UNITED STATES SCHOOL GARDEN ARMY

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A Manual of School-Supervised Gardening for the Northeastern States

PART I—VEGETABLES

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A MANUAL OF SCHOOL-SUPERVISED GARDENING FOR THE NORTHEASTERN STATES.

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A MANUAL OF SCHOOL-SUPERVISED GARDENING FOR THE NORTHEASTERN STATES

I. PLANNING THE GARDEN.

Lesson 1: FIRST, CATCH YOUR RABBIT.

You remember the story of the boy who was telling about the rabbit he was going to eat, and his father said, "Son, first catch your rabbit." Well, that's the way you must do with these school gardens. Before you can eat the crops you expect to grow, you must get the garden.

For you boys and girls living in the country this will probably be an easy matter. Your fathers will be glad to give you a piece of land for your own use, as large as you are able to handle, where you can grow as many kinds of crops as you wish.

For you boys and girls living in the towns or cities it may be a little harder to get the land for your garden. But many of you will have a back yard of your own where many vegetables can be grown; or your next-door neighbor will be glad to let you use his back yard. At any rate, don't be discouraged if you can't find a place for your garden the first thing. By looking around and sticking to it you will find that there are a great many back yards and vacant lots near your own home which the owners will be proud to let you use after you have told them of the wonderful work the School Garden Army is doing.

If your garden is to be in a back yard, pick out one that is not shaded too much by trees or buildings. Growing things need sunlight and plenty of it. And try to pick out land that isn't all clay or gravel. You can't expect to grow much on soil like that. Ask one of your friends who is a farmer or who has a garden of his own to help you pick out the right place for your garden.

Lesson 2: HOW TO PLAN YOUR GARDEN.

Many of us think of gardening as work to be done only during a few brief weeks in the spring. This is wrong. Your garden will do its best for you if plans for it are made in the autumn and much of its preparation done then.

Here are some things you should think of in planning a garden:

1. *Size.*—The average boy or girl can easily spade and care for a garden 10 by 30 feet. A garden of this size will go far to supply vegetables for a family of four. Your garden should be sufficiently large to grow enough vegetables to make it worth while, but not so large as to make its care too much of a task.

2. *Width between rows.*—Rows must be farther apart if a horse or hand-wheel cultivator is used than if you use hand tools, such as a hoe or rake.

3. *Paths.*—Since your plants must receive personal attention, you should plan your garden with paths so that you can reach all parts of it without tramping down the plants.

4. *Rotation.*—This means using the same ground for the growth of one kind of crop, followed by another of a different kind, as a crop of corn followed by a crop of beans. Your planting scheme should avoid growing the same kind of plants over and over on the same ground.

5. *Keeping your garden at work.*—A planting calendar will tell you how, by second and third sowings, you can have fresh vegetables at all times during the gardening season.

6. *Use all your land.*—Vegetables which ripen quickly may be grown among those which ripen slowly. Thus lettuce, radishes, spinach, and like vegetables may be planted in the soil between tomato plants, potatoes, corn, etc.

7. *Plants to grow.*—The kinds of plants to be grown will determine very largely the nature of your plan. Radishes and lettuce may be planted closer together than cabbages or corn.

8. *Adding a touch of beauty.*—Finally, if you wish to make your garden not only productive but attractive, flowers may be grown about the borders.

An easy way to draw a plan is to measure the length and width of your garden and then make a map of it. Allow half an inch on your map for each foot in your garden. Then decide what you are going to plant and rule in your rows. In making your plan remember these things:

Put tall crops—like sweet corn and pole beans—on the north or west side.

On level ground run the rows north and south.

On hilly ground run the rows across the hill.

Plan for parsley, Swiss chard, or carrots along the front border.

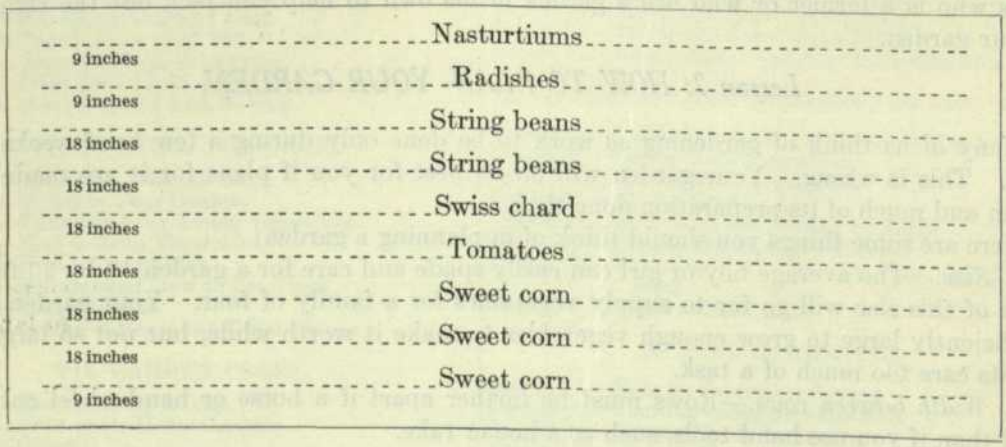
In shady places plan for lettuce, chard, cucumbers, or squashes.

Plan for companion or succession crops, or both.

Lesson 3: PLANS FOR SMALL GARDENS.

You can easily see how the plan of this pictured garden was made. At the left is a row of radishes, then two rows of string beans, then a row of carrots, and beyond the carrots a row of Swiss chard. That is a fine selection of crops for a small garden.

There are no flowers in this garden. In war times it is desirable to raise all the food possible; and even yet, when so many people in the world are starving, we should grow mostly vegetables. But it is a pity that every child with a garden should not grow a few flowers. So here is a plan for a small garden with one row of flowers:



This garden would be 12 feet across the rows. It can be as large in the other direction as you wish, of course. If it is not large enough for all these crops, the three rows of sweet corn can be left out.

This plan, of course, can be changed in many ways. Carrots may be planted in place of Swiss chard, and turnips may be sown after the string beans are gathered. If the soil is very rich, a few cucumber seeds may be sown in the outside row of sweet corn. Lettuce may be planted in place of the radishes and the radish sown with other crops as they are planted from time to time.

Courtesy of Van Evrie Kilpatrick

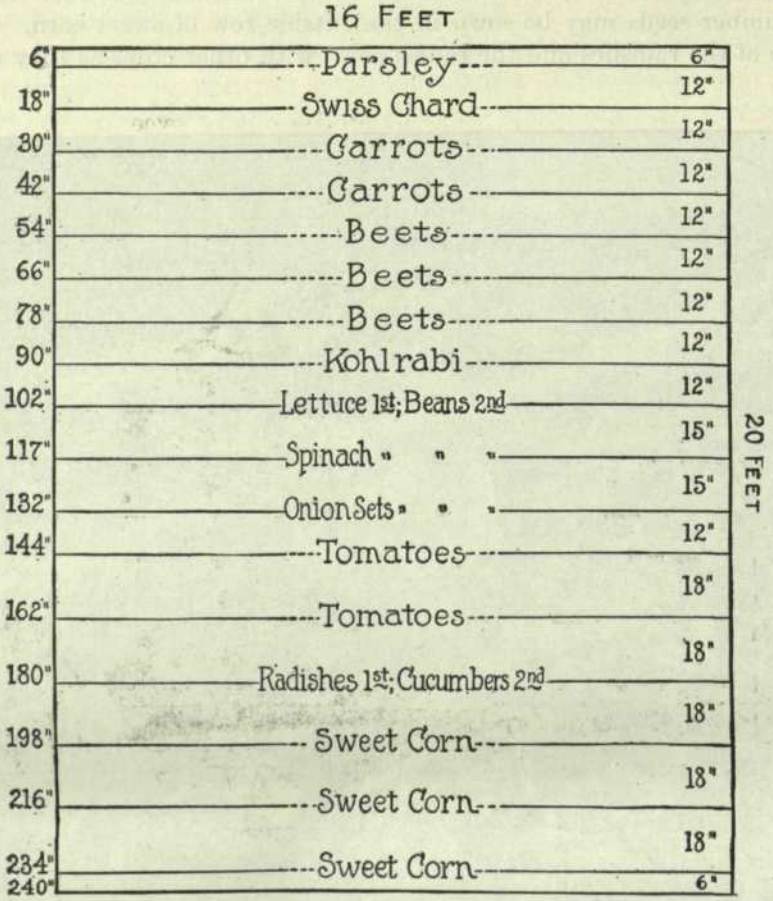
This picture of these happy boys and girls gathering their crops will surely make you want to have a garden this year. And it should also help you to make a real plan for it

In small gardens most plants which are set out as transplants—like cabbages, peppers, eggplants and tomatoes—should be interplanted in some such way as this:

Set out tomato plants from eighteen inches to three feet apart in the row. Between each two tomato plants set out two or three lettuce seedlings. Give good surface tillage and pick the lettuce as soon as it is of good size for use. It will be out of the way before the spreading tomatoes reach the lettuce.

In a similar way set out lettuce seedlings in the rows of cabbage, cauliflower, eggplants, and pepper.

Lesson 4: PLANS FOR LARGER GARDENS.



Here is a simple plan for a garden 16 by 20 feet. The three rows of sweet corn should be on the side away from the sun so the corn plants will not shade the other crops. Perhaps the cucumber vines may run in among the corn a little, but that will not hurt anything. The parsley along the front will make a decorative border.

The figures on the right show the distances between the rows. The figures on the left show the distance in inches from the front border.

In part of the garden the plan provides for two crops. Thus, where the diagram says "Lettuce first, beans second," it means that you grow an early crop of lettuce and get it harvested in time to plant the beans.

All garden plans are to be taken as suggestions. This one can, of course, be changed to suit your special needs. You may wish to grow other crops or your garden may be larger. If so, you can easily make your own plan, using this diagram as a model.

