Manure

Reprint from "BIO-DYNAMICS"
Vol. II, No. 2, 1943

Manure

When we consider the soil in its biological totality we see that fertilizing feeds not only the plants but the organisms in the soil. Nature provides humus as food for the bacteria and other micro-organisms and the earthworms by the decay of dead plants and animals. It is our task to add to this organic process. The fertilizer must come to the soil in such a condition that it can fulfil this task. In this respect manure is least effective when in a raw, fresh state. The half-rotten products of decay (certain proteids, for example) are taken up directly by the plant roots and work destruction in them. Well known are the cooking odors of cauliflower and other vegetables—a direct proclamation of the kind of manure used.

The best form of organic fertilizer is humus. Unfortunately, it takes a long time for stable manure to break down into humus. Meanwhile, most valuable constituents disintegrate and are lost. For instance, the disintegration of nitrogen compounds takes place under the influence of certain bacteria. These bacteria are particularly active on the outer surface, that is, wherever there is enough air. When stable manure is carelessly tossed out or spread on the manure heap and thus exposed directly to the rain and sun, up to 50 per cent and more of its valuable nutritive substance is lost. What the sun does not dry out and the air oxidize is washed away by the rain. In a month or so about 50 per cent of the nitrogen is lost and about 20 per cent each of the calcium, phosphoric acid and potassium.

Robert M. Salter and C. J. Schollenberger of the Ohio Agricultural Experiment Station show that the annual manure production of the livestock of the United States is one billion tons. Ignoring the liquid part, one ton of the solid part of cow manure contains 6.4 pounds of nitrogen, 4.2 pounds of phosphoric acid, 3.2 pounds of potash and 6.8 pounds of calcium. Of course, no attempt is made to use all of the one billion tons, but if there were, the usual careless methods of handling would result in losses of 1,600,000 tons of nitrogen, 420,000 tons of phosphoric acid, 320,000 tons of potash and 680,000 tons of calcium. Figuring nitrogen as worth $24.00 a ton, phosphoric acid $10.00, potash $8.00 and lime $5.00 a ton, this amounts to cash losses to the nation's farmers amounting to $38,400,000.00 in nitrogen, $4,200,000.00 in phosphoric acid, $2,560,000.00 in potash and $3,400,000.00 in lime—a total of $48,560,000.00.

Besides the drying out of the manure, another bad practice is that of allowing the heap to stand in its own liquid, which slowly rises higher, drowning out a correct fermentation. In that part of the heap a kind of peatlike, black, smelly mass is formed, with a very limited nutritive value. It smears the soil, breaks up poorly and after weeks we still find the black chunks almost unchanged. Again, a too firmly packed manure runs the danger of becoming overheated and losing its best qualities through burning.

How, then, do we obtain a properly balanced fermentation resulting in a fine, crumbly, neutral humus? The answer is in careful handling according to the following methods:

SITE. The manure yard or site for the pile, if located near the field on which it is to be spread, should be chosen with the following in mind:

There should be trees to shade the piles. Decomposition is halted when the piles dry out. It has been found that the best trees for this purpose are birch, alder, elderberry and hazel-nut, since their root exudations have a stimulating effect on the life in the heaps.

The trees should be also a shelter from the wind, or a fence or wall should shield the heaps from thus drying out.

The site should not be in a wet spot so that the bases of the heaps become soaked.

Naturally, the place should be accessible to the manure spreader or, in the event of the piles becoming too dry, to the liquid manure or water tank.

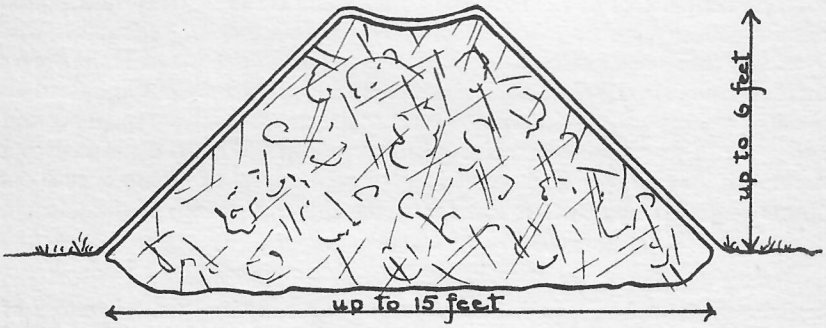

Fig. No. 1. Cross section of a manure pile.

BUILDING. The first step is to dig a pit about 9 inches deep and here start piling up the manure. Experience has shown that the decomposition of manure runs its course differently according to the base upon which it is piled. A better and quicker fermentation occurs on a humus and topsoil base, the slowest on a base of concrete. By digging a pit the door is opened to the earthworms and bacteria of the soil. If the soil is very sandy the pit should be lined with a layer of clay to prevent leaching or with a layer of straw. The practical form for a heap is a long rectangle. Strawy, dry manure should be trodden and wet with rain or pond water. It is best to take the pit by sections, building up a small area to the desired height, rather than spreading the manure over the whole area and thus exposing it to the air and sun. The action of those bacteria which break up the nitrogen compounds ceases only when the access of air is considerably diminished. So when completed the pile is covered with a layer of earth. The topsoil excavated in making the pit is used for this. If insufficient, more can be obtained by digging a shallow ditch around the heap. Sandy

soil should be spread on about 3 inches thick, medium soil about 2 inches and heavy clay soil an inch or less. The covering of the heap is very important. It should be done as soon as possible on a long heap, even if the heap is not quite completed. The heap should be covered, with or without preparations in it.

SIZE. The width of the heap should never exceed 15 feet; 12 feet is a good width. The sides should slope in so as to hold on the earth cover. When first made a heap 12 feet wide and 6 feet high is about 3 feet wide at the top. Later it sinks considerably. In the same proportions a heap 8 feet wide and 4 feet high is about 2½ feet wide at the top. The heaps can be as long as desired.

