

CHAPTER SIX

The Treatment of Manure and Compost

The first problem facing the farmer is the proper use of manure and the correct treatment of compost. Contrary to the general popular belief, *we feed the soil by manuring*. We do not feed the plants. The vital activity of the soil must be maintained. Nature takes care of this by humus-developing activities, bacteria, earth-worms, roots that break up the soil, and weathering. The farmer's first task is to aid these natural *organic* processes in the soil. When manure is applied it must enter the soil in such a condition as to contribute to this work. It is least able to do this when it is raw and fresh. Unrotted manure, in its process of decomposition, actually feeds on the soil for a certain length of time. This is so because unrotted manure requires biological activity and energy in order to rot. Especially objectionable is the absorption of the decaying products of half rotted albumen which may be taken up directly by the plant roots. This can have a disturbing effect on plant and also on human health. In the familiar smell of cooking cauliflower, the sort of manuring treatment which the plant has received can be detected. *One can actually smell in the kitchen the pig manure, the sewage, etc., which have been worked into the garden soil.*

The best form of organic fertilizer is humus. Unfortunately a considerable length of time is required for stable manure to rot and become humus. And during this rotting period valuable substances are disintegrated and lost, if leakage is not checked. Generally speaking, stable manure is exposed to an endless series of losses. In the first place there is the loss of nitrogen under the influence of certain bacteria and the weather. These especially rob the surface of the manure mass wherever too much air is allowed to penetrate. The usual method of throwing stable manure loosely out into the manure yard, and exposing it to the sun and rain, may cause a loss of 50 per cent and more of nutritive substances. Some of its nutrition is dried out by the sun and oxidized away and more

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is washed out by the rain. If the manure stands on a slope, one sees a brown stream running out of it, carrying away the most important nutritive substances. The same farmer who has carefully calculated from fertilizer tables the amount of ammonium sulphate he needs in order to have a profitable harvest will, curiously enough, watch with the utmost tranquillity the nitrogenous substances of his manure running away in liquid form down the road, fertilizing the pavement and drains or, at best, the weeds along the ditch. I once met a man, exceptionally "practical" in his own estimation. Below his manure heap there was a small pond to which the brown liquid from his manure heap was running in numerous rivulets. "*Oh, that is all caught in the pond,*" he said. "*We clean it out every four years!*"

Then there is the opposite sort of manure heap, one that gathers all its liquid at its base; this slowly wets the base and then rises higher into the body of the heap. This condition quite insulates the part standing in the water or liquid manure from the air. Thereby, a proper fermentation is prevented, with the result that instead of a good fertilizer material we have a black, strange-smelling mass, a substance turning into a sort of a peat. The value of this as manure is slight. Such a product is more like a wet loam or clay than manure. It smears the ground, is taken up with difficulty, and even after weeks the black lumps are to be found in the soil still almost unaltered. Processes have taken place in this case which go far beyond the goal of humus formation, in contrast with manure which is dried out by too much exposure to the air. Manure which is, on the other hand, too tightly packed runs the danger of heating too much and of losing its best qualities. In short, there are many wrong ways of treating manure which may result in the loss of half its original nutritive value. Having calmly thrown away a large part of the nutritive substances in his manure, the farmer rushes to make up his loss by the use of mineral fertilizers. Even so, he soon discovers that these are only a temporary help.

The first and foremost practical rule for the right treatment of manure is to heap it up daily with proper care in the manure yard. It is best to start in one corner of the yard and build a firmly trodden, but not stamped-down, rectangle from two to three feet high, with a base area of two or four square yards. Then a second heap is placed alongside it, then a third, and so on. The first section may be covered temporarily with a few planks, so that a wheelbarrow can easily be run over it to the next. It is of the greatest importance, however, that the manure be always well covered. It is only

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when the entry of air into the heap is lessened by proper covering that the action of the bacteria which rob the surface is arrested. The best covering for the heaps is earth. With medium soil a four-inch covering is enough; if the soil is heavy less is needed. The leaching and drying-out processes are prevented by covering. Only where no soil is available should the covering be of peat-moss, planks, straw, or potato-plant thatch. If potato plants are used, it must be realized that a certain amount of their own valuable substance will be lost as they rot on the surface.