An easy way to draw a plan is to measure the length and width of your garden and then make a map of it. Allow half an inch on your map for each foot in your garden. Then decide what you are going to plant and rule in your rows. In making your plan remember these things:

Put tall crops—like sweet corn and pole beans—on the north or west side.

On level ground run the rows north and south.

On hilly ground run the rows across the hill.

Plan for parsley, Swiss chard, or carrots along the front border.

In shady places plan for lettuce, chard, cucumbers, or squashes.

Plan for companion or succession crops, or both.

Lesson 5: ESTIMATING THE NEEDS.

The vegetable garden, so far as possible, should supply the needs of the family. The practicability of doing this depends of course on many things, but chiefly on the size of the garden and the number in the family. In a general way it is possible to estimate the needs in advance and to make up the seed list accordingly.

Here is a little table that shows the amount of seed needed to supply a family of four with vegetables throughout the year:

Bean:		
Bush lima	pint	1
Pole lima	do	1
Snap	quarts	1–2
Beet	ounces	4
Cabbage:		
Early	packet	1
Late	ounce	½
Carrot	do	1
Celery	packet	1
Corn, sweet	pints	1–2
Cucumber	ounce	1
Eggplant	packet	1
Kale	ounces	2
Lettuce	do	½
Onion sets	quarts	4–6
Pea, garden	do	4–6
Parsley	packet	1
Parsnip	ounce	½
Radish	do	1
Spinach:		
In spring	pound	¼
In fall	do	½
Squash:		
Hubbard	ounce	1
Summer	do	1
Tomato:		
Early	packet	1
Late	ounce	¼
Turnip	do	2–3

It is not supposed that any family will use all the vegetables listed, nor will all families require the same amount of any crop. The pupil should select his seed from this list and make successive plantings.

Lesson 6: SHORT-SEASON COMPANION CROPS.

Companion cropping consists simply in growing two or more crops together on the same area at the same time. It usually takes advantage of a difference in rapidity or in habit of growth of two crops. Thus button radishes mature to edible condition in a few weeks, so that they may be sown and harvested before some slow-growing crops are fairly started. These may be called short-season companion crops.

Some practical combinations of this sort are indicated below:

Sow lettuce seeds as usual. Before covering the seeds sow radish seeds of the early button varieties in the open furrow very sparsely—perhaps one radish seed to every 2 inches. Then cover and firm the soil. The radishes will come up before the lettuce, helping to break the soil and showing the row lines so the spaces between can be easily hoed. Weed and thin the lettuce as usual, leaving the radishes to grow for three or four weeks. Then pull them for table use.

Apply the same procedure to these crops: Beets, carrot, Swiss chard, parsley, parsnip, salsify.

Here is a method of companion cropping of cabbage, lettuce, and radishes: Set out the cabbage plants in carefully lined rows 3 feet apart. Ten inches from the cabbages sow rows of radish seed. Half way between the radishes sow a row of lettuce seed or transplant lettuce plants. The space between the rows will allow hoeing from the start. The radishes will mature and be out of the way in four or five weeks, leaving a good chance to continue hoeing the whole space between the cabbage and lettuce. A month or so later the lettuce will mature and be removed. The cabbages are now reaching a good size and have all the ground to meet their needs. With varieties of small-headed early cabbage the distances between the rows might be less.

In small gardens most plants which are set out as transplants—like cabbage, peppers, eggplants, and tomatoes—should be interplanted in some such way as this:

Set out tomato plants from 18 inches to 3 feet apart in the row. Between each two tomato plants set out two or three lettuce seedlings. Give good surface tillage and pick the lettuce as soon as it is of good size for use. It will be out of the way before the spreading tomatoes reach the lettuce.

In a similar way set out lettuce seedlings in the rows of cabbage, cauliflower, eggplants and pepper.

Lesson 7: LONG-SEASON COMPANION CROPS.

Some crops grow tall and others near the ground, both continuing through a long season. Thus corn and pumpkins are commonly grown together. The pumpkins begin to run over the surface after the cultivation of the corn ceases. Notwithstanding the shade, the pumpkin leaves get sufficient sunlight to grow. This may be called long-season companion cropping.

Comparatively few crops are thus planted together to grow throughout the season. In the garden this principle may be applied in these ways:

I. Mix leek and onion seed at the rate of one part leek seed to ten of onion seed. Sow together in the row. Thin and cultivate in the usual way. Harvest the onions when ready and leave the leeks to grow until the ground is plowed or spaded.

II. Have the garden soil rich. Sow sweet corn as usual. In every third hill along the outer rows sow three squash seeds. When danger from cutworms and striped beetles is past thin to one squash plant for each hill.

III. Sow sweet corn as usual. In every other hill sow three seeds of string beans or horticultural shell beans. Or sow these beans half way between each two hills of corn. Give good surface tillage and keep the hills always weeded.

Lesson 8: SUCCESSION CROPPING.

The result we are after in succession cropping is to have a continuous supply of fresh vegetables in the best condition for use. You can get this result in either of two ways: (1) By planting early, medium, and late varieties; or (2) by making successive plantings of an early variety.

Practical results under the first of these methods may be obtained by following these directions:

Sow at least three varieties of peas—one early, one medium, and one late. The seed catalogs classify the various sorts under these three headings.

Sow seeds of two or more varieties of carrots, as early French Forcing for early, Chantenay, Coreless, or Danvers Half-long for later crop.

Sow seeds or transplant seedlings of at least two varieties of celery, as White Plume or Golden Self Blanching for early crop and Boston Market or Easy Blanching for late crop.

Sow seeds of at least three varieties of sweet corn, as Golden Bantam or Golden Rod for early, Moore's Early Concord or Black Mexican for medium, and Country Gentleman or Stowell's Evergreen for late.

Sow seeds of these beets in early spring: Crosby's Egyptian, Eclipse, or Boston Market for early, Detroit Dark Red and Crimson Globe for succession.

In May, when the ground is warm enough, sow these beans for use as string beans: Bountiful, Hodsdon, or other early bush sorts; Golden Cluster Wax, to be trained on poles and to furnish an abundant supply for the latter part of the season.

Plant at least three varieties of cabbage, as Jersey Wakefield for early, Succession for summer, Danish Ballhead for fall and winter.

Plant sets of onions for early use. Sow seeds of onions for succession crops.

Plant at least two varieties of potatoes, as Bovee or Early Ohio for early and Green Mountain or Uncle Sam for late crop.

The other method of succession cropping is very simple. Select one favorite variety of a given vegetable and sow the seeds at intervals of 10 days or two weeks as long as there is good prospect of its being able to reach edible maturity. Thus many people prefer Golden Bantam to other varieties of sweet corn. They sow a small plot to this variety every two weeks during May, June, and the first half of July.

Lesson 9: PLANNING FOR FOLLOW-CROPS.

By follow-crops we mean those crops which may be planted after others have been harvested during the same season.

In planning for follow-crops the two important points to consider are the length of time required for growth and the adaptation to the season. Some crops complete their growth in a few weeks, others require a much longer period. Some crops thrive best in the cool weather of spring and fall; others require the warmth of summer. By careful planning one can take advantage of these characteristics to keep the soil producing from early spring until late autumn.

Some successful combinations for the small garden are indicated in these tables:

Three short-season crops.

Hardy cool season.	Tender warm season.	Hardy cool season.
Spinach	Early sweet corn	Radish.
Leaf lettuce	Bush string beans	Turnip.

Two partial-season crops.

Early crop.	Late crop.	Early crop.	Late crop.
Radish	Peas.	Leaf lettuce	Sweet corn.
Leaf lettuce	String beans.	Carrots	New Zealand spinach.
Spinach	Squash.	Peas	String beans.
Onion sets	Beets.	Peas	Carrots.
Onion sets	Melons.	Radish	Tomato plants.
Peas	Celery.	Beets	Turnips.
Head lettuce	Cucumbers.	String beans	Late cabbage plants.

These combinations are merely suggestive. One could rearrange them almost indefinitely. The chief point to consider is whether the early crop gets out of the way in time to allow the late crop to mature.

It is often possible to combine the methods of companion and rotation cropping. If you have rows of lettuce 12 inches apart you can sow beet seed half way between, two or three weeks before the lettuce is harvested. When the lettuce is out of the way the beets will have the soil to themselves. Similar methods may be used with a great many other crops.

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II. SOILS.

Lesson 10: THE KINDS OF GARDEN SOILS.

The success of a garden depends chiefly upon two things—the personality of the gardener and the characteristics of the soil. If the gardener is intelligent and industrious, he can overcome many difficulties, even with the poor soil, but if he also is fortunate enough to do his gardening in a fertile loamy soil, success should be assured.

Most soils consist chiefly of tiny particles of rock mixed with decayed fragments of plant life. The kind of soil depends largely either upon the kind of rock from which it was derived or upon the proportion of decayed plants that make it up.

In general we may roughly group our common garden soils under four headings—sandy soils, clay soils, limestone soils, and humus soils.

The sandy soils vary all the way from pure sand, such as you find in a sand bank, to sandy loams in which a large amount of decayed plant life has been added to the sand. In general the more of this decayed plant life or humus there is present in the sandy soil, the better is its quality. Consequently one of the best ways to improve such a soil is to add large amounts of fallen leaves or strawy manure, so that the humus content may be increased.

Clay soils may vary from a pure clay such as is found in the clay banks from which bricks and tiles are made, to a clay loam in which there is much humus and perhaps some sand.

Limestone soils occur in those regions where the underlying rock is of limestone. Such soils are particularly valuable for growing crops of the legume family—peas, beans, clovers, and related plants.

Humus soils are those made up chiefly of the remains of plants. You can find an almost pure humus soil by visiting a swamp or peat bog and digging up the black muck. There is, of course, such a thing as having too much humus, and these pure humus soils need to have sand or clay or limestone soil mixed with them to improve their quality.