BEST AND WORST TYPES OF MANURE. Strawy, loose manure overheats easily, especially when horse manure is present. Wet, fatty manure becomes putrid. The feeding program also has an influence upon manure production. The best manure is produced by coarse feed, grass eaten on the pasture, alfalfa, hay, clover, pea vines and other straw. Such manure has the most favorable structure for fermentation, especially when a great deal of straw bedding is used in the stable. Mangels, turnips, turnip leaves and exclusive green feeding or silage in the stable produce too wet a manure. Concentrates also produce a manure with a wet, sticky structure which allows too little air to penetrate it. The worst quality manure results from the exclusive feeding of concentrates, especially when leaves, sawdust or peanut shells are used for bedding instead of straw. Shredded corn fodder is an excellent material for bedding.

MIXTURES OF MANURES ARE BEST. Cow manure can be piled alone with beneficial results, but with other manures it is best to mix them with cow manure or layer them with half-rotted compost or earth. Combinations of different manures work toward a better conservation of all their qualities (horse manure, for example, acts as a protection against denitrifying bacteria in cow manure).

Horse. Spread a layer of cow manure in the bottom of the pit to a depth of about 6 inches. On this spread a layer of horse manure 3 or 4 inches deep. The latter should steam out. Before the next addition tread down the pile. If the manure is strawy this can be done quite firmly, but if it is too wet and smeary treading must be omitted. Manure which is the product of concentrate feeding and contains little straw must lie open longer to steam out or to dry somewhat. Continue the alternating layers in this way.

Chicken, Hog, Sheep, Goat and Pigeon Manures can be treated in the same way as the horse manure, except that the layers should be slightly thinner. Hog manure is not so hot as the others, so it can be layered in 3-inch thicknesses, but the chicken, sheep, etc., manures should be put on in 2-inch layers, with the cow manure in 6-inch ones.

MANURE COMPOST. A good way of using manure is to compost it with waste vegetable material. This is a particularly good way of using the hot types like chicken and sheep manure. First, a layer of the manure is spread in the pit and on it a layer of the vegetable material. On this is sprinkled a little quicklime, then a thin layer of topsoil, then more green material and then the series is started again with the manure. In the case of horse manure the layers could be 4 or 5 inches thick; in the case of chicken and sheep and

the others, except cow, the layers should be thinner—about 2 inches. For further details on composting see the separate leaflet, "Compost." No quicklime or hydrated lime should ever come in touch with the layer of manure.

PREPARATIONS. The cover put over the manure pile serves as a boundary or skin between it and the outer world. The heap should develop its own inner life. This life should not, however, run its course undirected, willy-nilly, first here, then there. Only one definite direction is suitable to it and desirable for the farmer. The final goal for all healthy decomposition is a neutral humus. Manure which has been led over to this condition offers the maximum in fertilizer value, both with respect to nutritive substances and physical structure. Substances which accomplish this guidance have been evolved through Bio-Dynamic research. The efficacy of these preparations can be illustrated by the following. If we wish to make bread we mix water and flour to a dough. This can then be left standing exposed to the air. Yeast bacteria (so-called wild yeast) present in the air may accidentally settle on it and in the course of some hours or days bring about a fermentation. The bread baked from this dough will be sour, bitter, hard, not edible. The baker, therefore, uses one special yeast culture or a "sour dough" in order to get a quick and good fermentation. The usual treatment of manure is comparable to the first instance—accidental fermentation. What should be attained, however, is a controlled fermentation which leads to a minor loss of nutritive substances and an improved humus formation. Dr. Rudolf Steiner indicated that such a desired activity resides in various plant preparations, and that these plant preparations are accordingly suited to lead the fermentation in the right direction. Experiments have shown that the preparations are also rich in plant hormones and growth-stimulating substances.

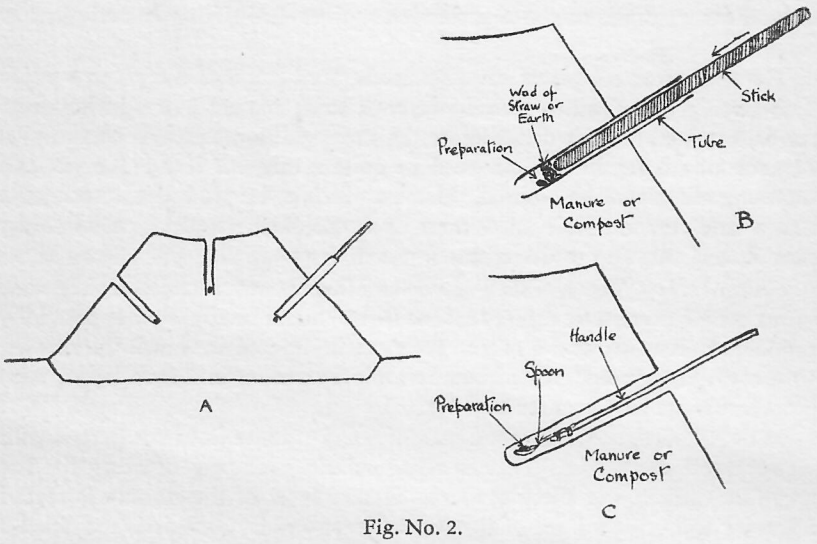

Fig. No. 2.

After the heap is covered these preparations are inserted in order to transform the organic products of the decay of the manure into an odorless humus mass which can be quickly absorbed and digested by the soil. The individual

preparations 502 to 507 are humuslike plant substances gained by special processes from such well-known medicinal herbs as chamomile, yarrow and dandelion. Preparation 507 is an extract of valerian. Small portions of these preparations inserted in holes in the large manure heaps are sufficient to introduce a swift, healthy process of decomposition.