The thickness of the earth layer, as already indicated, depends very much upon the kind of soil used. However, the contents of the heap should on no account be completely shut off from outside influences. Impermeable soils, such as heavy loam and clay,

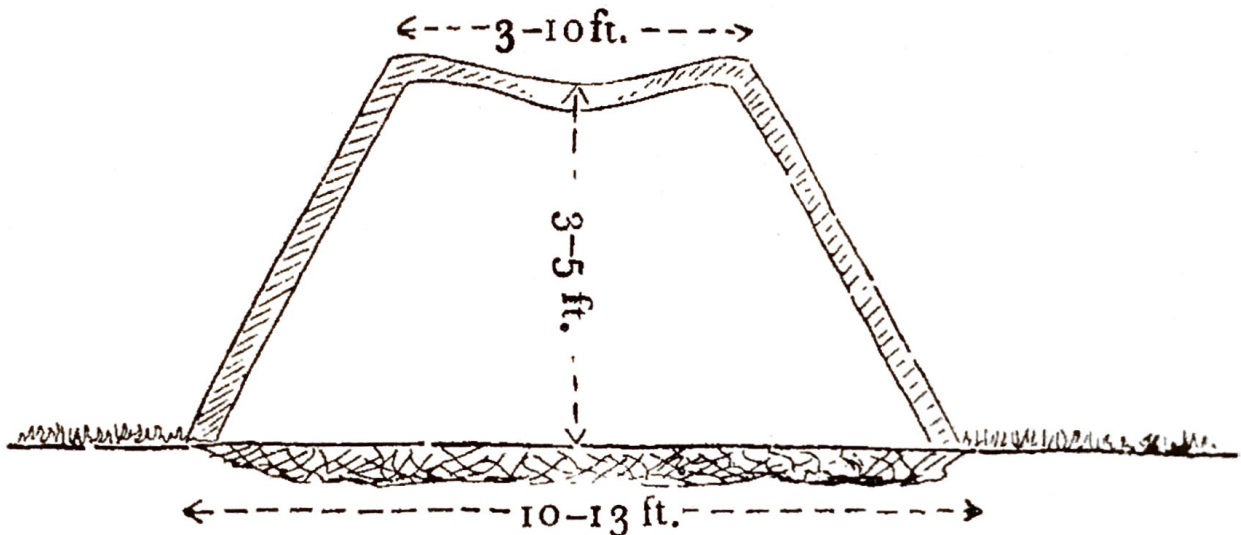


FIGURE 1. MANURE HEAP AND COVERING

must be applied thinly, especially when these are put on in a wet state. If sand is used, care must be taken that it will not be blown away by the wind nor be in danger of sliding down the sides of too steep heaps. The guiding principle in all this is the fact that the manure heap itself must be treated as a living organism, because of its bacterial content and its internal fermentation. As such it must have its outer boundary, or skin, separating it from the outer environment. It should develop its "own life". The decomposition of manure should not be subject to a haphazard fermentation. The one aim of the manure heap is the production of humus. And the purpose of all useful organic decay is to produce a neutral humus. Manure brought to the soil in this state not only gives it the maximum in fertilizer value, as far as available nutrients are concerned, but it is also most helpful to the physical structure of the soil.

At this point, besides the proper and careful handling of manure, begins the bio-dynamic method of soil treatment offered

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by Rudolf Steiner. Its effect on the soil can be likened to the process of making bread. Water and flour are first mixed into a dough. If this is then left standing for a certain length of time, exposed to the air, any yeast bacteria that may happen to be floating about (so-called wild yeast) will fall into this mixture and in the course of several hours or days will cause fermentation. The bread baked from such a dough is sour, bitter and hard; it is inedible. In order to produce a good edible bread, the baker must use a select strain of cultivated yeast or perhaps a leaven in order to get a quick and good fermentation.

The farmer generally treats his manure after the first method; fermentation is left to chance. His proper course should be to develop a controlled fermentation, which allows only a minimum loss of nutritive elements and causes a better humus formation. In this way he follows a controlled method, not one left to chance.

Dr. Steiner has shown that such control can be obtained by the use of certain plant preparations¹ which induce the right kind of fermentation. This is done by the use of various plants, which have always been employed also as medicinal herbs, such as: camomile, valerian, nettle, dandelion, horsetail, etc. These plants are themselves first put through a long fermentation process, buried at specific depths in the earth in close contact with certain parts of an animal organism. The process can be described by saying that through a kind of hormone influence the fermentation is guided in a definite direction.

After a number of months, these plants are actually transformed into humus-like masses. If small amounts of these preparations are inserted into a carefully piled up manure heap, the entire fermentation of the heap is given the proper tendency towards humus formation. The result is that after a short time — generally two months — the dung is turned into a blackish-brown mass, rich in humus materials.

