|-----------------------------|--------------|----------------------|-----------|-----------|
| | | Zone A | Zone B | Zone C |
| Lot II—1st Trial (Dry)..... | 5½ | 120-130°F | 130-140°F | 145-155°F |
| Lot II—2nd Trial (Wet)..... | 2 | 160-165°F | 170-180°F | 170-180°F |
| Lot IV—(Packed)..... | 3½ | 160-165°F | 165-175°F | 165-175°F |
| Lot V—(Wet and Packed)..... | 6 | 170-180°F | 180-200°F | 180-200°F |

The compost is such a poor conductor of heat that it would be a very difficult matter to heat any considerable quantity of it by means of a steam coil in a box or a pile.

Lot II, in which the compost was well wet down around the coil, heated through rapidly and more uniformly than the other lots. This method, i.e., wetting down the compost around a steam coil and then letting the whole pile steam through, might work fairly well on larger quantities.

Heating to 180°-200° would kill most of the weed seeds in the compost and to 160°-180° would kill many of them.

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Checking We will check your actual deliveries before you sow.

Write for particulars

International Seed Testing Laboratories, Inc.

E. E. Pattison, Director J. M. Stanton, Asst. Director
11 Park Place NEW YORK CITY

Member Association of Commercial Seed Analysts of North America

Table Showing Treatment and Germination

| | Lot I | Lot II | Lot III | Lot IV | Lot V |
|-------------------------------------------|------------|------------------------------------|------------|--------------------------|-------------------------------------------------|
| Weight of Compost..... | 44 lb. | 44 lb. | 44 lb. | 44 lb. | 44 lb. |
| Weight of Seed Mixed with Compost | | | | | |
| Red Clover..... | None | None | 60.2 gr. | 60.2 gr. | 60.2 gr. |
| Timothy..... | None | None | 103.6 gr. | 103.6 gr. | 103.6 gr. |
| Mixed Weeds..... | None | None | 40.6 gr. | 40.6 gr. | 40.6 gr. |
| Heating | | | | | |
| Temp. to which heated..... | Not Heated | 160-180°F. | Not Heated | 160-175°F. | 180-200°F. |
| Time held at this Temp..... | | 20 minutes | | 20 minutes | 40 minutes |
| Time to reach this Temp..... | | 2 hours | | 3½ hours | 6 hours |
| No. Heating Coils Used..... | | 1, 4-turn | | 2, 4-turn | 2, 4-turn |
| Condition of soil at start of heating.... | | Wet around coil. Remainder dry. | | All dry. Packed well. | Fairly wet around the coils, packed well. |
| Condition of soil at end of heating..... | | Slightly moist, friable. | | Dry, friable. | Dry, slightly lumpy. |
| Germination | | | | | |
| Date Placed in Germination Boxes.... | 3-11-27 | 3-11-27 | 3-11-27 | 3-11-27 | 3-12-27 |
| Dates on which lots were photographed.. | 4-14-27 | 4-14-27 | 4-12-27 | 4-12-27 | 4-12-27 |
| Dates when first plants appeared..... | 3-13-27 | 3-22-27 | 3-13-27 | 3-13-27 | 3-14-27 |
| Appx. No. of Seeds which Germinated | | | | | |
| Grass..... | 5 | 0 | Many | 500 | 75 |
| Clover..... | 5 | 0 | Many | 150 | 25 |
| Weeds..... | 7 | 1 | Very Few | Very Few | Very Few |