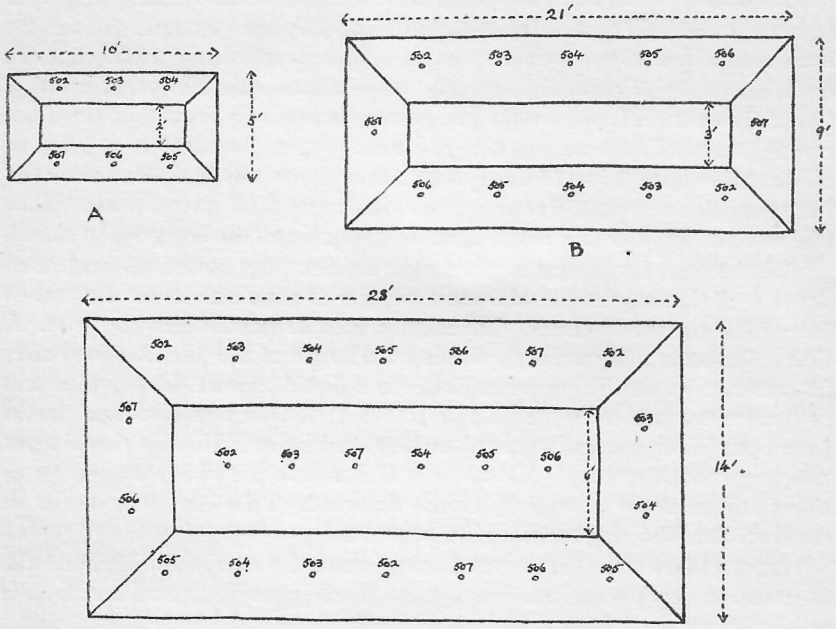

Fig. No. 3.

Holes are made with a crowbar or stick along the sides of the heap near the top at an angle towards the center and to a depth of about 2 feet. These holes run all around the heap at about 3-foot intervals and, if the heap is wide, also along the central depression. One preparation (½ to 1 gram) is placed in each hole. If the heap is small three of the preparations can be put in three holes on one side and three on the other. If the heap is larger, say 18 to 20 feet long, the portions should be divided so that there are 12 holes, each containing a half portion of a preparation. If the pile is much over 20 feet long it should receive two sets of preparations. After insertion the holes are closed firmly with manure and earth. One set of preparations usually is enough for each 15 tons of manure. (See Fig. No. 2 and Fig. No. 3.)

10 to 20 drops of the liquid preparation 507 are put into a gallon of water, making a solution which may still have the valerian odor. The water used should be lukewarm and should be rain water. If there is no rain water available pond water is next most desirable and after this creek water. Spring or well water should only be used as a last resort. The solution should be stirred for 10 to 15 minutes so that it is thoroughly mixed. A small part—a quart or less—is then poured into the assigned hole, the remainder being finely sprayed

diately involved in the fermentation process. Meanwhile, the other tank is standing full and fermenting while the new one is filling up. If each tank takes three months to fill, the oldest part of each tank should be six months old, the freshest not less than three when used.

Although it is always safer to put the liquid manure into compost heaps, if it is really well fermented it can be diluted in a ratio of about one-third liquid manure to two-thirds water and sprayed directly on the fields at the rate of about 2000 gallons to the acre. There have been good reports of corn, mangels, rye and winter oats treated in this way, the liquid being applied after the fields are ploughed.

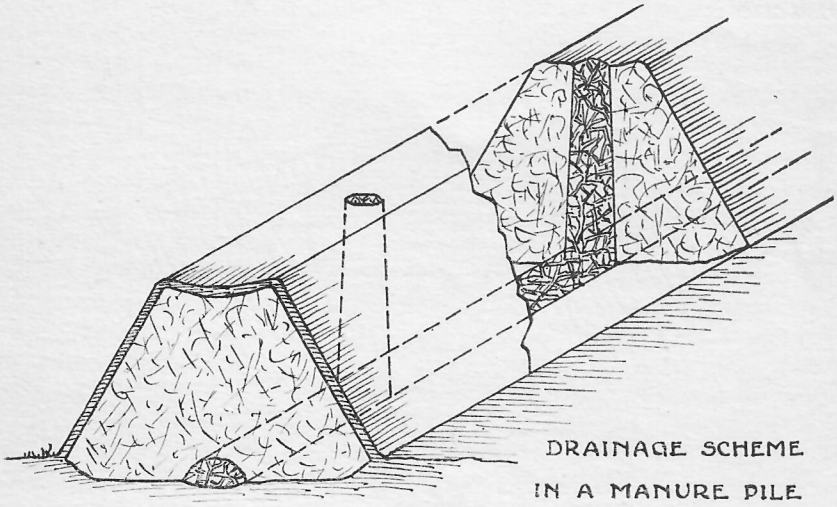

Fig. No. 4.

BARREL. A manure barrel is of great value in the home garden for watering the compost. A small, strong barrel is half buried (about up to the bung) in a semi-shaded spot. Earth is hilled up around the part above ground. The barrel is thus protected from rotting and a more even temperature is held in its contents. All kinds of manure which usually have a caustic effect when used alone (chicken, pigeon and rabbit, for example) are put in the barrel. This is then filled with water (rain water being best) and preparations 502 to 507 are put in as described above. When some of the barrel's contents have been used on a growing or completed pile, more water is added and thus the dilution is maintained. When the manure is used up more is added and more preparations inserted.

TIME. If all these methods are followed carefully manure should be turned into humus in about 2 to 3 months. Of course, in winter, when it is extremely cold, bacterial action is largely suspended so that little decomposition occurs. However, it has been found that in bio-dynamically treated manure the action continues longer during cold weather than in untreated manure. It is important not to let the manure get too dry. If these rules are observed and the requisite energy expended the returns will reward the farmer or gardener with increasingly fertile soil and more health-giving crops.

over the whole heap with a watering can. The water should not be boiled and then cooled but merely warmed.

