Fertilizing Lawn and Garden Soils

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Fertilizing Lawn and Garden Soils

Abstract
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FERTILIZING LAWN AND GARDEN SOILS

BY PERCY E. BROWN

To make a good lawn or a productive garden, the soil must be reasonably fertile or be made so by special treatment, and it must be kept fertile by the regular use of manure or other suitable fertilizers.

At no time can more be done to insure a good soil for lawn or garden than when the excavating and grading are under way. Very often a site that is naturally fertile is made infertile by spreading over its surface the subsoil that is brought out of the basement excavation or moved in grading. Often, too, the building rubbish is scattered over the yard and covered thinly with subsoil. In either case, grass and vegetables grow feebly, the lawn is unsightly and the garden unprofitable. One of the first rules in making a lawn or garden, therefore, is to keep at least six to twelve inches of rich soil on the surface.

If it is necessary in grading to remove the original surface soil, which is likely to be fertile, save it; then remove a layer of the subsoil about a foot deep, haul it away, and put the surface soil back in its place to bring the yard to grade. If the soil taken from an excavation is to be used in filling a low spot, remove the surface soil from that spot first and later spread it over the subsoil that has been used for the fill. Remove all building rubbish from the yard before grading. Do not use it for filling unless the low spot is so large that the rubbish can be covered over with a good even layer of rich surface soil in which grass or vegetables will grow.

If these precautions were always taken to have the surface of the yard uniformly covered with a good rich soil many of the troubles with lawns and gardens would not arise.

Inasmuch as a rich surface soil is not always at hand, as difficulties of drainage and the like must be dealt with, and as the lawns or gardens already established are often not satisfactory, special methods must be followed to make soils productive. These methods must vary with different conditions, especially where lawns are concerned as it is clearly impossible to put organic materials into the soil under an established lawn; in such cases the methods must be adapted to the special problem.

It must be recognized furthermore that exactly the same methods of treatment will not fit all soil conditions. The recommendations of this circular are for average soil conditions; for special conditions the treatment must be modified, usually by varying the amounts of fertilizer used.
LAWNS.

The fertilization of lawns will be considered under three headings: Establishment, maintenance and renovation.

ESTABLISHING THE LAWN.

The successful establishment of a lawn depends upon, first, the careful preparation of the land; second, the proper fertilization of the soil, and third, the planting of grasses best suited to the locality and general soil and climatic conditions.

PREPARING THE SOIL.

The suggestion has already been made that the grounds around the house should be carefully graded after removing all building rubbish, that the subsoil should never be exposed at the surface and that a rich soil from 6 to 12 inches deep should cover the entire surface of lawn or garden. Several other things in preparing the soil are equally important.

In the first place, good drainage should be insured. To do that the laying of tile may be necessary. If the subsoil is very heavy and does not permit excess moisture to run off very readily, the surface soil is likely to hold too much water and become water-logged. Such a condition means a lack of air, and hence the beneficial processes that depend upon air cannot go on and there is an accumulation of injurious compounds which are harmful to grass. Tiling is necessary to remedy such a condition.

On the other hand, if the subsoil is light and sandy the water is lost too rapidly and the lawn will suffer in dry weather for lack of moisture. For such a condition the use of manures and lime will also often prove of much value.

In general it may be said that the subsoil should be moist at all times and yet permit of thorough drainage. It should hold enough moisture after the wet season to supply the lawn during dry weather.

In choosing the soil to cover places which have been filled in, secure a good loam, fairly rich in plant food and organic matter and free from objectionable weeds. Soil which has been under cultivation and has been giving satisfactory yields of ordinary farm crops is good, as its fertility has been proved and many objectionable weeds have been eliminated from it by the thorough cultivation to which it has been subjected. Soil for filling purposes should not be taken from cuts, steep hillsides or infertile areas overgrown with weeds, if it is to provide the surface soil for a lawn. It is almost impossible to obtain a good stand of grass on such soil.