Researches have shown that, during the rotting process, the bacterial content of such a manure heap is ten times that of one not so treated. Particularly noticeable is the presence of a great number of earthworms. Such heaps are constantly filling up with earthworms which, after their humus-forming activity is completed, die and provide an additional fertilizing substance through the decomposition of their own bodies. For the attainment of the results outlined here, a number of other points must also be considered.

¹ Cf. Preface

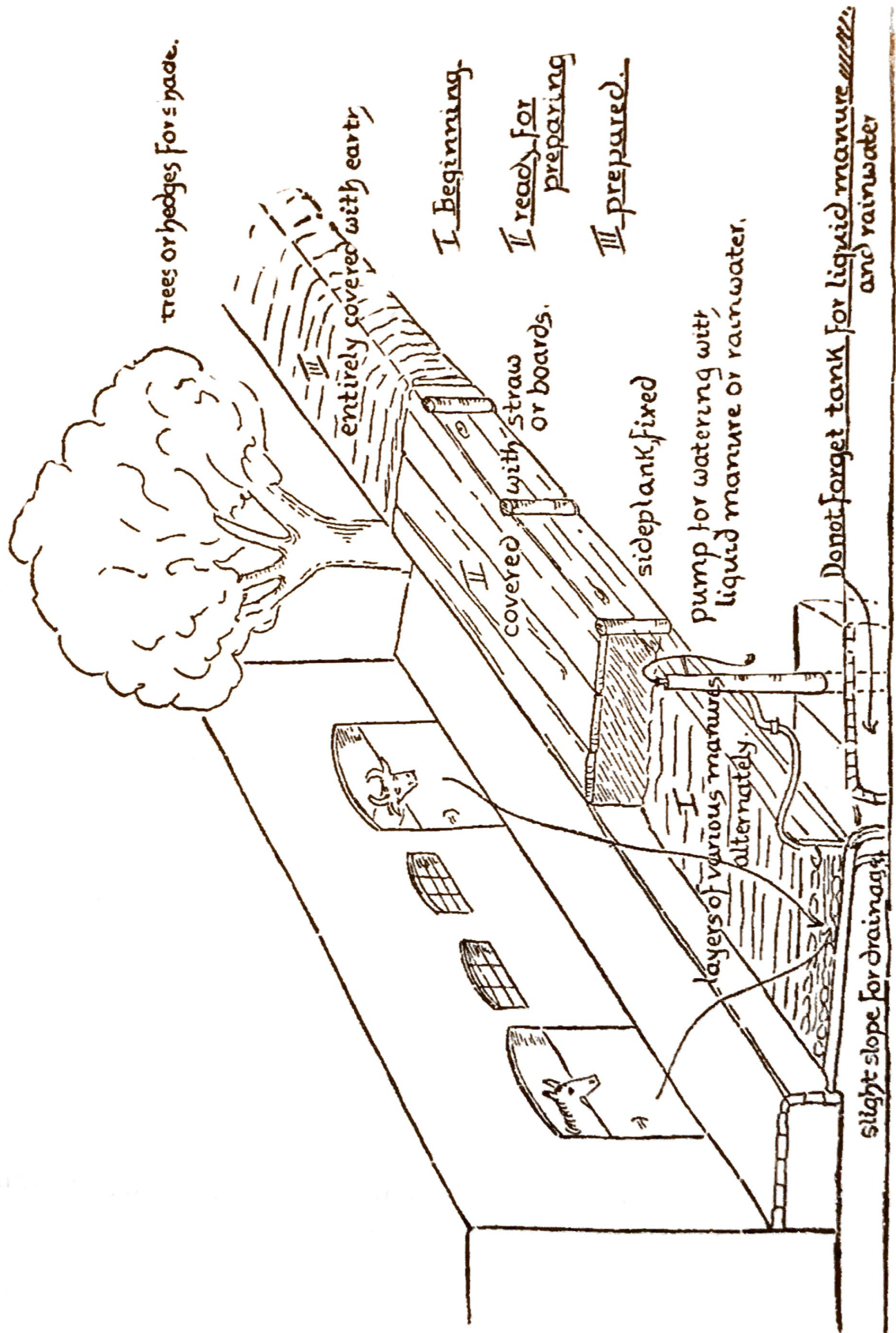


FIGURE 2. METHOD OF STACKING MANURE IN THE FARMYARD.