TURNING. A properly made manure pile should need no turning. But the piles should be examined at the end of a month. If an error has been made in the piling up and the material has become compacted, it might be advisable to turn over the mass and allow more air into it. If it is too loose it may need treading down and rain water or liquid manure sprayed onto it. Before one decides to turn a manure pile on account of unfavorable fermentation, one can try other means of correction, namely, by perforating the heap with crowbar holes. This should be done if the pile gets too hot and dry or too wet. In either case the access of fresh air will help the fermentation. At distances of 3 feet in all directions holes 2 to 3 feet deep are made with the crowbar. With a too wet heap the holes will probably need to be closed again after several weeks. If the pile was too dry, watering is also necessary, after which the holes can be closed.

WATERING. During times of drought manure piles sometimes become so dry that all decomposition, with the exception of some activity on the part of the molds, practically ceases. Water must then be poured into the piles. A depression on top like a trough running the length of the pile is formed after its construction for this purpose. Sometimes liquid manure diluted with rain or pond water is used in the ratio of 1: 2 to 1: 5. The liquid manure should have been bio-dynamically treated as described below. Usually pumping or pouring it into the trough will allow it to soak into the pile, although sometimes it is necessary to make holes into the center of the heap with a stick or crowbar, thus allowing the liquid to penetrate.

LIQUID MANURE. The urine of animals contains many valuable minerals. In 1 ton of cow's urine, for instance, while the phosphoric acid and lime is relatively low, there is 19 pounds of nitrogen as compared with 6.4 pounds in a ton of solid; 19 pounds of potash as compared with 3.2 in a ton of solid.

TANKS. To preserve this valuable liquid tanks should be built to catch it as it drains out from the stable. A concrete manure tank outside the dairy barn can be constructed at relatively small expense. All gutters of the barn can drain into it. The tank could be emptied 2 or 3 times a year. It is estimated that 1 adult cow produces about 1 ton of liquid manure per year. This too should be allowed to ferment and lose its rankness. It has been demonstrated that this takes place much more quickly in tanks made of stamped clay and covered with boards than in cement tanks. The same preparations, 502 to 507, are used for the liquid manure as for the solid piles. Preparation 507 is stirred, as previously described, in warm water for a quarter of an hour and then poured directly into the liquid manure. Preparations 502 to 506, however, are placed in individual linen bags with a stone in each and suspended on strings from a wooden cross, which floats on the surface of the liquid in the pit. The bags themselves sink below the surface of the liquid manure, which should be stirred frequently. (Cf. Drawing, page 8.)

The best system is to have two tanks and a method of diverting the drainage from one to the other. When the liquid is used from one, a little fermented liquid should be left in the bottom, a set of preparations put in and the liquid diverted into it. The fresh manure comes in contact with the old and is imme-

The extra time needed for proper piling and building up of a manure heap may be found by saving time through careful planning of the other parts of the work. For example, in the manure-hauling program, this hauling and piling can be done at times when other farm work is not pressing, such as after a rain or when the soil is frozen and the fields are not accessible. Also, the heaps can be located at intervals along 2 opposite borders of a field so that later when the manure spreader is working it will be emptied just before it reaches each pile and so spend no time running back empty. Furthermore, the value of time spent for proper handling of manure is more than balanced by the quality of the humus attained and the value of the nutritious substances thus saved.

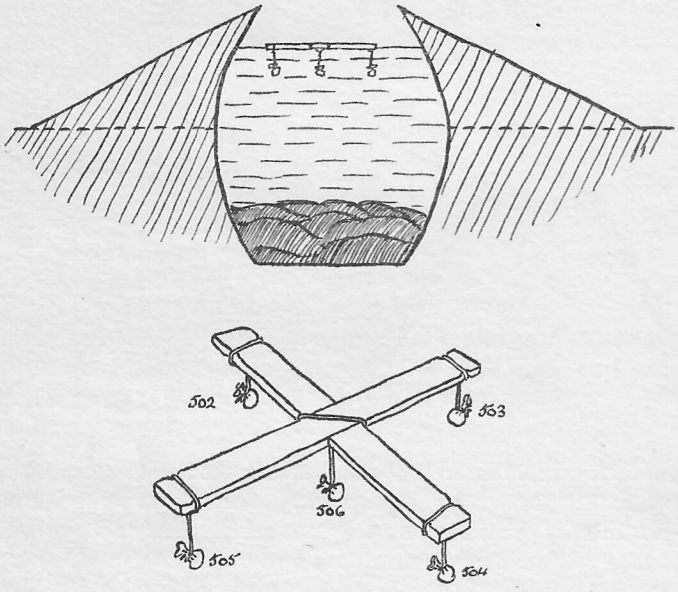

Fig. No. 5.

The Compost Heap

Reprint from "BIO-DYNAMICS"
Vol. II, No. 1, 1942

The Compost Heap

Supplementing the humus content of the soil is the surest way to fertility. While manure is the first thing that occurs to most farmers and gardeners as a means to this end, there is a vast reservoir of potential humus in all kinds of animal and vegetable material usually thought of as "waste." Those who realize this can never be guilty of the offense of setting a match to a pile of dead leaves. All material that is of organic nature is capable of being changed into humus—the best of all fertilizers.

Such material is found on every hand—for example: garden waste, leaves, grass-cuttings, hedge trimmings, weeds, sods; all sorts of garbage, including kitchen garbage; waste from cider mills and wine presses, and dust and waste from wool, cotton and tobacco mills; spoiled silage, old straw, spoiled hay, potato vines, cornstalks, threshing chaff and seaweed; pond, ditch and road cleanings; wood ashes, bone, hoof, horn and blood meal. Even peanut shells and sawdust will break down into humus if properly tended and given time.

As the material becomes available, it should be built into a compost heap with careful application of the methods hereinafter recommended. This may at first seem like a lot of trouble, but time thus spent will bring rich rewards in increased fertility of the soil, in finer soil structure and in healthier plants, and consequently in healthier human beings. A plant constitutionally strong is resistant to disease and therefore needs less poison sprays, or none at all. These sprays, falling on the plants, kill the disease organisms, but in falling on the ground, they also destroy beneficial soil organisms. So it will help both the soil and our pocketbooks, if we can cut down on their use.