After the yard has been properly graded and provided with good drainage and a good surface soil to a depth of at least 6 to 12 inches, plow up the entire area, turning over as much of the soil as possible without admixing any of the subsoil with the surface. Then it is ready for fertilization.
FERTILIZATION.

The foundation for fertilizing lawn soils is the use of manure, and enough must be used to provide an abundance of organic matter to keep the soil in the best condition for maintaining the lawn thru a long period of years.

The organic matter furnished by manure keeps the soils in the best condition for plant growth by increasing the waterholding power of light soils and by opening up heavy soils and putting them in better physical condition as regards both aeration and moisture. Manure also adds plant food and millions of bacteria, those microscopic organisms which are of so much importance in providing available food to plants. The proper decomposition processes cannot go on in soils and plant food cannot be produced in necessary amounts unless bacteria are present in abundance. The plant food added in the manure is only a small part of what will be necessary for the lawn for any long period of years and other fertilizers must be used also. But commercial fertilizers cannot take the place of manure in keeping the physical condition of the soil at the best, hence the necessity of a heavy application of manure when the soil is being prepared.

There is only one danger in the use of manure and that is the introduction of weed seeds which may prove very objectionable later. This danger may be overcome by the use of thoroughly composted and rotted manure, for in the rotting process the weed seeds are killed.

The amount of manure to use in preparing a lawn will vary somewhat with the type of soil. On sandy soils the dressing can be made much heavier than on heavy soils. On average soil 40 to 60 loads per acre of well rotted stable manure is not too much. If the soil is very light and sandy more may satisfactorily be used. It is hardly possible to make the soil for a lawn too rich, and there is danger of its not being rich enough, so that abundant applications of manure should always be made.

In case stable manure is not available use dried manures, such as sheep manure. These may be secured from fertilizer companies, if not locally. Apply such materials at the rate of 1,000 lbs. per acre. They are not of as much value as well rotted stable manure, but they are not likely to contain weed seeds and they contain no litter and hence are somewhat more concentrated than stable manure.

If neither stable manure nor dried manure is available, the yard may be seeded to a green crop, such as clover, cowpeas or soy-beans, and after it has made abundant growth, it may be plowed under. This will add a considerable amount of organic matter to the soil and while the treatment is not as satisfactory as the use of well rotted stable manure, it is a valuable substitute for that material. One objection to this method is, of course, that it delays the securing of the lawn for
one season, but it is worth while to wait a year to insure a more permanent and satisfactory stand of grass.

After applying manures, determine whether the soil is acid or not. If it is acid apply three to four tons of ground limestone per acre; this amount should prove sufficient for most soils in this state. It is possible, however, to apply lime in small amounts from time to time, provided finely ground limestone is used, and hence it is not necessary to make such a large initial application as in the case of manures, but enough should be used. Lime not only remedies acid conditions but also improves the structure of both heavy and light soils, opening up the former and making the latter more retentive of water and plant food. Lime also aids bacterial development and thus increases the production of available plant food, while it is itself a necessary food for the growth of most grasses.

To insure an abundance of plant food for the luxuriant growth of grass, applications of concentrated fertilizing materials in addition to manure and lime should be made. Phosphorus is the element most likely to be lacking from soils and this may be supplied in the form of bone meal, acid phosphate or rock phosphate. The former material is preferable and from 500 to 1,000 lbs. per acre should be used at first. Further amounts may be added later as necessary. Acid phosphate may be used if bone meal cannot be secured and a similar application made. If rock phosphate is employed, from 2,500 to 3,000 lbs. per acre must be applied as it becomes available very slowly. Even in the presence of abundance of organic matter supplied in the manure the production of available phosphorus from rock phosphate would be slow under a lawn and the use of bone meal or of acid phosphate is undoubtedly preferable.