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Strawy manure, containing much air, heats easily, especially when it contains horse manure. Wet, greasy manure becomes putrid. The kind of manure produced depends also to a large extent on the feeding system in the stable. The best manure comes from a feed of roughage, grass, hay, clover, pea vines or other straw. It has the structure most favourable to fermentation, especially when, in addition, liberal use is made of straw for bedding down the animals. Turnips, turnip tops, etc., produce too wet a manure. Concentrated feeding produces a sticky manure of wet consistency which ferments slowly or not at all. The most unsatisfactory manure comes from animals fed chiefly on concentrates with little hay and when only such materials as leaves, sawdust, etc., are used as bedding instead of straw.

Any partial or complete departure from conditions which produce the best manure can easily be noted and corresponding measures taken to correct them. Because the best preservation of fertilizer values is obtained from mixed manures (horse manure especially being a protection against denitrogenizing bacteria), a mixed heap is to be recommended — but, of course, only where this is possible. Anyone who uses horse manure for hot beds must naturally store this up separately. The best practice otherwise is to take a cow manure, produced from hay and green feed and caught up in straw, and spread it carefully out over a small area in the manure yard. A thin layer of horse manure is then put directly on this underlayer of cow dung. This combination remains lying for a number of hours in order to “steam out”. Then, before the next layer of manure is added on top, the under layer is trodden down until it becomes fairly firm. When the manure is strawy, this treading down can be done more vigorously; if it is too sticky and wet, it must be less solidified. If the manure originates from concentrated feeding and has little straw mixed with it, it must lie exposed to the air a little longer to “steam out”, to dry out somewhat. In such a case, when possible, two piles should be started alongside each other and additions to them should be made alternately.

When the heaps have reached a height of three or four feet — strawy manure shrinks together more than other manures and can be heaped higher than wet manure, which suffers from too much pressing and packs itself too solidly together — they are then covered with earth or boards or straw. A new heap is then started or additions are made to the old one. The sides can be made of movable pegged planks, which are removed when the new batch is set up alongside. When making long heaps the



PLATE 1. A bio-dynamic manure heap.





PLATE 3. A model compost yard.

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procedure is to cover three to four sections as soon as they are set up. Such complete sections must then have the bio-dynamic preparations¹ inserted *from all sides*, in order thus to get a properly controlled fermentation from the very start.

If for any reason the manure is too wet (this comes from the wrong kind of feeding or from too much liquid manure, lack of straw, or excessive rain), a provision must be made for drainage within the heap. The manure heap must never stand "with its feet in the water". If the manure is too wet it cakes firmly together and becomes greasy and is unable to get sufficient air for its fermentation. In a case of that sort, when the addition of straw during the piling does not help sufficiently, the required and proper aeration can be obtained by drainage.

The necessary drainage can be effected by making a core of thorn brushwood, stiff briars or brambles of the stouter sort, or by the use of perforated drain pipes. It is advisable in very bad cases of dampness, or where the heap easily gets overheated, to put in "ventilators". These can be opened or closed as need indicates. The liquid running out of the drains should be gathered in a tank located at the end of the manure yard.

A manure heap that is too dry requires watering. Dry manure gets hot very easily, and, when there is no moisture at all, a fermentation is induced which is disintegrating and destructive. The heap remains unchanged or, when some chance wetting occurs, mould may form. This whitish-grey growth, as well as the presence of wood-lice in manure and compost, is always the sign of a too dry treatment of the manure.

The correct state of moisture for manure is that of a damp sponge; no liquid should flow out of it, nor should it be stiff and dry. For good fermentation this state should be maintained under all conditions. The best means of adding moisture is through pipes inserted in the upper part of the heap. This even becomes a necessity under extremely dry conditions. But ordinarily a trough-like depression in the top of the heap is sufficient. Water or liquid manure is poured into this trough and slowly seeps into the heap. The best liquid for such use is that which drains from the manure itself, the next best is liquid manure. Pumping the natural liquid manure out of the reservoir tank or pit on to the heap once a week, in order to moisten it, offers a very special advantage, for in this way the liquid manure is absorbed by the organic matter; it does not become putrid but is drawn into the

¹ Cf. Preface.