Fortunately, in very few gardens will you find a pure type of any of these soils, and the hopeful thing about this is that you can improve the quality of any of them by a little study of their needs and the addition of the things needful.

Lesson 11: THE HIDDEN GOLD.

There is an old story that runs something like this: A father left a piece of garden ground to his three sons, John, James, and Oscar. Just before he died he told them there was much wealth buried in the soil, but it would be found only by the one who dug it over three times.

So after the old man had been properly buried, the three sons divided the garden into three equal plots and then drew lots for the plots. They all began to dig the land at once and kept at it until each garden was all spaded up. But none of them found any gold or buried treasure of any sort.

So John said: "No more digging for me. I'll plant a crop and get something for my trouble anyway."

But James and Oscar dug away until their gardens were all spaded up the second time. But still they found no buried treasure. Then James said: "I've had digging enough. I'll plant a crop too."

But Oscar said: "Father told us to dig it over three times to get the wealth. And I'm going to do it."

So Oscar dug the garden over the third time. Still he found no buried wealth. But he noticed how fine and mellow the soil had become. So he also planted a crop.

As the weeks passed the crops of the three brothers came up and grew into green blades. John's crop was planted first and so had the start of the rest. But that of James soon caught up with it. Oscar's crop was later than either of the others, but after it got started it grew so rapidly that within a few weeks it was taller than the others and each plant was so green and vigorous that it seemed fairly to laugh in the sunshine.

So the crops grew on till harvest time. And as the brothers looked at the heading grain it was easy to see that Oscar's crop was a great deal better than the others. When at last the grain was cut and the golden kernels threshed from the chaff Oscar had double the amount that his brothers did.

"Dear, wise father," said Oscar, "he knew what he was talking about when he told us that gold was buried in the garden."

This is an old, old story. But it is as true to-day as it ever was. And here is the proof: The other day there was a meeting of gardeners near Boston to listen to an expert who had gotten rich raising vegetables for the market. He told them that the one great secret of his success was found in the fact that he plowed his soil three times before planting the crops.

Lesson 12: THE THIRD PLOWING.

I have just finished working over a piece of garden ground which had of necessity been neglected before this season. The surface was covered with weeds or sod. This soil was hard and partly filled with witch grass roots. It did not look like a very good place for gardening.

So we plowed it first. This buried up most of the weeds and much of the sods but it brought a lot of witch grass roots to the surface. Then we harrowed it with a toothed harrow and after harrowing, went over it with a toothed cultivator that pulled out many of the tangled masses of witch grass.

The garden then looked more promising but it left much to be desired. Many witch grass roots were still present and much of the soil was still in great hard lumps through which plants could hardly send their roots.

So we plowed it again. Of course this brought many of the sods back to the surface. We harrowed it again, thus breaking up most of the sods and clumps of soil. Then we went over it with the cultivator and extracted another lot of witch grass roots. These we gathered up and carried off to cover some rocks where their growth would do no harm.

This second treatment certainly helped the looks of the garden. The soil had really been gone over six times, and of course it ought to have been improved. But here and there a white root stock of witch grass showed its spear and frequently a lump of soil still showed the need of pulverizing.

So, remembering the story of The Hidden Gold and the advice of the Boston Market Gardener, we went at it the third time, plowing, harrowing, and cultivating as before. And the results in making the soil fine, in getting out the witch grass roots, and in bringing hidden stones to the surface were so satisfying that the extra work seemed well worth while even before the crops were planted.

You can easily see what this pulverizing of the soil means to a plant by a little school-room experiment:

Take two or more pieces of blotting paper. Place them between small panes of glass. Moisten the blotting paper and place between the sheets seeds of radishes, turnips, lettuce, or almost any other vegetable. The seed will soon sprout. Let the sprouts grow a few days to send out roots and rootlets. Then see that on these roots and rootlets thousands of tiny hairs develop. These are the root hairs.

The growth of the crop depends upon these root hairs. They are so fine that they absorb moisture from the tiny bits of soil. The tinier the bits of soil are, the better the root hairs can do their work.

Lesson 13: CROPS FOR NEW CLAY GARDENS.

Many crops are planted every year on clay soils which have not lately been used for gardens. To insure success, follow these suggestions:

1. Be careful not to work the soil when it is too wet. Wait until it is dry enough to crumble between the fingers.

2. If well rotted stable manure is available, plow in or spade in a good dressing of it. Or turn under a layer of old leaves or almost any kind of vegetation that you can get.

3. After the garden is plowed or spaded and before it is harrowed or raked, spread lime evenly over the surface. If it is lime carbonate, spread it on to a thickness of at least half an inch. Then work the lime thoroughly into the soil.

4. After the lime is thoroughly raked in, spread on a light dressing of commercial fertilizer and rake it in. Or, if preferred, work in a little commercial fertilizer in the bottom of each drill or furrow just before sowing the seed.

5. Select these crops for such soils: Lettuce, Swiss chard, sweet corn, beans, tomatoes. The root crops are not likely to do well until the garden has been worked over a season or more and a large amount of humus has been thoroughly worked into it.

Lesson 14: FEEDING THE FISHWORMS.

You don't find many fishworms in a sand bank. There is nothing there for them to eat. Nor will you find many in a light sandy soil. There is not much more to eat there than in the sand bank.

If you will put a thick layer of leaves on sandy soil and place a few fishworms on the leaves something is likely to happen. The worms will make their way through the leaves to the top of the soil. Then they will begin to eat the leaves and draw them down into the holes in the soil that the earthworms are always making. The small bits of leaves along with the small bits of soil pass through the bodies of the worms and are finally cast out as little pellets on the surface beside the holes. You can see such little piles of pellets almost any summer morning by looking in the garden.

This experiment shows what is happening all summer in every garden where leaves and fishworms are present. And it is not leaves alone that the fishworms eat. All kinds of plant materials soft enough for them to get hold of are devoured and the particles passed through their bodies to be cast out as pellets on the surface. In this way the earthworms have been very helpful in increasing the depth of soils. For while one worm alone may not do much in one year, a million worms in a hundred years will accomplish a great deal.

You will readily see that this grinding up of the leaves in the bodies of the worms makes them more useful in furnishing food to roots of plants. The tiny root hairs can penetrate

all through the fine particles and absorb moisture and food. But the grinding up is also helpful in another way. The soil is full of minute germs called bacteria, which are always at work producing food for plant growth. These bacteria can work much better in this finely ground leafy material than in coarse leaves. So the worms are of great assistance in making the soil richer in chemicals for plant growth.

Even the holes that the worms make in the soil are helpful. They permit air to penetrate and rain to run in, thus furnishing two of the most necessary things to keep the soil in action. On this account alone it is desirable to have earthworms in the garden.

You will find the little word "Humus" discussed in Lesson 15. Humus is there called the Food Producer. When you feed fallen leaves to the fishworms they become producers of humus and enrich the soil by so doing. They help to make the soil better, but they must have plant materials to do it with. In general the richer your garden the more earthworms there will be. And the more earthworms the more humus and the more humus the more food, and food is what every soldier of the School Garden Army is after.

So it all comes down to this: If you feed the fishworms the fishworms will feed you.

III. ENRICHING THE SOIL.

Lesson 15: HUMUS—THE FOOD PRODUCER.

Humus is a little word of two syllables—hu-mus—that sounds a bit extraordinary. So did the word automobile 30 years ago. Yet humus is of vastly greater importance to America than are automobiles.

It is up to the teachers of America to make the word humus as common as the word automobile, and its meaning as well known by the man on the street.

Humus is the great basis of food production. The best way to Hooverize is to increase the humus in the soil. An ounce of humus will produce a pound of bread.

Humus is simply the decayed or decaying parts of plants or animals in the soil. Even if derived directly from animals it came first from the growth of plants. The black leaf mold on top of the soil in the woods is almost pure humus in an early stage of decay. The black soil of swamps is also nearly pure humus in a late stage of decay.

The great trouble with most of our poor soils is that for them every day is a humusless day. The first duty of many soldiers in the United States School Garden Army is to furnish humus to such soils. Old leaves, straw, grass, animal or plant refuse of any kind—even garbage when it can't be used to feed pigs or poultry—may be worked directly into the soil or made into a compost heap, which you may learn about in lesson 20, to decay and be dug in later.

An appalling waste of humus is taking place all the time. We throw it away. We burn it. We let the rivers carry it off. We neglect to produce it as we should.

Let's get down to the real basis in this great business of food production. Let's teach the children of America that to save humus and put it to work is the first duty of the patriot. If food will save the world, humus will produce the food.

Lesson 16: IMPROVING SANDY SOILS.

You have often heard of soils so poor that they would scarcely grow a hill of beans. Generally such a soil is a good deal like a sand bank. It is light in color and is made up of fine sandy particles.

Such soils have several faults when you try to grow garden crops in them. The chief faults are the fact that water runs through so quickly the plant roots suffer in dry weather and the fact that there is very little plant food present for the roots of the plants to absorb. Now, plants are like humans in this respect—to grow well they need a continual supply of water and of food.

If you have read the leaflets entitled "Humus—The Food Producer," "The Compost Heap," "Save the Fallen Leaves," and "Feeding the Fishworms," you know already that the one important way to improve a sandy soil is to add humus to it. As compared with ordinary, rich, dark-colored garden soils the great lack of these sandy soils is humus.

So the first thing to do to improve a sandy soil is to add humus and work the soil over and over again to get the humus thoroughly mixed with the particles of sand. When this is done, the soil will hold moisture better because the humus acts as a sponge in catching and holding the water as it filters through the soil. So one great step will be taken in making the garden more productive.

The plant or animal materials—leaves, lawn clippings, manures, composts—that you add to the soil to make humus are generally not in condition to be used immediately by plant roots. For the soil is not simply a mixture of fine rock particles and dead leaves. It is rather a vast workshop in which billions of tiny germs, called bacteria, are working to bring about the making of plant food. Even the wisest scientists do not pretend to understand all about how it happens, but they assure us that the humus is the basis of existence of a large proportion of these helpful germs.