In addition to phosphorous fertilizers, 300 to 500 lbs. of a high-grade commercial fertilizer should be applied per acre. Several brands of complete fertilizers may prove of value, a "3-6-8" or a "2-8-10" probably being the best; that is, complete fertilizers containing 3 percent nitrogen (NH₃), 6 percent phosphoric acid (P₂O₅), and 8 percent potash (K₂O), or containing 2 percent nitrogen (NH₃), 8 percent phosphoric acid (P₂O₅), and 10 percent potash (K₂O).

These complete fertilizers add enough available nitrogen, phosphorous and potassium to supply the needs of the young grass crop for its immediate growth, and stimulate the grass to an abundant early growth, giving it the start necessary to overcome the growth of weeds.

*The litmus paper test is convenient for testing soil as to its acidity. Secure blue litmus paper from any druggist. Take a small sample of soil, free from roots or grass, and put it in a clear glass tumbler. Insert two strips of the litmus paper in the soil so that they are half covered, being careful not to touch with the fingers that portion of the paper placed in the soil. Then add pure water carefully until the soil is thoroughly soaked. Let the test stand from 20 to 30 minutes, remove the paper and rinse thoroly. If the paper which was in contact with the soil has turned red then the soil is acid.
SEEDING.

In seeding choose grasses suitable for the locality. Kentucky blue grass makes the best turf. Canada blue grass is not as satisfactory. A mixture of blue grass and English or Italian rye grass gives the best immediate results. The English and Italian grass are quick growers and make a good temporary lawn, gradually dying out and leaving the blue grass in possession. Three parts of Kentucky blue grass to one of English rye grass is a mixture which has generally proven successful and is sown at the rate of 70 lbs. to the acre.

Special lawn mixtures which are sold for seeding shady places cannot be recommended. They do not give general satisfaction. If a lawn is to be established under trees with dense foliage, the only way to insure satisfaction is to trim the trees so as to admit sunshine.

Whatever mixture of grasses is sown, the seed should be pure seed and of high germination. The stand of grass is likely to be uneven and scant in parts of the yard if uncleaned, unselected seed containing a great number of hulls and light seeds is used. Selected or re-cleaned blue grass seed, although costing more than the poorer grades, will prove more economical in the long run.

The seed should be thoroughly distributed, preferably scattered half in one direction across the yard and the other half in the other direction. In this way, there is no possibility of bare spots or streaks.

It is desirable to sow grass seed just before a light shower. The rain pats the seed down close to the soil and insures a uniformly thick stand of grass. In Iowa the best time to seed a lawn is early in the spring, though in many seasons a very good stand can be secured by sowing about the middle of August, or just before the fall rains. Fall seeding, however, is quite uncertain on account of the unfavorable moisture conditions in the soil at that time of year. Furthermore, if the ground is not protected by snow during the winter and freezes and thaws repeatedly, the young grass plants from fall seeding are likely to be killed.

After the seed has been sown rake the surface of the soil carefully. If the ground is dry, it is advisable to roll also, but if showers have followed the seeding only the raking is necessary.

MAINTAINING THE LAWN.

After the lawn is established it must not be neglected or all the care used in its establishment will be wasted. It must be tended more carefully even than the farmer tends his crops, for it is expected to last for many years without being remade.

First, it is important that the grass should never be allowed to go to seed. Nothing else is so injurious to the maintenance of a luxuriant lawn as the production of seed. Keep the lawn mowed, just clipping the grass close enough to leave sufficient leaf area for the normal functioning of the plant. Only in periods of drought should mowing
be stopped and even then it is not well to allow any production of seed.

Mow the new lawn just as an old one, but set the mower high in order not to cut the plants back so far as to injure them. In the case of the new lawn it is well to allow considerable growth in the late fall to protect the grass roots during the winter.

Rolling is of considerable value on the new and also on the old lawn. The newly established lawn particularly needs frequent rolling to compact the soil and make the grass roots as firm as possible; the heavier the roller the better. On old lawns early spring rolling is essential to overcome the loosening of the grass roots due to winter's freezing and thawing. Frequent use of the roller during the entire season will also help to make the surface of the lawn more compact.

The use of water on lawns is frequently necessary during continued droughts, but under ordinary circumstances with average rainfall it is not necessary.