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general process of fermentation at once. In this form, the liquid manure has also an inhibiting effect on the activity of the nitrogen-destroying bacteria and thus preserves the nitrogen content of the manure. Its sharp rank effect on plant growth is in this way avoided. In many districts, particularly the hilly regions of Central Europe, it is customary to carry the fertilizing liquid manure directly out on to the pastures and hayfields. A clever peasant, whose farmyard lay high on a hill, with the pastures lower on the hillside, once built a pipe system in such a way that he only had to

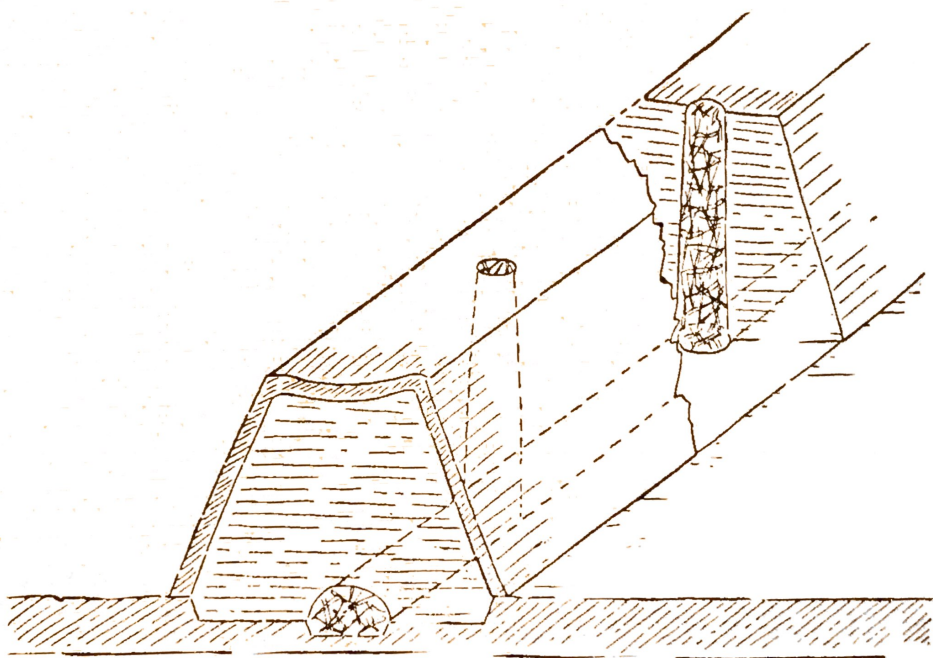


FIGURE 3. DRAINAGE SCHEME IN A MANURE HEAP.

turn on a cock at the liquid manure pit in order to accomplish his fertilizing. The harmful results of such one-sided fertilizing with liquid manure are well known. The reaction of the soil becomes more and more acid, characteristic pasture weeds appear and the growth of clover gradually ceases altogether. Furthermore, the high solubility of potash present in the liquid manure leads to a high percentage of this element in the fodder. This, as was proved by the Swiss research scientist, F. von Grünigen,¹ has in turn a

¹ F. von Grünigen, "Mitteilungen aus dem Gebiete der Lebensmitteluntersuchungen" in *Hygiene*, vol. xxvi, Nos. 3-4, Berne, 1935.

"Die physiologische Bedeutung des Mineralstoffgehalts im Wiesenfutter mit besonderer Berücksichtigung des Kalis."

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baneful influence on the health of the animals. All such bad results can be avoided if the procedure suggested above is followed.

In general, a manure which has been carefully heaped up and given the bio-dynamic preparations becomes ripe in two months and is transformed into a humus-like mass, ready for use. If dryness or too much moisture, or an excess of one type of the manure (too much horse in proportion to cow, for example), has brought disturbances into the fermentation, such as putrefaction, mouldiness, or too much heating, then it is advisable to turn the heap. This can be done when necessary from the second month on. If after two months the fermentation has already transformed the heap into an odourless mass, turning is unnecessary. If during the turning too great a dryness is observed, together with too high a