The practical lesson from all this study of the bacteria in the soil is that it is well worth while so to treat the land that these germs will be free to develop under as favorable conditions as possible. They live in dead plant or animal forms or executions, so these must be furnished. They require oxygen, so the soil must be drained and tilled. They do not thrive in acid soils, so lime must sometimes be applied. In short, the better the agricultural methods, the more completely can these tiny organisms carry on their beneficent work.

Lesson 17: MANURES.

All garden crops require a rich soil, well supplied with humus. Humus is decayed vegetable or animal matter. Barnyard or stable manure is the best garden fertilizer because it furnishes this humus. In some places it is impossible to get manures for the garden, and you will have to use commercial fertilizers and materials from the compost heaps, which have been described.

When manures are selected for your garden, you should take care that there is nothing in them that will hurt the soil. Sawdust and shavings in manure tend to make the soil sour. If the manure used comes from stables, all shavings and sawdust should be removed if possible. The manure from sheep, pigeons, and chickens contains a great deal of food that the plants use. These manures are more valuable than the ordinary barnyard manures, but must not be spread too thickly over your garden.

It is generally customary to work coarse manure into garden soil in the fall so that it will have time to decay. In the spring well-rotted manure can be worked into the soil with a digging fork. The amount of manure necessary for your garden will depend upon the condition of the soil. Poor worn-out soils will necessarily need more than rich, mellow soils. From 20 to 30 tons of manure an acre is generally very satisfactory. This means about a pound of manure to every square foot of garden space.

Humus may be added to the garden soil by planting what is known as a leguminous crop. Cowpeas, soy beans, and vetch are excellent crops for this purpose. Such crops take nitrogen out of the air and store it in their roots. After these crops are plowed into the soil, the nitrogen is said to be "fixed" and young growing plants can use it as they need it. This plan of putting humus into the soil is followed only between cropping times and can not be successfully used to any great extent while your garden is in action. When green crops are thus plowed or spaded into the soil we call it green manuring.

Lesson 18: COMMERCIAL FERTILIZERS.

The commercial fertilizers consist of various combinations of chemical materials which are helpful in plant growth. Most gardeners use small amounts of these fertilizers even if the soil has been well enriched with stable manure. One reason for this is that the fertilizers help the plants in getting a good start early in the season.

The most essential chemicals in commercial fertilizers are nitrogen, phosphorus, and potash. These three elements are needed for the rapid growth of plants, and they are the ones most likely to be exhausted from the soil by previous crops.

The commercial fertilizers may contain nitrogen in a purely chemical form, in which case it is likely to be derived from nitrate of soda or sulphate of ammonia, or it may be derived from such animal materials as dried blood, tankage, fish scraps, or such vegetable material as cottonseed meal.

The phosphorus in these fertilizers may be derived from such chemical materials as phosphate rock and Thomas slag, or from such animal sources as ground raw bone, ground steam bone, and bone black.

The potash in the commercial fertilizers may come from various chemicals, such as kainit, muriate of potash and sulphate of potash, or from wood ashes which contain a considerable amount of this material.

Acid phosphate is a form of phosphorus that is often used to advantage in soils which have been enriched by stable manure. Such manure contains considerable quantities of nitrogen and potash but comparatively little phosphate. Consequently the acid phosphate helps to make a complete fertilizer for the soil.

One way to apply these fertilizers on small garden plots is to spread it broadcast and rake it in, after the ground has been plowed and harrowed, applying it at the rate of 5 pounds to each 100 feet of plot.

Another way and the one which is preferred by most gardeners is to apply it in the furrow at the time the crop is planted. After the furrow is made, the fertilizer is strewn along the bottom and is then hoed in with the soil so that it may be thoroughly mixed before the seed is sown. The advantage of this method is that the fertilizer becomes directly available by the roots of the young plant and gives it a start when it is most needed.

Much material in commercial fertilizer is simply added to give bulk and weight. The real value of the fertilizer depends upon the percentage of nitrogen, potash, and phosphoric acid. A good fertilizer should contain at least 4 or 5 per cent of nitrogen and 8 or 10 per cent of phosphoric acid.

Lesson 19: FERTILIZER PROBLEMS.

For several years the Martin School, of Boston, has made a practice of selling commercial fertilizers to the pupils at cost. The work is correlated with school activities in a very practical way. Principal Charles M. Lamprey has kindly furnished for this Manual the following statement of this successful correlation with arithmetic:

Almost every boy who has a garden has used his knowledge of arithmetic in adding the prices of the different seed packages that he buys, but there are many other interesting problems that come to the gardener and farmer that require more knowledge than addition.

If a garden is 20 feet long and 7½ feet wide, we find the number of square feet by multiplying 20 by 7½. We find that the area of the garden is 150 square feet.

If we know that fertilizer ought to be applied at the rate of 2,000 pounds to the acre, we first find what part of an acre the garden is and then take this part of 2,000 pounds.

An acre contains 43,560 square feet, but for practical purposes we may call it 45,000 square feet.

$$\frac{150\times 2{,}000}{45{,}000}=\frac{\overset{10}{\cancel{150}}\times 2{,}\cancel{000}}{\underset{3}{\cancel{45{,}000}}}=\frac{20}{3}=6\tfrac{2}{3}\text{ or about }7$$

This shows that we need 7 pounds for a garden 20 feet by 7½ feet.

Another rule for applying fertilizer is to allow 1 pound for each 20 square feet. We divide 150 square feet by 20 square feet and buy as many pounds as the answer shows that we need.

The work is performed in this way:

$$\frac{150\times 1}{20}=\frac{15\cancel{0}\times 1}{2\cancel{0}}=\frac{15}{2}=7\tfrac{1}{2}$$

Either one of these rules is all right for most crops in a small garden.

When we distribute fertilizer in school we sell it to the children at about cost in 3-pound and 6-pound bags. About half of it is sold in each form. So if we have 300 pounds to distribute there will be 150 pounds in 3-pound bags and 150 pounds in 6-pound bags. This will require 50 bags plus 25 bags. Seventy-five bags cost 50 cents. The express on fertilizer is $1.50, and the fertilizer costs $3.50 a hundred or $10.50. We have to allow for a loss of about 50 cents worth from leakage from the large bags that the fertilizer comes in and 25 cents for overweight when the boys are measuring it into paper bags.

50 bags containing 3 pounds for 15 cents=		$7.50
25 bags containing 6 pounds for 25 cents=		6.25
		13.75
300 pounds fertilizer cost	$10.50	
Express	1.50	
Bags	.50	
Leakage	.50	
Overweight loss	.25	
	13.25	

When we have sold enough fertilizer to pay all costs we put any that is left on the school garden.

It is not easy to handle fertilizer from the bags in which it comes, so we turn it all into large ash cans and weigh it out from these. One boy dips it out and puts it into the scoop on the scales until they balance; another turns it into a bag held open by a third boy, who passes it on to another boy, who packs it away after folding the top securely. It takes about half an hour for three boys to put up in this way 300 pounds of fertilizer.

When we apply fertilizer in the rows at planting time, we find the paper bags much the best things for scattering it. It can be shaken out in very small quantities, or more freely, as we may choose. Applying it in this way, it is not necessary to soil the hands, and any fertilizer remaining is all ready to use any time we want it.

FERTILIZER PROBLEMS.

1. If a garden is 20 feet by 7½ feet how many square feet does it contain?
2. Calling an acre 45,000 square feet, what part of an acre does it contain?
3. Calling an acre 40,000 square feet, what part of an acre does it contain?
4. At the rate of 2,000 pounds to an acre how many pounds of fertilizer would be required on the basis given in example (2); that is, 45,000 square feet in an acre?
5. At the same rate how many pounds would be required on the basis given in example (3); that is, 40,000 square feet in an acre?
6. If you could not buy a fractional part of a pound, how many whole pounds would you buy after considering your two answers in examples (4) and (5)?
7. If 300 pounds of fertilizer is sold, half of it in 3-pound bags and half of it in 6-pound bags, how many bags will be required?
8. If the 3-pound bags are sold for 15 cents each and the 6-pound bags for 25 cents each, how much is received?
9. If the fertilizer costs $3.50 per 100 pounds, express on the whole amount costs $1.50, bags 50 cents, and we lose 50 cents worth by leakage and 25 cents worth by putting too much in the bags, how much more would be received for the fertilizer than the total cost?
10. At the rate of 1 pound for 20 square feet, how many pounds would be required for a garden 20 by 25 feet?

Lesson 20: THE COMPOST HEAP.

The chief need of most poor garden soils is humus. This is the great basis of food production, as explained more fully in lesson 15.

It is getting harder every year in cities, villages, and suburban communities to obtain stable fertilizers to enrich the gardens, because automobiles are displacing horses. Consequently, commercial fertilizers are being used more largely to enrich our gardens. But commercial fertilizers contain practically no humus, so the soils are not being prepared for that permanent production which should be the aim of every gardener.

The best way for most gardeners to improve upon these conditions is to start a compost heap and keep it as a permanent part of the garden outfit. Select for this an out-of-the-way corner, preferably behind the screen of an arbor or fence. Then, pile upon it all refuse vege-

tation from the garden or the kitchen and mix with it enough soil of any kind to keep it moist and help it to decay.

This compost heap soon becomes the handy place about the garden that gets everything for which there is no other destination. Its size increases surprisingly as one piles on from week to week the tops from the gathered root crops, the clippings from the lawn, the fallen leaves from the trees, the rakings from the paths, everything, in fact, that contains plant tissue—the raw materials for humus making.

The compost heap should be forked over about twice a season. This mixes the materials more thoroughly and makes them decay more rapidly.

As soon as part of the compost heap has rotted down sufficiently to mix readily with the soil it should be spaded in wherever needed. The coarser portions, which are slow to decay, may well be buried in the bottom of border beds for perennial flowers or vegetables.