If the lawn is watered do not sprinkle it. Sprinkling does little more than to check the giving off of moisture by the leaves. It does not wet the ground except at the surface, from which the moisture is evaporated before it gets down to the grass roots. It is far better to lay the hose on the ground and allow the water to flow freely from it in one spot for an hour or more, and then move it to another spot. Such watering is not necessary every day even in the driest weather.

FERTILIZATION.

After the lawn is once established it can be fertilized only by surface applications. It must be emphasized again that no amount of later fertilization can remedy a lack of care in the preparation of the soil when the lawn is established. But after a good lawn is secured, its proper maintenance depends upon the addition of various materials to keep up the content or plant food.

Well rotted manure may be applied to lawns as a fall mulch, or during the winter, at the rate of 10 to 20 tons per acre. It protects the soil from the alternate freezing and thawing of the winter and also adds valuable plant food which is leached out of the manure and into the soil by the winter rains. Only rotted manure should be used for such a purpose as the danger from weed seeds in fresh manure is very great. The manure may be left on the lawn until the grass begins to grow in the spring when it should be raked off and the lawn thoroughly rolled. In case rotted stable manure is not available, dried sheep manure may be applied at the rate of one-half to one ton per acre. The best effects from this material would probably be secured by its use in the early spring, although it may also be applied in the fall. The objection to the spring application is that it mars the appearance of the lawn.

As a spring top dressing, apply finely ground bone meal at the rate of 500 to 1,000 lbs. per acre. Phosphorus may also be applied in the
form of acid phosphate, but the bone meal is preferable. Potassium may be applied as wood ashes or as commercial muriate of potash, but it is usually preferable to use a complete fertilizer such as was recommended in the establishment of the lawn, that is, a "3-6-8" or "2-8-10" brand, instead of a special potassium fertilizer. If this is applied at the rate of 300 to 500 lbs. per acre one year and then the ground bone for two years, sufficient phosphorus and potassium will be added to keep the grass supplied with these elements.

Nitrate of soda should be applied at the rate of 200 lbs. per acre in the spring after active growth has begun. This may be added by dissolving in water and sprinkling over the lawn, or by spreading it over the grass just prior to a rain or a sprinkling. The complete fertilizer and bone meal should also be applied at a time when it promises to rain in order that they may be washed down into the soil.

Further applications of nitrate of soda may be made to the lawn during the summer with advantage. Fifty pounds per acre applied several times during the season will keep the grass green and rank during the hot summer months when nitrification in the soil is low and the grass is apt to become parched and yellow.

Lime should be applied to lawns only very infrequently. If a liberal application, such as has been recommended, is made when the lawn is established it should not be necessary to apply more lime within five or six years. If the soil has a tendency to become acid, however, it will be well at the expiration of that time to apply finely ground limestone in the fall at the rate of 500 to 1,000 lbs. per acre. This operation should be repeated every five or six years and the reaction of the soil will then be kept satisfactory.

The use of well rotted stable manure, or of dried sheep manure, the application of finely ground bone meal for two years and a complete fertilizer every third year, a spring and summer application of nitrate of soda and the use of lime every fifth year, should together keep a lawn covered with a vigorous, luxuriant growth of grass.

Proper mowing and rolling are also to be emphasized as important in the maintenance of a fine greensward.

**RENOVATING THE LAWN.**

The most effective way to renovate the old lawn is to make a new one. In most cases it will not pay to attempt to patch a poor grass plot for the difficulty probably is due to lack of proper soil conditions and these cannot be satisfactorily remedied without an entire remaking of the lawn.

If the lawn is on a good soil and is merely disfigured with weeds, it can be brought into satisfactory condition by scratching the surface with a rake after removing the weeds and seeding with good cleaned seed, using about one-half as much as for a new seeding. Bone meal, a complete commercial fertilizer and nitrate of soda may then be
added as recommended in the discussion of the maintenance of lawns. But usually a poor lawn is due to originally poor soil conditions and these can only be remedied by a new start. It is best to plow up the lawn, apply lime and manure, bone meal and commercial fertilizer as recommended in the establishment of lawns; seed with good grass seed, roll and keep mowed and fertilized and a new lawn may be secured which will prove very satisfactory.