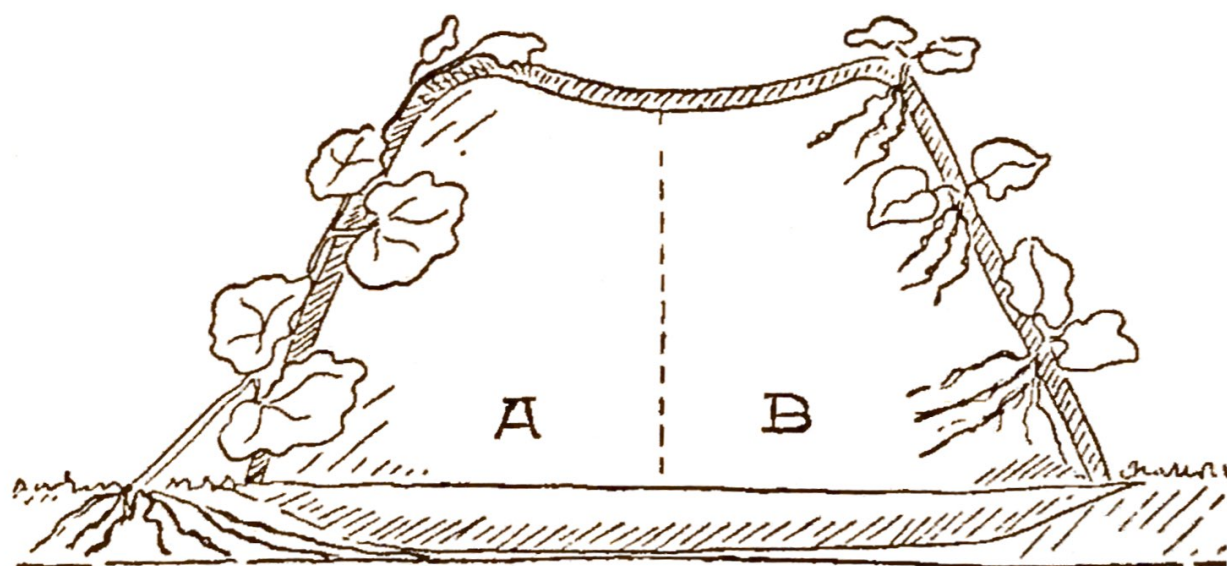


FIGURE 4. RIGHT AND WRONG WAY OF GROWING PLANTS ON A COMPOST HEAP.

temperature (anything over 150 degrees Fahrenheit must be considered harmful), then the mass must be thoroughly watered. Turning on rainy days is a good measure. Weeds should not be allowed to grow on manure or compost heaps. A growth of grass on the heaps is also harmful, for it cuts off air with its thick root system and thus checks fermentation.

On the other hand, where there is no shade the heap is exposed too much to the sun. It will then pay to screen it with matted straw, reeds, etc. If however it is necessary, for the sake of shade, to plant something on the heap, lupins or vetch are suitable or, as may be seen more frequently, cucumbers or gourds. The latter are planted in the ground around the outer edge of the heap, and the stems are trained up over it. A small hedge, or trees, should, correctly speaking, be planted around the site of the heaps. In dry summers a variation in the speed of the rotting on the north and

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south sides of the heaps has been noted. The shady side ferments somewhat more rapidly.

What has been said here in a general way concerning the handling of manure is equally valid for the preparation of compost. Compost is a mixture of earth along with every sort of organic refuse, which rots without having gone through an animal organism. It therefore lacks the presence of animal hormones which, even when present in infinitesimal amounts, foster plant growth.

Direct contact with the earth is very necessary for both compost and manure. Innumerable micro-organisms, which up to the present have not been isolated in pure cultures, are present in the earth, and we are therefore obliged to use the earth as the source of these organisms. For this reason it is necessary to build compost and manure heaps directly on the bare ground and to avoid anything which causes a separation, such as concrete floors, etc. In this way micro-organisms and earthworms have free access to the heap. Even grass and turf constitute a certain separation and it is therefore better to remove the turf from the site of the heap. For the same reason the compost heap, while being made, should have mixed with it soil which is "ripe", that is to say, which contains bacteria and humus. This has the effect, figuratively speaking, of a "leaven" or "sour dough" in bread making. Having developed a ripe compost, it is advisable, when taking it away, to leave a very thin layer of the old heap on the ground and to build up the new heap on this residue. Everything that will disintegrate into humus can be used for compost. All sorts of plant refuse, straw, chaff from threshing, kitchen garbage (the inorganic substances, such as broken glass, iron, etc., should be carefully removed), ditch cleanings, road scrapings, bracken, seaweed, potato plants, hedge trimmings, wood ashes, slaughter-house refuse, horn, hoof and bone meal, can be used.

The setting up of the compost heap is carried out as follows: The first step is to dig a pit for the heap from five to ten inches deep. If this pit is pure sand, then it is best to spread a thin layer of clay over the surface; at a pinch, straw may be used. This should be covered, when possible, with a thin layer of manure or compost already rotted; or if it is an old site the bottom layer of the previous heap will serve the same purpose. What has been said concerning the "drainage" and moisture of the manure heap is equally valid for compost. The structure and consistency of the compost should be moist, but not wet.