But there is this danger in a compost heap: It may easily become a means of spreading the germs of various plant diseases. So be careful not to put upon it rotting cabbages or leaves of vegetables infested by blights and rusts. The leaves of trees are safe, and so are lawn clippings and many other parts of plants that you will readily find in your gardening operations.

Lesson 21: GREEN MANURES.

The crops you can grow in a garden depend directly on the richness of the soil. As a rule you get small crops from a poor soil and large crops from a rich soil.

When you speak of a rich soil you really mean several things. Such a soil must have a good deal of humus or decayed vegetation in it and it must also have enough chemical plant foods—especially nitrogen, potash, sulphur, and phosphoric acid—to keep the plant growing thriftily.

Consequently when we want to make a poor soil rich we can do two things. If it lacks humus we can dig in dead leaves, stable manure, or other similar materials, and we can apply chemical fertilizers containing nitrogen, potash, phosphoric acid, and sulphur.

There is one way, however, in which we can do both of these things at once. If we sow clover seed on a poor soil the clover will gather nitrogen from the air and will develop a lot of humus-making material in its roots, leaves, and stems. By spading or plowing this clover crop under we are able to make the soil much richer.

This process of growing clovers and other crops and plowing them under is called green manuring. It is one of the most important ways in which farmers improve the quality of their soils.

Nitrogen is the chief chemical plant food that is added to the soils by green manuring. As you probably know there is plenty of nitrogen in the air but most plants can't get it from the air. There is one great family, however, which has developed a partnership with some of the tiny forms of germ life called bacteria by means of which the free nitrogen of the air is made available for growth. This is the legume family—the great group with butterfly-like flowers and two-walled pods—the peas, beans, clovers, vetches, and related plants.

If you dig up a thrifty clover or alfalfa or cowpea plant and wash the soil carefully away from the roots you will probably find a great many nodules or tubercles upon the roots. They seem to be simply curious swollen outgrowths scattered here and there along each root. Should you crush one of these nodules and examine a bit of the contents with a high-power microscope you would find millions of the tiny bacteria of which the nodule is chiefly made up.

We have in the relations of the clover or alfalfa plant to these bacteria a sort of partnership or mutualism—an arrangement by which the two live together in helpful relations to each other.

The clover furnishes the bacteria a place in which to live and multiply and the *bacteria gather from the air in the soil free nitrogen and change it into a form in which the clover plant can use it.* This is a most important factor in plant production, for it places within the reach of man a method of drawing upon the vast stores of free nitrogen and utilizing them in crop growth.

The nitrogen which is thus gathered from the air is stored in all parts of the plant: fruit, leaf, stem, and root, each has a share. Even if the clover or alfalfa or other crop is cut for forage and taken away the stubble and roots retain much nitrogen to enrich the soil. If, on the other hand, the green crop is plowed under, practically all of the nitrogen is retained in the soil, which thus becomes much richer in plant food.

IV. THE SEED.

Lesson 22: THE SEED ORDER.

All seeds of a given kind may look alike yet the crops they produce may vary greatly—some good, some fair, some poor. For a seed is simply a baby plant wrapped in an outer covering. What it will grow into depends largely upon its parentage.

The best seeds have had their ancestors carefully selected by the men who grew them. The fields in which they were being produced have been gone over frequently and all unpromising plants removed. This has left for seed production only those true to the type desired.

Such selection costs money. So the selected types are likely to be a little higher in price than those unselected, but they are well worth the difference. The reputable seedsmen make it a rule to handle only selected seeds.

The first result of selection is the production of varieties. It is much better for you to buy a packet of French Breakfast radish seed than simply a packet of radish seed. You are likely to get a better crop and will learn more about gardening in growing the crop.

So in planning for the seed order, the first thing is to plan to buy good seed and the second is to plan to buy named varieties.

Seeds may be bought in bulk much cheaper than in packets. The making of small envelopes or seed packets is an excellent school exercise. So is the dividing of the seeds in bulk into small sets. The working out of the cost of the smaller portions when a pound is so divided up furnishes a good problem in arithmetic.

The following suggestions are made as to the buying of seeds:

1. Where practicable buy in bulk of reliable seed houses, and subdivide the seeds with the help of the pupils.

2. Buy named varieties, selecting either those recommended on the lists sent out from this office or those which have been found successful by local gardeners. An excellent way to get the pupils interested is to ask them to find out the names of successful varieties grown locally by home or professional gardeners. Make the basis of the list the varieties which the pupils have grown themselves.

3. When the seeds are bought in prepared packets, get named varieties, if possible.

4. The supply of good seeds is often short. There must be no waste. So calculate carefully and order only what are needed.

Lesson 23: USING THE SEED CATALOGUES.

The seed catalogues are excellent textbooks on school gardening. They are always up to date. They have attractive pictures. They give prices of seeds in packets or in bulk. They describe the best varieties. Many of them give directions for planting.

These seed catalogues appeal strongly to pupils. Boys and girls know that they are the real thing. They see their value and soon learn how to use them.

Here is a little plan for getting and using these catalogues:

1. Tell the pupils to look in the advertising columns of the magazines for the names and addresses of seed houses that offer their catalogues free to those who apply.

2. Make a blackboard list of all the firms reported. Get a list of at least six or eight such firms.

3. Divide these firms among the pupils so that only a few will send to each firm.

4. Have a lesson on the form of the application, allowing each pupil to make the request in his own way, provided it is in clear and simple English, with proper courtesy. Let the lesson end when the request is written on a post card or as a letter ready for mailing. Find stamps some way and see that the requests are mailed.

5. When the catalogues come, have each pupil keep his own in his desk. Use these in connection with every crop which is studied. Let pupils look up lists of varieties and compare prices and descriptions. Many pupils will be able to bring recent seed catalogues from home. Let these be brought in such cases rather than to send for new ones.

A live teacher can make these seed catalogues one of the livest features of a live school.

Lesson 24: VARIETIES OF VEGETABLES.

In making up the seed order it is very desirable to know definitely the varieties of vegetables most desirable for planting. The following list should prove helpful in this respect. It is highly important to order early so that you may have seeds to plant the gardens. Advertisements of leading seedsmen will be found in many magazines and periodicals. Copies of their catalogues will be sent by any of these firms upon request. In these catalogues practically all of the following varieties will be found listed:

Bush string or snap beans:
Green-podded.—Bountiful, Stringless Refugee, Stringless Green-pod.
Wax-podded.—Wardwell's Kidney Wax, Brittle Wax, Hodson's Kidney Wax.
Beets:
Crosby's Egyptian, Detroit Dark Red, Early Eclipse, Early Blood Turnip.
Brussels Sprouts:
Long Island Improved, Long Island Half Dwarf.
Cabbage:
Early.—Early Jersey Wakefield, Charleston Large Wakefield.
Midseason.—Copenhagen Market, Early Summer, Succession.
Late.—Danish Ballhead, Autumn King, Warren's Stonemason.
Carrot:
Early.—Earliest Short Horn or French Forcing.
Midseason and Late.—Chantenay, Danver's Half-long, Improved Rubicon.
Celery:
Early.—White Plume, Paris Golden.
Late.—Boston Market, Giant Pascal.
Swiss Chard:
Giant Lucullus.
Corn, Sweet:
Early.—Golden Bantam, Adam's Early, Golden Giant.
Midseason and Late.—White Mexican, Country Gentleman, Stowell's Evergreen.
Cucumber:
White Spine, Davis's Perfect, Emerald.
Endive:
White Curled, French Moss Curled, Green Curled.
Lettuce:
Loose-leaf.—Black-seeded Simpson, Grand Rapids.
Cabbagehead.—Wayahead, Naumburger, Big Boston, California Cream Butter.
Crisphead.—Iceberg, Crisp-as-ice.
Cos or Romaine.—Trianon.

Muskmelon:
Green-fleshed.—Extra Early Hackensac, Delicious Gold Lined, Netted Rock.
Salmon-fleshed.—Emerald Gem, Paul Rose, Tip Top.
Watermelon:
Cole's Early, Fordhook Early, Kleckley Sweet.
Onion:
Danvers, Southport White Globe, Southport Red Globe, Prizetaker.
Parsley:
Emerald, Dwarf Perfection, Moss Curled.
Parsnip:
Guernsey, Hollow Crown, Long Smooth.
Peas:
Early Round-seeded.—Alaska, First and Best.
Early Wrinkled-seeded.—Sutton's Excelsior, Gradus or Prosperity.
Midseason.—Thomas Laxton, Alderman.
Late.—Potlatch, Champion of England.
Pepper:
Sweet Varieties.—Pimiento, Baby Bell, Ruby King, Chinese Giant.
Hot Varieties.—Red Chili, Red Cluster, Tabasco.
Radish:
Round or Turnip-shaped.—White-tipped Scarlet Turnip, Early Scarlet Globe, Rapid Forcing, Crimson Giant.
Oval or Olive-shaped.—French Breakfast, White-tipped Rocket, Early Scarlet Oval.
Long or Finger-shaped.—Early Long Scarlet, Cincinnati Market, White Icicle.
Rutabaga:
White.—Improved Purple-top, Budlong's Improved.
Yellow.—Golden Heart.
Summer Squash:
Crookneck.—Mammoth Summer Crookneck.
Pattypan.—Long Island White Bush, Early White Bush Scallop, Golden Custard.
Winter Squash:
Hubbard, Warted Hubbard, Golden Hubbard, Symme's Blue Hubbard, Delicious.
Spinach:
Spring and Autumn.—Victoria, Long Standing, Round-seeded Savoy.
Summer.—New Zealand Spinach.
Tomato:
Early.—Earliana, Chalk's Early Jewel.
Mid-Season and Late.—Stone, Globe, Red Rock, Beauty, Acme.
Turnip:
Snowball, Early Purple-top Milan, Early White Egg, Purple-top White Globe.