Compost Yard. The compost yard should be in the shade for a large part of the day and protected from excessive winds, for heaps must not dry out. When this happens, the bacterial action almost ceases and so does the humus formation. The yard should be enclosed with a hedge or, at least in the beginning, with a fence of straw or rush matting. Sunflowers, sweet corn or pole beans can also be used for this temporary hedge in the home garden. The best trees to use are alder, birch, elderberry and hazel-nut. Besides supplying shade they have root exudations that have a stimulating effect upon the life in the heaps and thus further the conversion of the material into humus.

The yard should be accessible to wagons, to the manure spreader if the compost is to be spread on pastures or tilled fields, and for the tank wagon to haul water and liquid manure to the heaps.

Building. The first step in setting up a pile is the digging out of a shallow pit about 9 inches deep and rectangular in shape. If possible, a layer of already decomposed manure or compost is then spread over the new pit. If the subsoil is pure sand it is best to line the bottom with clay and a layer of straw. The bottom layer of a previous heap may also very well serve for a base.

On this foundation a layer of compost material—any of the organic wastes mentioned—about 4 inches thick is spread. If it should be dry or fluffy, it must be firmly trodden down and moistened.

On this first layer is sprinkled granulated or powdered quicklime as thinly as powdered sugar on a pie. This is calcium oxide, also called unslaked, burnt or "hot" lime. If this material is not available, hydrated lime may be used as a substitute. Ground limestone (CaCO) has not the same effect.

Next comes a layer of earth 1 to 2 inches thick. The topsoil excavated in digging the pit or scrapings from dirt roads can be used here.

Then another layer of plant material is applied, and so on. (See Fig. 1.)

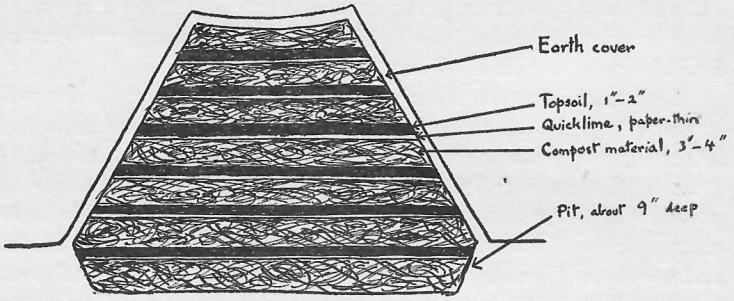

FIG. 1

The heap is shaped in building so that it tapers towards the top. The sloping sides thus are able to retain the earth cover, which is finally put over the whole heap. If the soil used for cover is very sandy, the sides should slope more so that the earth stays on. If sand is used, the cover should be about 3 inches thick; if the soil is average, a thickness of 2 inches is enough, while for a heavy clay 1 inch or even less is sufficient. The object is to exclude excessive air and to prevent escape of moisture. The right degree of moisture is essential in a compost heap. If the material is dry, it should be soaked as it is built up, if possible with rain water, or still better with liquid manure diluted with rain water. In the top of the heap a trough-like depression is made which catches rain and into which rain water and liquid manure can be pumped or poured, as the heap needs it.

Size. The size of the heap varies with the amount of material available and the area needing fertilizer. The width should never exceed 15 feet. Twelve feet is a good width. With a 12-foot base a heap slopes inwards to a width of 3 feet at a height of 5 feet. In the same proportions a heap 8 feet wide and 4 feet high is 2½ feet wide at the top. The heaps can be as long as desired.

Preparations. The cover put over the compost heap serves as a skin underneath which the heap should develop its own inner life. The process of decomposition resulting from its life activity should not run a haphazard course. There is only one desirable goal, and that is the formation of neutral humus, which benefits both the structure of the soil and the plants. To guide the decomposition towards this end certain plant preparations have been evolved through indications given by Dr. Rudolf Steiner. Their effect can be likened to that of a special yeast culture upon dough. An even, quick fermentation is promoted through the contact of these preparations with dead organic material. Experi-

ments have shown that the preparations are also rich in plant hormones and growth-stimulating substances.

After the heap is covered these preparations are inserted in order to transform the products of the decay of the organic materials into an odorless humus mass which can be quickly absorbed and digested by the soil. The preparations 502 to 506 are humus-like plant substances gained by special processes from such well-known medicinal herbs as camomile, yarrow and dandelion. Preparation 507 is an extract of valerian. Small portions of these preparations inserted in holes in the large compost heaps are sufficient to introduce a swift, healthy process of decomposition.

Along the sides of the heap and about one-third from its top holes are made with a crowbar or stick. These holes should run at an angle towards the center of the heap and about 2 feet in depth. (See Fig. 2A.) They are made around the heap at about 3-foot intervals and, if the heap is wide, also along the central depression. In each hole is placed a portion of one of the preparations (½ to 1 gram).

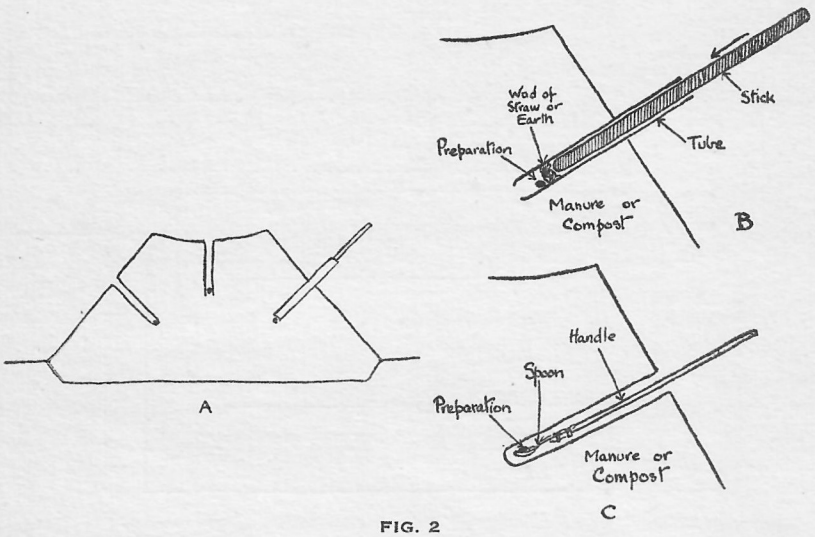

FIG. 2

(A) Cross-section showing even distribution of preparations in the heap. They should be at equal distances from each other and from the outside.