This is the quickest and surest method of securing a good stand of grass and a uniform lawn. Patching a lawn is a tedious process at the best and the result is almost certain to be anything but satisfactory.

**VEGETABLE GARDENS.**

Most of the difficulty in growing good vegetables is due to the fact that the soil is not properly prepared. Either the garden is made on poor subsoil thrown out in the building excavations, or the soil is not properly fertilized.

The soil should be just as carefully prepared for the establishment of a vegetable garden as for the establishment of a lawn, the only difference being that applications of fertilizing materials may be made annually to a garden soil and hence smaller initial amounts are required.

All vegetables require an abundance of plant food for their best growth. Available plant food is not produced rapidly enough even in the best type of soil, to supply the needs of rapidly growing vegetables. Furthermore, for early spring crops the bacterial processes in the soil at that time of year are too slow to feed the plants properly. The necessity for special fertilization of gardens is, therefore, easily understood.

The fertilizing methods used in ordinary farming will not do for the garden. Concentrated commercial fertilizers, supplying several kinds of available plant food, must be used for the garden. There is considerable variation in the fertilizer requirements of different garden crops but these cannot be discussed individually here. Furthermore, home gardens grow a large variety of crops in small quantities and for them it would be quite impossible to follow special methods of treatment for individual crops. The case is different in market gardening, of course, but it is the intention to consider here only the home garden. The recommendations will, therefore, be made general to suit the needs of the common vegetables which make up the ordinary garden.

Certain special fertilizing mixtures are suitable for a large variety of crops and are good as a general basis for fertilizing gardens. For the small garden some complete brand of fertilizer ready for use is cheaper than incomplete brands suitable for the different crops. The home mixing of small amounts of incomplete fertilizers for use on gardens is troublesome and unnecessary. Complete brands quite as suitable for general garden crops may be purchased ready for use.
PREPARATION OF THE SOIL.

As in the case of lawns, gardens should not be made on areas from which the surface soil has been removed or which have been filled in with subsoil or building rubbish. For a successful garden it is essential that there be a covering of surface soil at least 12 inches deep. If this is not the case, surface soil must be secured and spread over the area if a satisfactory growth of vegetables is to be insured.

It is quite essential also for gardens that the drainage be satisfactory. Vegetables will not do well in a soil which is wet and consequently cold. In choosing the location for the garden, select a southern exposure if possible, as this is most desirable. Soil on a southern slope is easily worked, allows of the perfect control of the water which falls upon it and, what is more important than either of these points, it permits of earlier spring working. Frequently it is possible to grow two crops on a southern slope where only one could be grown on a northern slope. Then, too, certain crops, such as melons and tomatoes, which require a long season and a warm location to mature, might not ripen on a northern slope. For early spring crops it is necessary that the soil be light and sandy; warming up quickly under the influence of the spring sun. Such a soil on a southern slope presents ideal conditions for early vegetables. In most cases, however, there is little opportunity for choice in the location of the garden and the soil must be used as it is found and put in the best condition possible for the growth of vegetables.

If the soil is heavy and has a tendency to be too wet, install tile drains or many vegetables will suffer from an over supply of moisture and consequent delayed growth.

A good loam surface soil underlaid by a rather stiff, clayey subsoil will present ideal conditions for gardens. On such soils enough water is retained in the subsoil for the nourishment of the crop, but it is also porous enough to permit of proper drainage and the surface soil will not retain an over supply of water.

If the subsoil and surface soil are both light and open in texture, they may not hold enough moisture to keep the crop supplied. In such cases cultivation, whenever practicable, will be of much assistance in preventing the rapid loss of water which may occur by evaporation. A good mulch on the surface of light soils will help them to hold as much as 30 percent more water than the same soil uncultivated. With some crops, of course, such cultivation is not possible, but it should be practiced on light soils whenever feasible.