Alternate layers of compost material and earth are then laid on

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the heap and between these layers a thin sprinkling of unslaked lime should always be used. When the heap has reached a height of five to six feet, it should be completely covered with earth. The size of the heap should be kept to the following proportions: length, as convenient; breadth at the base, thirteen to fifteen feet; breadth at the top, six feet; height, five to six feet. Smaller heaps may be proportioned correspondingly. The dimensions given should not be exceeded. If the material is plentiful it is better to start a new heap than to exceed the dimensions given. Only in dry and hot climates are larger heaps preferable since they conserve moisture better. In wet climates narrower heaps are preferable because they permit a better air circulation. This also applies to manure heaps. The thickness of the earth — both the interlayers

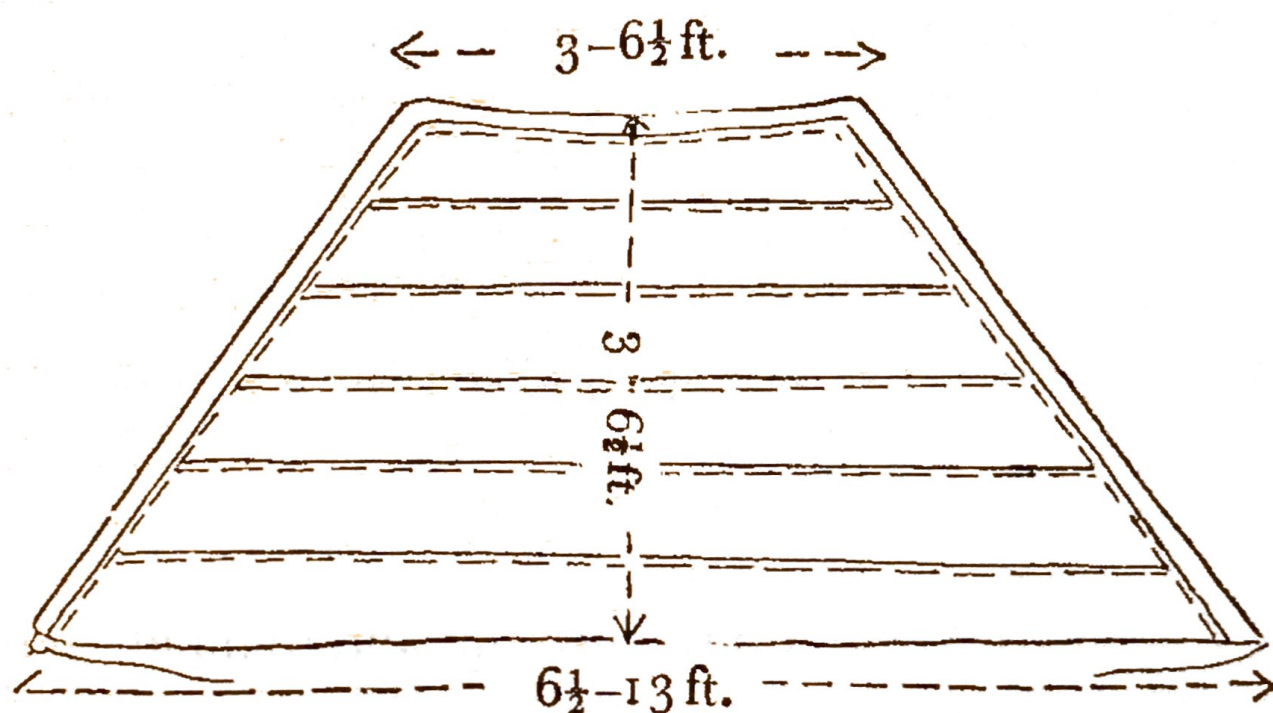


FIGURE 5. CONSTRUCTION OF A COMPOST HEAP.

and the covering — will depend on the nature of the soil in question. We should be guided by the fact that the fermentation of the heap is a life process, hence the heap must be allowed to breathe. It should have a *skin* which holds it together but which does not isolate it. If the soil used is heavy and sticky clay, the thickness should not exceed two to three inches; when the soil is light, the thickness can be from four to eight inches. It is important to note that soil from orchards and vineyards, which have been sprayed with arsenic, lead and copper preparations, is impregnated with these metals which are hostile to bacteria; such soil is entirely unsuited for preparing compost. I have seen heaps made with such soil which had not rotted after standing for two years.