Lesson 25: SEED TESTING IN THE SCHOOL.

A seed consists of two parts—an embryo plant and an outer covering.

If the embryo plant is alive, it will sprout into growth under favorable conditions. If dead, the seed is worthless.

It is a simple matter to test this sprouting ability of seeds by furnishing them with warmth moisture, and air. Air is everywhere, so practically we need to provide only moisture and warmth.

Here are some simple ways of testing the viability or sprouting qualities of seeds:

1. Fill a water tumbler, a cup, or a bowl half full of clean moist sand. Place on top of the sand 10 or more seeds. Place over the top of the tumbler a small pane of glass or a saucer.

2. Pour a little water into a soup plate or pie pan. Set a flower-pot saucer right side up in the water. Place 10 or more seeds in the saucer. Cover the saucer by inverting over it another flower-pot saucer, preferably slightly smaller. Keep in a warm room.

3. Cut three or more pieces of blotting paper or heavy carpet paper so they will lay flat in a pie plate, a soup plate, or some similar dish. Place 10 or more seeds between each two layers of paper. Add enough water to moisten the paper, and either cover the receptacle or else add more water to keep the paper moist. Keep in a warm room.

4. Plant the seeds in soil in a paper flower pot, an earthen flower pot, or a window box. Keep the soil moist and warm.

In each case the seeds should germinate in a few days. After the root sprout is well developed let the pupils examine the seeds to see the baby plant and the wrapper that incloses it.

This seed testing offers excellent opportunities for problems in percentage. If a pupil places 10 radish seeds in a germinator dish and 7 grow, let him work out the percentage of viability.

It is especially important to test seeds that have been held over from previous years. It is worth while, however, to have pupils test samples of all seeds.

Lesson 26: RADISHES FOR SCHOOL-SUPERVISED GARDENS.

The radish is one of the most important crops for school-supervised gardens. Its season is so short that even in the most northern States it can be planted in spring and harvested before school closes. It may be planted very late in the season and makes a good succession crop. This makes it one of the few crops that can be used to advantage in any school garden.

Grades I–III.

The essential thing in these grades is to give the children *experience* rather than *information.* The only real knowledge they have they get through feeling, seeing, smelling, tasting or other sense-perceptions. The teacher's voice may be ever so pleasant, but her telling about radishes is no adequate substitute for a child's experience with radishes.

Most young children have eaten radishes, and every child in these three grades should have the experience of growing radishes in a real garden. The great advantage of the crop for use with young children is that the seeds sprout quickly, the plants grow rapidly, and the roots are ready to harvest a few weeks after the seeds are sown.

Much can be done in the schoolroom as a preparation for the work in the outdoor garden. Valuable experience with the sprouting seeds and the growing seedlings may be given the pupils in practically all primary schools if the teacher realizes the fundamental importance of letting each pupil do and see and feel things for himself.

You can get a packet of radish seeds for a nickel or an ounce for a dime. Or very likely your Congressman will send you some for the asking. Here are a few simple things that you can have your pupils do with them:

I. Take a platter, a soup plate, a dinner plate or a pie pan. Cut three pieces of blotting paper to fit the bottom. Add enough water to moisten the blotting paper. Let each pupil put a radish seed on top of the blotting paper. Lay a pane of glass over the seeds and the paper. Keep in a warm room where the pupils can see what happens. Add water as necessary to keep the blotters moist.

In a day or two the seeds will sprout. The white roots will come out of the brown coat. It will grow rapidly. When it is about an inch long it will send out a fuzzy growth of root hairs.

In many cases the seed leaves will also break out of the brown seed coat. The children will be thus able to see for themselves that the radish seed was made up of *a baby plant wrapped in an outer covering.*

They will also learn from this experience that when a seed has *water, warmth,* and *air* it will sprout—that is, the baby plant will break out of the brown wrapper and begin to grow.

II. Fill a flowerpot or a window box with moist soil up to within an inch and a half of the top. Let each pupil place a radish seed on the surface of the soil. Then cover these seeds with half an inch of soil. Water carefully and place near a sunny window. If necessary, move the flowerpot about during the day so it will be in the sun as much as possible.

In two or three days the seedlings will break through the soil. The two seed leaves will open out and a few days later the shoot between them will show itself. In a week or two the shoot will grow into the true leaves or *sun leaves*—very different in shape and appearance from the seed leaves. Dig up one or more of the seedlings to see the root and stem.

From this bit of experience with real things the children become acquainted with radish seedlings and will learn:

That when a seed is planted in the ground it sprouts by sending *the root downward and the shoot upward.*

That a radish seedling has two kinds of leaves—the seed leaves and the sun leaves.

That the roots and root hairs take hold of the fine bits of soil.

III. Such exercises as these will be helpful in getting the pupils ready for the outdoor experiences of growing radishes. Even a small bit of ground in or near the school yard may be used for this purpose. Details of planting and culture are given in Lesson 51 of this pamphlet.

LANGUAGE STORIES.

These experiences may readily be utilized as a basis for oral and written language stories. Three, four or five clear cut sentences should be obtainable from third grade pupils. The following may serve as a model story:

I planted a radish seed in a flowerpot. I put the pot near a window. A little radish plant soon came up. It has two seed leaves. I am going to watch it grow.

GRADES IV–VI.

Any adequate teaching in these grades also requires personal experience on the part of the pupil. Mere information given through the teacher's voice or by reading a textbook without supplementary activity on the part of the pupil is of little value. This activity of the pupils should, of course, culminate in the growing of radishes in each pupil's home garden, and in general this should include the growing of the principal types of radishes in order that the garden experience may be as broad as possible.

But here also much may be done in the schoolroom in advance of the outdoor planting season to enlist the interest and increase the real knowledge of the pupil. Some of these schoolroom activities are suggested below:

I. Have the pupils look up varieties of radishes in the seed catalogues. See that they find the name of a variety of each of these types: Round or turnip-shaped; oval or olive-shaped; long or finger-shaped. Have them find also the names of varieties of these colors: Red, white, red and white, yellow.

II. Utilize this opportunity to have each pupil write a formal letter ordering a packet or an ounce of one variety of each type. Have it written as a business letter addressed to one of the seed firms, and see that it is correct in form, expression, and punctuation.

III. Take two small panes of glass. Put one or two pieces of blotting paper on top of one of them. Let each pupil put a radish seed on the blotting paper. Lay the other glass over the seed and hold it in place with rubber bands or spring clothespins. Leave it in a warm but not hot place where the pupils can see what happens. Dip the glass plates in water occasionally if necessary to keep the blotters moist.

The seeds will soon sprout, each sending out the white root on which root hairs will develop. Now place the glass plates on edge so they rest vertically. After a day or two have the pupils see whether the roots are growing downward or upward. After two or three days in this position reverse the plates so the roots point upward. Have the pupils see what happens.

From this experience the pupils will learn that *roots grow downward* under practically all conditions and should get the idea that a root is a living thing seeking for itself the right conditions for growth and adjusting itself to its surroundings.

IV. Utilize this same apparatus for testing the viability or sprouting quality of the seeds. Place 50 seeds on the blotter and let the pupils determine the percentage that sprout.

If you can get the old radish seeds, try these also and compare their percentage of viability with that of fresh seeds.

These germination tests can, of course, be made with many other bits of apparatus. Any device that gives the seeds air, warmth, and moisture will serve.

V. Let the pupils plant some radish seeds in soil in a window box or a flower pot near the window. Let them watch the growth of the seed leaves or cotyledons and of the shoot between that grows into sun leaves or foliage leaves.

Dig up gently some of these radish seedlings. Let the pupils see that many particles of soil cling to the roots. Use a reading glass to show that the root hairs touch these bits of soil.

From this experience the pupils will better understand the importance of having garden soil in so fine a condition that the particles are readily reached by the root hairs.

VI. It is well worth while to give the pupils practice in strewing radish seeds on a table or desk. If the type of desk used by the pupils has a groove for holding pencils and penholders such a practical exercise is very easy.

To understand the importance of this preliminary seed strewing one should realize that without it most children sow the seeds in the garden row much too thickly. To make good gardeners frequent practice is needed in all the essential operations. Classroom drill in seed strewing is most helpful as a preparation for outdoor gardening.

Give each pupil about 50 radish seeds. Tell him to lay them out in a straight line. Four to the inch. Make an arithmetic exercise if you wish and let him find out how many seeds this would be to the foot. Then let him measure the distance he has covered by the 50 seeds and try again. Repeat until the results are satisfactory.

VII. Sound practical garden knowledge should result from the study of the radish. Some of the more important points to be emphasized are these:

The radish is a quick-growing, cool season crop.

It should be used as a catch crop or companion crop.

Good quality requires rapid growth.

A constant supply requires succession sowing.

It is easy to plant at one time more seeds than are needed for the family supply.

Lesson 27: PLANNING FOR NEXT YEAR'S SEEDS.

Last spring many Congressmen received requests for seeds from members of the United States School Garden Army. Many of these requests came so late that the seeds could not be furnished because the supply was exhausted.

To avoid a repetition of this experience the following suggestions are made to teachers and garden supervisors:

1. After school opens let the pupils discuss—perhaps in connection with their language lessons—the crops which have been most satisfactory.

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2. Work up a collective statement of the amount of food raised by the Garden Army company, developing the topic in connection with arithmetic. Be critical of the reports each pupil makes.

3. After a full discussion make a blackboard list of the kinds of crops the pupils wish to raise another year.

4. Have the pupils appoint a committee of three to write to their Congressman. This committee may well consist of the officers of the company. Suggest that they tell him of their garden experiences as members of the United States School Garden Army, and that the pupils would like a supply of certain seeds for next spring—naming the seeds on the blackboard list.

5. Instead of letting the officers write the letter, all the pupils might be allowed to write it as an exercise in letter writing, and the three best letters be sent.