(B) Cross-section of pile showing use of the tube and stick to insert preparations.

(C) Spoon method.

A convenient way is to use an iron tube into which fits a round stick—a broom handle, for instance. First, the tube with the stick in it is plunged into the side of the heap. (A hole can be made with a crowbar first if the material is especially resistant.) Then the stick is withdrawn. The preparation is inserted into the tube and a handful of compost material, manure or earth is

pushed in. The stick is then used to ram the wad and preparation to the bottom of the hole. The tube is withdrawn somewhat and the stick pushed through so as to be sure that the preparation is deposited. Then the stick and tube together are withdrawn and the hole filled. (See Fig. 2B.) Another method is to use a spoon attached to a long stick. A hole is made with a crowbar and the preparation placed in the spoon and lowered into the hole. (Fig. 2C.)

If the heap is small, 3 of the preparations can be put in one of its sides and 3 in the other. (Fig. 3A.) If the heap is larger, say 20 feet long, the portions should be divided, 6 holes made in each side and a half portion put in each hole. (Fig. 3B.) If the pile is over 21 feet long, it should receive 2 sets of preparations. (Fig. 3C.) After insertion the holes are closed with plant material and earth.

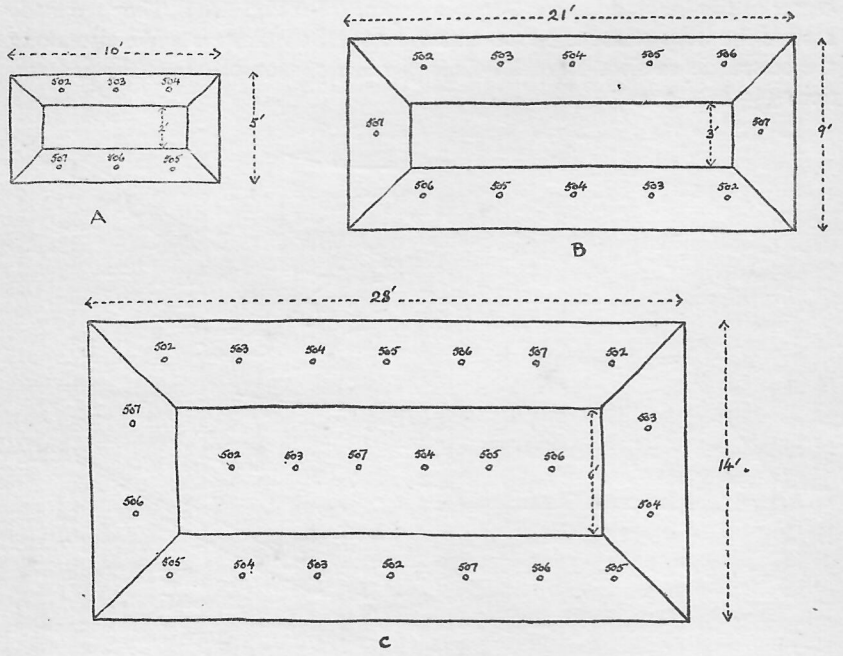

FIG. 3

(A) Small pile for which 1 set of preparations is used, never less than 1 set.

(B) "Standard" size of about 15 tons. One set of preparations is used. It is divided in half, and a half portion put in each of the 12 holes. This heap is about 5 feet high and is the size limit for 1 set. Piles larger than this should get 2 sets or more.

(C) Example of how to place preparations in a larger pile which is also rather broad. Placed 3 to 4 feet apart they are inserted in sequence around the pile. In the center 507 is inserted out of order to separate it more from the other portions of 507. For this pile 2 sets are used, divided into half portions.

Ten to 20 drops of the liquid preparation 507 are put into a gallon of lukewarm water, making a solution which still has the odor of valerian and is even slightly colored by it. The water used should be rain water. If there is no rain water available, pond water will do and next comes creek water. Spring or deep well water should only be used as a last resort, and then it should be exposed to sunlight for a couple of days before use. The solution should be stirred for 15 to 20 minutes so that it is thoroughly mixed. A small part—a quart or less—is then poured into the assigned hole, the remainder being sprinkled over the whole heap with a watering can. The water should not be boiled and then cooled but merely warmed.

Turning. After the compost heap is built, covered and has the preparations in it, it should be watched. At the end of a month dig into the side and see how the fermentation is coming. A heap properly soaked when made and carefully constructed should need no turning. Often, however, it is necessary, after two or three months, to turn the whole heap over, break up the layers, if they still remain, and bring the inside out, putting the outside of the old heap at the center of the new one and cover it again. If it has become too dry, it is best to soak it while turning, with rain water or liquid manure and afterwards to put in another set of preparations. Turning in rain is preferred.

Watering. Compost should be kept in the condition of a moist sponge—no liquid should run out of it, nor should it be stiff and dry.