It is of great importance that all compost material be moist. If, as with leaves, etc., this is not the case, the material must be moistened with water, or liquid manure must be poured on it at the

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time of setting up. *Maintenance of the proper moisture is one of the most important requirements of the manure or compost heap.* In time, the compost maker acquires the necessary experience. As far as possible, leaf compost should be set up immediately after the leaves have fallen and not next spring, when they will already have been "washed out". While the heap is incomplete, the material spread out on it, for example, the daily kitchen garbage, should be immediately covered with straw mats, sacking, reeds, fir or evergreen branches, or straw etc. In tropical regions, banana leaves are particularly suitable for this purpose. If the finished heap cannot be made in the partial shade of trees and shrubs, it needs a covering which will afford a similar protection. When the heap has grown to about a yard in height, the treatment with the bio-dynamic preparations is begun. Preparations 502 to 506 are inserted at distances of about a yard apart, and the heap is sprinkled with preparation 507. What was said on page 52 concerning the treatment of manure applies here also.¹

This treatment brings about a speeding up of the fermentation in the direction of humus formation. In about three to five months after the heap has been made it is turned, and if necessary, the preparations are again inserted. After the turning, the material is naturally mixed together, and is no longer in layers.

The art of compost making was better known in earlier centuries than it is now even to many "experienced" agriculturalists. In Flanders there was formerly a guild that had the sole right of collecting organic refuse during the daytime. This was interlaid with earth. The ripe compost found a ready market. Anyone outside this guild wishing to make compost was obliged to build his heaps secretly by night. In many places in South Wales people are still familiar with the old practice of building heaps with layers of manure, rubbish and quicklime, and covering them with earth. For such heaps it is necessary only to insert the preparations given by Dr. Steiner to add the proper "finishing touch". The "Indore process", of Sir Albert Howard based on experiences under tropical and subtropical conditions is reminiscent in many ways of the bio-dynamic treatment, except, however, *in the use of the preparations.*

Weeds of all kinds can also be used in the compost heaps. Care must be taken that this material all reaches the inner part of the

¹ More detailed information on the use of bio-dynamic preparations is available through the authorized information centres and in the booklet: *Short Practical instructions in the Use of the Biological-dynamic methods of Agriculture*, by E. Pfeiffer. See Biodynamic Associations — page 212.

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heap in time. Here, because of the lack of air, the conditions of fermentation are such that they destroy all seeds. In turning the heap, the outside of the original heap should be made the inner part of the new, and the former inside part now becomes the new outside. In this way the weed seeds are destroyed in all parts of the heap. Best of all is to make separate weed compost heaps and let them lie longer, even up to five months, before turning, and eighteen months before use. The normal time of rotting of well-handled compost in the damp cool climate of Central Europe is from eight to twelve months for compost material of all sorts. Cabbage stalks, which require about eighteen months, are an exception. Hence it is preferable to mix such material as this with weed compost. In tropical and subtropical climates the fermentation occurs in about three months.

The final result is a fine, aromatic compost earth, smelling like woodland soil (humus). Anyone who has much experience with the preparation of compost will soon discover two things: first, that the making of compost is an "art", second, that on every farm or garden where all the refuse material is carefully gathered, the amount of compost material is far greater than is generally believed. But this is true not only of gardening. In extensive farming also there are great reserves of compost, if we include chaff from threshing, potato plants, mud from ditches and ponds, waste straw, turnip tops not used for fodder, road scrapings and other materials. On a mixed farm of 250 acres, with fourteen dairy cows, four horses, a proportionate number of young cattle, and an intensive culture of grain, it has been ascertained empirically that the quantity of compost gathered together in a year was equal to the quantity of stable manure gathered in six months, the latter being well mixed with straw. (Katherine Castelliz comments: Since horses are no longer used, more cattle can be kept in their stead with the same results as far as manure is concerned. The lack of labour on farms unfortunately reduces the sources of compost. On the other hand, a lot of material is available commercially, such as municipal compost and manure from commercial animal enterprises and from riding stables, albeit one might have to be a little careful with these because of poisonous substances they may contain, for instance wood preservatives. Machines can be used to set up the heaps and soil can be shoved up onto a heap in the field, as this soil then goes back again on the same land.)

If we include the conservation of fertilizer values resulting from bio-dynamic treatment of the organic manures and composts, we

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can confidently assert that by composting the fertilizing materials not used before the farmer will have, after the change of method, more than *double his previous amount of fertilizer* in respect of value and content. It should be pointed out to the agriculturalist or fertilizer expert, who may think the bio-dynamic method does not adequately cover the nutrient requirements of the land, that the full value of the manure of the bio-dynamic farmer is conserved instead of being wasted and he thereby creates a reserve. He can cultivate more intensively because his organic fertilizer — the basis of all agriculture — is more intensively treated.