6. In either case inclose with the letter a copy of the collective statement as to the food raised by the company.

7. This opportunity should be utilized as a lesson in civics, letting each pupil learn the number and the geographical limits of the congressional district in which the school is situated and the name of the Congressman now representing the district. Let them see pictures of the National Capitol and of the congressional office buildings.

This suggestion is important and should be followed early in the school year.

V. PLANTING THE CROP.

Lesson 28: GETTING YOUR GARDEN READY.

The success of your garden depends largely upon the condition of the soil in which you sow the seeds. Soil that has not been spaded or plowed for some time becomes so hard that the roots of plants can not easily go through it. So you must get the ground ready by digging it up and working it over so that the bits of soil will be loosened from one another. This makes it easy for roots and root hairs to penetrate between them and get from them the moisture and plant food needed for rapid growth.

The process of digging up and working over the soil is called *tillage*. Plowing and spading are examples of *deep tillage*. Cultivating, hoeing, or raking are examples of *surface tillage*.

In small gardens deep tillage is best done with a spade or tined digging fork. The spade or fork should be thrust down in a nearly vertical direction to its full depth and the soil turned over. After this is done it is well to spread broadcast over the freshly turned soil a light dressing of commercial fertilizer. Then rake the surface smooth. The soil is now ready to be lined out and planted.

In tilling clay soils it is important to wait until the ground is so dry that it crumbles easily between the fingers. Here are two simple tests which any pupil can make:

1. Take about a heaping teaspoonful of the damp clay soil. Work it into the shape of a marble. Roll the marble along the ground. If it does not crumble, the soil is too wet to work.

2. Take about a heaping teaspoonful of soil. Squeeze it tightly in the hand so that the water runs out between the fingers. Now drop the ball upon hard ground. If it simply flattens out, the soil is too wet to be tilled. If it crumbles it is in the right condition to till.

Sandy soil can be greatly improved by spading in fallen leaves, stable fertilizer, lawn rakings, or almost any kind of vegetation. As this material gradually decays it furnishes the right conditions for holding moisture and supplying food to plant roots. Such decaying vegetation in the soil is called *humus*.

Many garden soils are infested with witch-grass roots. These should be dug out before the crops are planted. A tined potato digger is one of the best tools for this purpose. A hoe or a spade that cuts the roots is worse than useless. Each piece will grow into a new plant.

Lesson 29: HOW TO PLANT YOUR CROPS.

Well begun is half done in gardening as in other things. To get good crops, you must begin by sowing the seeds at the right time and in the right way.

One of the easiest mistakes you can make is to sow the seeds too deep. When this happens, you are likely to wonder why the plants do not come up. But if you dig down you will find the buried seedlings trying hard to reach the surface.

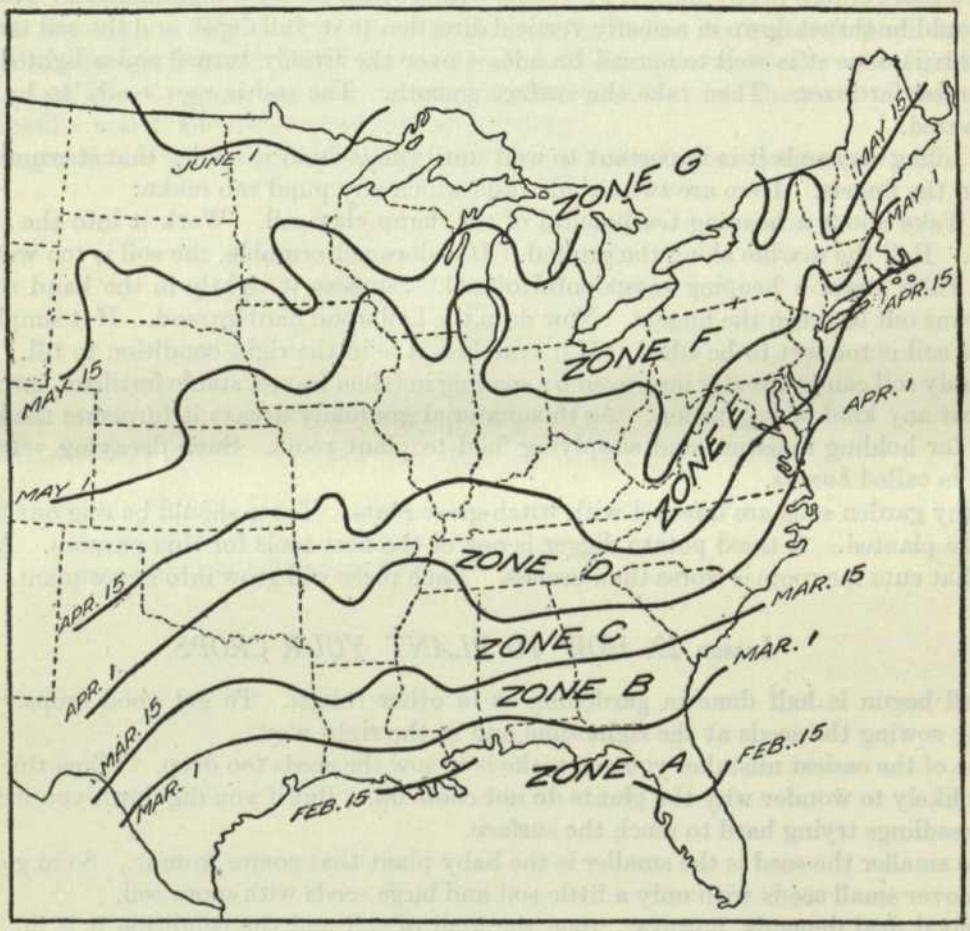
The smaller the seed is the smaller is the baby plant that comes from it. So in general you should cover small seeds with only a little soil and large seeds with more soil.

A good deal depends, however, upon the kind of soil and the condition it is in. In early spring when the soil is wet, the seed does not need to be covered so deeply as in summer when the soil is dry.

It is also especially necessary in summer to firm the soil down upon the seeds, by walking over it or by pressing a board down upon the rows after the seeds are planted. This serves to bring the soil particles in closer contact with the seeds so that they absorb moisture better. It also enables the root hairs that soon appear upon the sprouting roots to get moisture for growth more easily and it helps the rise of soil moisture from below by capillary attraction.

The depth of seeding also depends somewhat upon the character of the soil. A sandy loam through which the little seedlings can easily poke their heads is of a very different consistency from a clay soil, which often bakes into a hard crust that effectually smothers the plants, which are unable to break through. Consequently, one can cover the seeds deeper in sandy soils than in those of clay.

The thickness of seeding depends upon various conditions. In a great many cases one must sow many more seeds than can possibly mature. One reason for this is that a lot of seedlings growing close together can break through the ground more easily than they could by pushing up singly. Consequently, this ability to work together in coming up is one important reason for thick seedage. Another is that by thus having a surplus of seedlings one can use a process of selection when it comes to thinning the plants, leaving in each case the strongest ones to grow.



Outline map of the United States, showing zones based on the average date of the last killing frost in spring.

Lesson 30: THE CROPS TO PLANT FIRST.

The map above shows the three main planting zones for the Northeastern States. They are marked E, F and G. In zone E, along the southern boundary the last killing frosts in spring range between April 15 and May 1, while in zone G along the northern boundary of New England such frosts occur often after May 15.

A small but important group of hardy vegetables may be planted two weeks before the average date of the last killing frost. This is about the time the soil dries out sufficiently to be worked to advantage.

This hardy group for early planting includes these seed crops: Radish, kale, turnips, mustard, and the early smooth peas.

The following vegetables may also be set out at this time: Onion sets for bunch onions or scallions; cabbage plants from hot bed or greenhouse; potatoes for the early crop.

The names of recommended varieties of these vegetables are given in Lesson 24. The following planting suggestions may prove helpful:

Radish: Line the rows 8 inches or more apart. Make the drills an inch deep. Sow the seeds about four to the inch. Cover half an inch deep. Firm the soil lightly over the seeds.

Turnips: Line the rows 12 inches apart. Make the drills half an inch deep. Sow the seeds sparsely, about six to the inch. Cover lightly.

Onion sets: Line the rows 12 inches apart. Make the drills 2 inches deep. Place the sets in the drills 1 or 2 inches apart. Cover an inch deep.

Peas: Line the rows 12 or 15 inches apart. Make the drills 2 inches deep. Sow the seeds two to the inch. Cover 2 inches deep.

Lesson 31. THE OUTDOOR SEED BED.

An outdoor seed bed is a great help in growing several vegetables. It need be only a few feet square. It should be chosen in a sunny sheltered spot where the soil is rich and well-drained. Then the soil should be made fine and mellow. The little seedlings have tiny roots with still more tiny root hairs. The finer and richer the soil, the surer and more rapid is the growth.

Clay soils may be improved by working in lime or sandy loam. Sandy soils may be improved by working in finely rotted manure or leaf mold from the woods. In any case it is well to spread over the surface a light dressing of commercial fertilizer and rake it in. Make the surface layer fine and smooth.

Having the seed bed thus prepared the next thing is to pack it down rather lightly with a flat board. But he careful simply to firm the soil and not to pack it so tightly as to drive the air from between the bits of soil. When this is done the drills may be furrowed out with a pointed stick or anything that is handy.

The next thing is to sow the seeds. Scatter these along the bottom of the furrow, dropping them from between the thumb and fingers. For some of the smaller seeds this is a good plan: Cut off the corner of the seed packet. Hold the packet in the left hand. Tap it gently with a lead pencil as you carry it along over the furrow. This causes the seeds to come out evenly along the row. The depth of covering depends upon the size of the seeds.

After the seeds are covered, the soil should be thoroughly firmed down with a piece of board in order that the roots of the young plants may take a firm hold. Great care is needed in watering so as not to wash out the seeds. It is a good plan to cover the soil with old burlap and spray the water on the burlap.