Applications of manure will also assist in keeping up the moisture content of light soils. The organic matter supplied makes the soils less porous and open and makes the percolation and drainage less rapid. The application of lime to such soils is also of value in making them less porous. Lime is also of value in opening up heavy soils and making them less retentive of moisture.
FERTILIZATION.

Just as in the case of lawns, the basis upon which the fertilization of gardens rests is the use of stable manure. This is the best material for maintaining the humus content of the soil. The importance of humus in both light and heavy soils has been discussed. The relation of organic matter to the moisture content, to the amount of air present, to the decomposition processes in the soil, and hence to the production of available plant food has been pointed out. No other material accomplishes quite as much as manure along these lines.

In preparing for the garden, therefore, a liberal application of manure should be made. The actual amount may vary considerably, but at least 25 tons per acre should be applied and if the soil is very light in texture even a larger amount may be used.

Manure adds some plant food to the soil, but its value from this standpoint is secondary to its value in improving the physical condition of the soil. Plant food may be added by the use of commercial fertilizers, but such substances are of no value in keeping soils in the best physical condition. When large amounts of manure are used, however, the plant food introduced becomes of importance and smaller amounts of commercial fertilizers are necessary to keep up the plant food content of the soil.

Well rotted manure has been found to be preferable to the fresh material. Fresh manure is not quick enough in its action to give the best effects in the soil. Its coarseness prevents its thorough incorporation with the soil particles and hence its valuable influence is lessened. Again, fresh manure is likely to cause a rank growth of such crops as tomatoes, egg plants, peppers, melons and cucumbers, at the sacrifice of the fruit. With root crops, like radishes, turnips, beets and carrots, fresh manure not only causes excessive growth of tops but also prevents the best root development. Furthermore, fresh manure is apt to carry objectionable weed seeds which will prove troublesome in the garden. Rotted manure should, therefore, always be used when available.

In many cases rotted stable manure is not available for use on garden soils and some other material must be substituted. Dried animal manures, such as sheep manure, may serve in such instances just as was suggested with lawn soils. An application of such materials at the rate of 2 to 3 tons per acre should be made. The concentration of plant food in dried animal manures is much greater than in stable manure but their value for their effect on the physical condition of the soil is very much less. They prove, however, a valuable substitute for stable manure.

Green manure crops are frequently used to advantage to supply humus to the soil in case rotted stable manure is not available. Such a means of improving the physical condition is particularly important on light sandy soils deficient in organic matter. Clover, cowpeas, soybeans or other legumes may serve for the green manure crop.
Leguminous crops are preferable to non-legumes for green manures because of the nitrogen which they add when well inoculated. When such crops are grown for green manuring purposes they should be turned under in the soil before they become mature so that the decomposition processes proceed properly. If the crop has matured and consists, therefore, largely of crude fibre, its decomposition will occur very slowly and much of the value from its use will be lost.

The objection to the use of leguminous green manure crops as humus formers is that the establishment of the garden must be delayed for a season, but where the soil is poor in humus and stable manure or dried manures are not available, it is the only means of preparing the soil to produce satisfactory crops. Frequently green manuring may be practiced in gardens after their establishment by introducing suitable green manure crops into the rotation preceding the regular garden crops.

One precaution should always be observed in turning under crops for green manures and that is that the moisture conditions are satisfactory in the soil. If a heavy crop is turned under in a dry soil or during hot dry weather, the subsequent crop may suffer for lack of moisture.

When the humus content of garden soils has been insured by the use of rotted stable manure, dried animal manure or green manure, test the soil for acidity. If it is acid, apply lime. Three to three and one-half tons of ground limestone per acre is an average application for Iowa soils that are acid and will usually prove ample to put the soil in the best condition for vegetables. Many vegetables are quite sensitive to acidity; others are less affected by acid conditions, but practically all are favored to a greater or less degree by the presence of an abundance of lime in the soil.