In order to keep the compost in a moist state it is best, if the material used is rather dry, to pour a weak solution of bio-dynamically treated liquid manure in rain water over the material while piling it. After completion it is important to keep the heap moistened with periodical applications. There are two kinds of liquid manure which can be used for this purpose. One is the liquid excretions of the animals, the other is made by dissolving pure (cow) manure in water. (Both should have been treated with preparations 502 to 507.) A crock can be kept on hand in which to stir the second kind. Ordinarily the trough in the top of the heap is sufficient for the application. Water or liquid manure is poured into the depression and slowly seeps into the pile. In addition deep holes can be made toward the center of the heap. The liquid manure is pumped from a tank or poured from buckets into the heap as often as needed, perhaps every two weeks. As it soaks into the pile it is absorbed by the organic matter present there. It does not become putrid, but is drawn into the general process of fermentation. Its rank, harsh effect on plant growth is thus avoided.

It is not necessary to drench the heaps or pump torrents over them; moderate applications are sufficient. These, however, should take place regularly, alternating liquid manure with dissolved (cow) manure. The liquid manure should be diluted with about 2 parts water, while the solid cow manure should be dissolved in 12 or 15 times its volume of water.

Manure Barrel. For watering the compost in the home garden a manure barrel is of great value. A small, strong barrel is half buried (about up to the bung) in a semi-shaded spot. Earth is hilled up around the part above ground. The barrel is thus protected from rotting and a more even temperature is held in its contents. All kinds of manure which usually have a caustic effect when used

alone (chicken, pigeon, rabbit and dog, for example) are put in the barrel. This is then filled with rain water and preparations 502 to 507 are inserted. Preparation 507, the valerian, is stirred as described above and poured into the water. Preparations 502 to 506, however, are first placed in individual cloth bags and fastened to a wooden cross which floats on the surface. The bags themselves are submerged in the liquid manure by means of a stone in each bag. (Fig. 4.) The liquid should be stirred frequently.

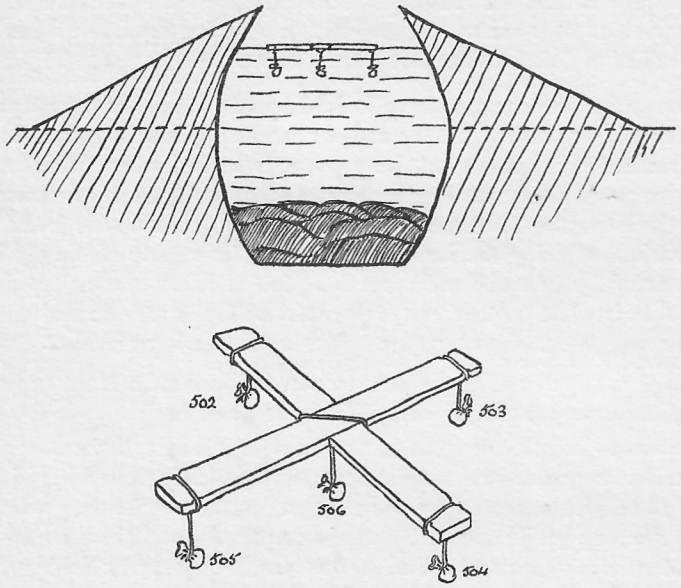

FIG. 4

This solution is poured over the growing or completed compost pile. Additions of water are made, thus keeping the solution from getting too strong. The manure is thus gradually dissolved and then replaced.

Tanks for the Barn. If possible, liquid manure should be preserved at the cow barn by building tanks into which it can drain. Preparations are inserted in the same way as described for the barrel. It has been demonstrated that fermentation takes place more quickly in tanks made of stamped clay and covered with boards than in cement tanks.

The best system is to have two tanks with a method of diverting the liquid into one or the other. A little of the old liquid should be left in one tank, preparations inserted and the liquid diverted into it. The fresh liquid coming in contact with the old is immediately drawn into the fermentation process. Meanwhile the other tank is standing full and continuing its fermentation. If each tank takes 3 months to fill, the oldest liquid in the tank ready for emptying is 6 months old, the freshest not less than 3. When the new tank is full, the old tank is emptied, except for a residue, a set of preparations is inserted and the liquid diverted into it. The other tank now stands full, while this one fills up.

A cow gives 1 cubic yard of liquid manure a year. With 2 tanks, each taking 3 months to fill, the volume required would be half the yearly production of the cows. For instance, with 20 cows a volume of 10 cubic yards would be required. Two tanks each 5 feet x 9 feet x 3 feet would be necessary.

Weeding. Compost heaps should never be allowed to become overgrown with weeds. Grass also makes a thick mat with its roots and hinders decomposition. Through its transpiration the plant draws out of the heap an enormous amount of water. So it is important to keep the heaps weeded.

Variety of Materials. In general, the greater the variety of materials in a compost heap the better. Instead of making a heap for example only out of leaves, a more fertile humus will result if the leaves are put in layers with grass cuttings and spoiled silage. The forest floor has such a rich humus because of the many different kinds of vegetation contributing to it.

Manure Compost. If some cow or horse manure is available a fine compost can be made by making layers as follows:

First—In the bottom of the shallow pit a 4-inch layer of manure.
Second—A 4-inch layer of garbage, garden waste or other organic material.
Third—A sprinkling of quicklime.
Fourth—A 2-inch layer of topsoil.
Fifth—Another layer of waste.
Then repeat, starting with the manure again. (See Fig. 5.)

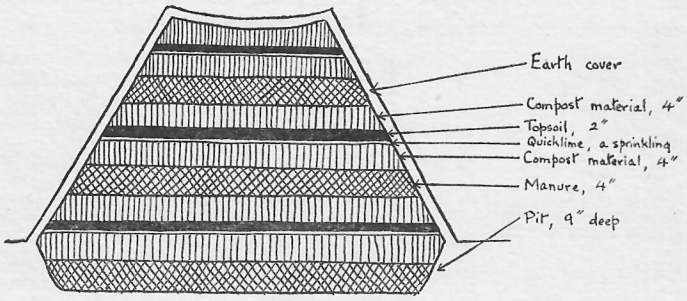

FIG. 5

The object of having layers of waste on both sides of the lime layer is to prevent contact of the lime with the manure. This would cause a "burning up" of the manure and hinder an even decomposition. Always avoid putting lime directly on manure.