Vegetables require an abundance of available plant food and hence it is necessary to apply some concentrated commercial fertilizer to gardens in addition to the rotted stable manure, dried manure, or green manure. These latter materials supply some plant food, but their main value is due to the organic matter they add to the soil and the plant food introduced is not enough to meet the needs of the rapidly growing vegetables.

Several brands of complete fertilizers are on the market which have proven quite satisfactory for gardens. Among these may be mentioned a "3-8-5" brand and a "3½-8-4" brand especially prepared for vegetables. Either of these materials applied to the garden soil at the rate of 500 to 1,000 lbs. per acre should prove of much value, supplying as they do considerable quantities of all the essential plant food constituents in a readily available form. If the soil is very light in texture and poor in plant food, 1,000 to 2,000 lbs. per acre should be supplied.

Such complete fertilizers may be used from year to year on garden
soils but manure should also be used or the soil will soon become deficient in humus and fail to grow good crops in spite of the presence of abundance of plant food.

Sodium nitrate is often used to great advantage on gardens. Applications at the rate of 200 lbs. per acre in addition to other fertilizing materials are of particular value on early crops such as lettuce, radishes, early peas, and early cabbage.

For potatoes use special potassium fertilizers. Applications of the muriate of sulfate of potash at the rate of 600 lbs. per acre, in addition to the complete fertilizer brands already mentioned, have been found to be of value. Where potatoes are to be grown, therefore, it will be well to substitute a complete brand of fertilizer containing more potassium for the special brands which have been suggested. Thus, instead of a “3-8-5” brand, a “2-8-10” or a “4-8-10” brand will be found to be of superior value for potatoes.

These same fertilizers may be used from year to year on the garden soils and if the organic matter or humus content of the soils is kept up by the use of well-rotted stable manure or green manures, the soil will be in the best condition for the growth of vegetables.

SEEDING.

The best seed should be used, for poor seed will not give good yields even on the very best of soil. It pays to procure selected seed even at a greater expense. The varieties of vegetables should be chosen to allow of the greatest range of seasonal growth. Early, medium, and late varieties may be chosen and planted in succession, thus insuring an almost continuous yield of certain desired crops.

Some crops should be started in hotbeds or cold frames and later transplanted to the garden when the season is far enough along to allow of their satisfactory growth. Others which are hardier, such as lettuce, radishes, beets and parsnips, may be seeded early enough in the garden soil.

In arranging the garden, each crop should be allowed enough space for its proper development. It is well also to group all long season and perennial crops together. The short season crops are soon out of the way and may be followed by a succession of crops if they are planted in adjoining rows.

It is desirable further to rotate the crops in the garden as far as feasible for several reasons. In the first place, such crops as onions are especially liable to insect injuries if grown in the same place successively. Injuries from fungus diseases such as potato scab, beet scab, onion and melon rust, corn smut, and other diseases, are much less likely to occur when the crops are not grown repeatedly on the same soil.

Then too, the plant food in the soil may be utilized to the best
advantage if the crops are varied, for different crops use varying amounts of plant food in their growth. By changing the location of garden crops from year to year the best results are secured.

After the garden is established its thorough cultivation as far as the crop grown will permit is important. Cultivation not only rids the ground of weeds but, more important, it maintains a mulch on the surface and that means the better maintenance of moisture conditions in the soil. By thorough cultivation the water content of the soil is kept up to a greater percent and the crops are better able to withstand droughts which are so apt to occur.

In some seasons it may be necessary to apply water to gardens. This should not be done unless the crop is suffering and if it is done certain precautions should be observed. It is not advisable to apply more than enough water to moisten the land. The soil should not be water-soaked. The best plan is to arrange to wet the roots of the plants and avoid getting water on the leaves, as in this way less of the water used is wasted. Finally, after the water is applied, if the land will permit of it, the soil should be cultivated thoroughly so that it will not bake. Evaporation will then be prevented and the water applied will be saved in the soil.