Rabbit, chicken, sheep and other manures can be used in this way, but they should be put on in 2-inch layers only.

Weeds. All kinds of weeds can be used in the compost heap. These should, however, be put in the center of the heap, in which part, because of lack of air, all the weed seeds are destroyed. The heap should later on be carefully turned, so that the outside of the original heap becomes the core of the new one and the original core becomes the new outside. This ensures the destruction of the weed seeds in all parts of the heap.

It is usually best to set up a separate compost heap made of weeds and let it lie longer, even up to 5 months, before turning and a year and a half before using it. With the weeds it is a good plan to put in layers of other materials that take a long time to decompose, such as cabbage stalks, peanut shells and sawdust. The heap should then be marked and left for 18 months to 2 years.

Garbage. In bio-dynamic households there are 2 garbage cans in the kitchen, one for broken glass, cans, printed paper (ink is detrimental), etc., the other for organic material only, which is to be used in the compost heap. The garbage compost heap is, of course, built up gradually. After each addition, quicklime should be sprinkled and earth added. This discourages rodents and flies. When the heap is well under way, a set of preparations will start a quicker breakdown and remove any unpleasant odor. Chicken wire spread over the heap and weighted with heavy stones is an effective guard against dogs and skunks. This is removed for each addition and rolled back afterwards.

Leaves. Care should be taken that leaves do not become compacted and thus fail to decompose. A heap consisting of nothing but leaves will have to be turned more frequently than most other heaps. It is best, therefore, to use leaves in layers together with other materials.

Compost Without Lime. Some plants such as rhododendrons, azalea, blueberries and other berries like a slightly acid humus. To obtain this, the quicklime is omitted from the compost heap. Leaves layered with earth and kept well moistened provide a good humus for such plants.

Tomato Compost. Tomatoes thrive on a compost made from tomato vines. They also like to grow in the same place year after year. Since a garden may not have enough tomato plants to supply sufficient old vines for a pile of reasonable size, it is well to mix what vines there are with other material, using earth and lime as before. This compost is improved if quack or couch grass is included.

Conifer Compost. Pine needles and other conifer leaves, mixed half and half with other material, make a fine fertilizer for strawberries. Applied as a mulch after harvest, when next year's flowers start to form, it adds certain nutriments which give next year's berries a fine flavor. It also has the effect of strengthening the plant so that it stands up, holding its berries off the soil.

Clay Compost. Spread out an 8- or 9-inch layer of clay and allow it to remain over the winter. In the spring make a pile using this crumbly clay in layers of equal thickness with half-rotted leaf mold or other compost. Insert preparations and treat with liquid manure as described. The resulting humus, added to a sandy soil, adds weight and also makes a fine bed for roses.

Grass Cuttings. Grass cuttings should be used with other material, care being taken that the layers of grass are thin. If used in a pile alone they have a tendency to pack down, heat up and even burn, or else a lactic acid fermentation sets in and they are completely preserved as in a silo.

Pits. Deep pits are sometimes used for compost. This is a practice of those using the Indore method of Sir Albert Howard. It has good points, especially in a very cold climate where subzero weather over long periods suspends bacteriological activity, or in a very hot climate where the danger of drying out is great. Usually, however, much turning is needed to let in air and let out moisture, while a heap keeps a more even balance of air and water. The digging of deep pits also requires more labor, and would be inconvenient where compost is needed in different fields each year.

Time. Normally, in a moist, cool climate, the compost heap needs to be turned only after 2 or 3 months, and should be completely rotted in 8 to 12 months.

In the south the time is considerably shorter, the minimum for average material being about 2 months. The covering and shading in hot climates, however, must be done with care and the heaps watched so that they do not dry out. To help conserve moisture under these conditions, grass mats can be put over the heaps. Additional shade can be provided by planting vines—cucumbers, for instance—at the base of the heaps and training them over the top. The vines should not be planted on the heaps themselves, however; this would draw out moisture instead of conserving it.

Processes of fermentation leading to the formation of humus proceed very slowly when the temperature nears the freezing point and when the material is very dry. There is not much sense, therefore, in making a compost pile in winter if the material is cold or frozen. The kitchen garbage, however, can be piled all through the winter. It is also difficult to bring about decomposition in dried out material during a dry summer. In the latter case we should soak the material while setting it up and moisten it well during the drought period.

The condition of the compost at the time of turning determines whether or not it is necessary to insert more preparations. Usually decomposition will have gone so far that the layers are no longer visible. Since heaps will shrink, two heaps can be turned into one. If the original heap contained weeds or leaves which were infected with fungus diseases we must be careful, when turning it, that the outer part of the old heap becomes the core of the new one and vice versa. Seeds and pests are thus destroyed.

Cost. In the first season's compost-making on a large farm the total labor on a ton of compost costs about $1.55. On a smaller farm or garden, after compost-making has become well organized, the cost should be very much lower. Even $1.55, however, is a very low price for a ton of the best possible fertilizer—rich, neutral humus.

The art of compost-making comes with experience. It is at first astonishing to find how much material it is possible to find for the heaps. Eventually nothing goes to waste; all that has lived provides, when dead, material for new life. Thus the cycle is complete and the farm or garden becomes a biological unit.

The preparations are sold at cost to members of the Bio-Dynamic Farming and Gardening Assn. However, to those who show a serious interest in these methods a trial set of preparations may be sold. Those who wish to go deeper

into the methods are referred to the literature, particularly to the book "Bio-Dynamic Farming and Gardening" by E. Pfeiffer and "Grow a Garden and Be Self-Sufficient" by the same author.*

More information can be obtained by writing to the Bio-Dynamic Farming and Gardening Assn., Inc., R. R. 2, Phoenixville, Penna.

It is best to ask for preparations to be sent, only when the pile is ready for them. They may, however, be kept a week or two, if put in a damp, cool place.

* These books may be purchased from The Anthroposophic Press, Inc., 225 West 57th Street, New York City.