When the plants come up the soil between the rows should be hoed with care. Where the seedlings are too thick they should be thinned. They are likely to grow rapidly and should be ready to transplant in a few weeks.

Several vegetables may be started to advantage in the outdoor seed bed. Among these are cabbage, parsley, lettuce, Brussels sprouts and tomatoes. In the case of the latter, early varieties should be selected for this planting outdoors.

This outdoor seed bed can often be made at the school and used as a distribution garden for the home gardens of the pupils.

Lesson 32: WHEN TO PLANT YOUR CROPS.

You can easily arrange the different vegetable crops in two groups—those which are hardy to frost and those which are tender to frost. The time of planting of any crop depends largely upon whether it belongs to the first or the second of these groups.

For this reason you can plant the seeds of lettuce, onions, parsnips, or turnips as soon in spring as the ground is in good condition to work, even though frost may occur after the seedlings come up. But it would be foolish for you to plant at that time the seeds of tender vegetables like sweet corn, beans, cucumbers, or squash.

The time to plant depends, of course, upon the weather conditions, especially the dates of killing frosts. Study the map on page 28 of this Manual to see how these dates vary from south to north.

In general, it has been found practicable to classify vegetables into four groups with relation to the time of planting. These are indicated as follows:

Group 1.—Consisting of early cabbage plants from hotbed or seed box, radishes, onions, early smooth peas, early potatoes, turnips, and mustard. These crops may be planted two weeks before the last killing frost.

Group 2.—Consisting of beets, parsnips, carrots, lettuce, salsify, spinach, wrinkled peas, cauliflower plants, celery seed, parsley, and sweet corn. These crops may be planted about the date of the last killing frost.

Group 3.—Consisting of snap beans, okra, and tomato plants. These crops should be planted two weeks after danger of frost is over.

Group 4.—Consisting of lima beans, pepper plants, eggplant, cucumbers, melons, squash, and sweet potatoes. These crops can not be planted until all danger of frost is over, which is about four weeks after the last killing frost.

Find out the usual date of the last killing frost in your town.

Lesson 33: CROPS FOR LATE PLANTING.

Success in gardening depends largely upon keeping the soil busy throughout the season. After the first early crops are gathered there is still time to plant others. The extent to which this can be done depends largely upon the latitude, but even in the more northern States planting may be continued well into July.

One of the greatest dangers in late planting is that in a dry season there may not be moisture enough in the soil to give the crops a rapid growth. It is desirable in such cases to water the garden so thoroughly from a hose or pump that the supply of moisture will be replenished. This should be done before the seeds are sown to prevent washing them out and to get a thorough soaking.

The soil should also be spaded and raked or plowed and harrowed before replanting. This will put the particles in good condition for plant roots and help to prevent the evaporation of moisture. A light dressing of commercial fertilizer raked in will hasten growth.

Bush, string, or snap beans are among the best food-producing garden crops. The early varieties will begin to yield pods for cooking 60 days after planting. Consequently, in any locality where the killing frosts hold off until even the middle of September, one can safely plant up to the middle of July. Bountiful and Stringless Green-pod are good green-podded varieties. Brittle Wax and Kidney Wax are good yellow-podded sorts.

Green peas are delicious in early fall. If seeds of early sorts, like Gradus or Sutton's Excelsior, are planted before midsummer there is a good chance of getting a crop this season. The best way to plant at this time is in trenches about 5 inches deep. Sow the seeds in the

bottom about 1 inch apart and cover with 2 inches of soil. After the seedlings are a few inches high fill in the trenches gradually at each hoeing until the soil is level. This gives the roots a chance to develop in the deeper, cooler soil.

Good supplies of pot herbs or greens are greatly appreciated during the autumn months. Most plants used for this purpose are cool-season crops, so that if the seed is sown about the first of August the seedlings will be ready to grow rapidly late in that month and during September and October. Spinach is one of the best crops for this purpose. Victoria and Round-seeded Savoy are good varieties. Be sure the soil is treated to an application of commercial fertilizer to induce a rapid growth.

Lesson 34: ROOT CROPS FOR LATE SOWING.

The root crops are of special value in the food supply because they are so easily stored for winter use. Some of these, like parsnips and rutabagas, require a long season for growth, but others, like turnips and carrots, may be grown in a shorter time.

Even up to midsummer there is still a chance to plant some of the root crops for fall use. If these can be coaxed into a rapid, continuous growth from now until well into October, they will be excellent for late fall and early winter use.

Carrots are excellent when thus grown, provided the early sorts, like French Forcing or Earliest Short-horn, are selected. Up to the middle of July, Chantenay and Danvers may be sown. The rows should be about a foot apart and the drills an inch deep. Sow the seed sparsely, being careful not to sow too many of the small seeds. Sow also a few radish seeds of such a small variety as Early Globe to mark the rows. Cover with at least half an inch of fine soil and firm it over the seeds. Thin the carrot seedlings early to an inch apart, and begin using the tender roots when quite small for soups and stews.

The main crop of turnips for winter use is commonly raised from seed sown in summer. White Egg, Purple Top White Globe, and Purple Top Milan are good varieties. Turnip seeds are so small that it is difficult not to sow them too thickly. This may be avoided by mixing with corn meal or fine sand and then dropping carefully through the fingers. Make the rows a foot apart and an inch deep and cover with half an inch of soil. Thin the young plants to 2 inches apart, and begin using the roots for soups and stews as soon as they are large enough.

VI. GROWING THE CROP.

Lesson 35: THE CARE OF THE GARDEN.

Much of the waste in gardening is due to lack of care after the garden has been successfully started. It is easy enough to plant a garden but it takes patience and continued care to grow a full crop. You ought not to waste anything, now that there is so much demand for food products. Every plant you have in your garden that is neglected and allowed to die is just so much loss to your country.

You should cultivate the soil shortly after each rain in order to break the dried crust and make a layer of dust on top to keep the ground moist underneath. Never work your soil when it is too wet. It should be dry enough to crumble in your hands before a garden plow or hand hoe is used.

Practice regular and thorough stirring of the soil throughout the season. Gardeners sometimes neglect this during dry times. Even if a layer of dust is already present your garden will be helped by regular cultivation. Cultivation, besides making a layer of dust on top, will:

1. Loosen and break up the ground into smaller pieces.
2. Increase the amount of food that the plants live on, and make it easier for them to get it.
3. Make it easier for the air to get to each piece of soil.
4. Mix the fertilizer better with the soil.
5. Destroy weeds and insects.

While your vegetables are small, cultivate close to the plants and as deeply as the plants are in the soil. As your vegetable grow larger, do not cultivate so deeply but farther from the row. You should cultivate at regular intervals until the plants have grown so large as to make if difficult to use a cultivator. In a small garden a hand hoe or weeder may then be used if more stirring seems necessary.

The wheel hoe is set up on wheels and has several different kinds of shovels. These may be changed for different kinds of work. The wheel hoe is used to cultivate between the rows. It is also used to get the garden ready to plant. It is one of the most useful garden tools. A spade is used to dig up the soil. If you use a garden line in your garden, you can keep your rows straight, thus giving your garden a better appearance.

Lesson 36: WEEDING YOUR GARDEN.

A weed is a plant out of place. A carrot growing in a row of onions is a weed. It is out of place. It belongs in a row of carrots. A poppy growing in a row of carrots is a weed. It belongs in a bed of poppies. But most weeds are neither good to eat, like the carrot, nor beautiful to look upon, like the poppy. They are vagrant plants—the tramps of the garden—ready at any time to steal food and moisture, air and sunlight from the useful crops to which the garden belongs.

In most gardens there are vast numbers of weed seeds of many kinds ready to sprout into life whenever there is a chance. So when we plant the garden to radishes or carrots or lettuce or other crops and wait for these seedlings to appear, the eager weed seeds make the most of the opportunity and come up by the thousands. Many of these young weeds are sturdy plants, ready to grow so rapidly that they will crowd out the seedlings we wish to raise. Consequently, we must pull up the tramps, roots and all, and cast them on the ground to wither and die.

This process of pulling or otherwise destroying the weeds in the row of seedlings is called *weeding*. It is one of the most important garden operations, especially in the spring when so many crops are getting started.

To pull weeds intelligently we should know them by sight, and be able to distinguish them from the young seedlings of the crop plants. So if one does not know just how the crop seedlings look, be sure to find out before the weeding begins.

Weed seeds are easily distributed. Wind and animals help this distribution. In general, weed seeds are very hard to kill. Changes of temperature have little effect upon them. They sprout readily in small amounts of soil and will thrive well even under disadvantageous conditions.

To assist in destroying the weeds various small tools called hand weeders are used. They enable one to stir the soil nearer the crop seedlings than can usually be done by the hand. In case the seedlings are to be thinned to several inches apart, these weeders can be used to dig out seedlings and weeds together.

Make a blackboard list of the weeds the pupils know by sight.

Lesson 37: THINNING YOUR YOUNG VEGETABLES.

When we plant garden seeds, we generally sow them thicker than we wish the plants to grow. All seeds do not sprout, and therefore we sow many of them to get the desired number of plants. Then, when the seeds do sprout and grow, the mature plants will require more room for development than the seedlings. In order to give the best plants room enough, we remove the others. This removal of plants is called *thinning*.

In the case of most crops it is important to make the first thinning early enough to avoid disturbing the roots of the plants left in the soil. At first each seedling has only a few short roots, but as it grows these roots become longer and reach out in all directions. If two seedlings are close together, the roots will mingle with each other so that one plant can not be pulled up without breaking off many of the roots of the other. Such a breaking off of roots is liable to injure the plant left and to check its growth.

This early thinning is particularly important in the case of cucumbers and other vine crops. These plants are especially sensitive to the disturbance of their roots, and if two are left close together until they are of good size, it is difficult to pull up one without serious injury to the other.

The final aim of thinning is to give to each plant plenty of room in the soil for adequate root development and plenty of room above ground for its leaves, flowers, and fruits to mature successfully. There is a constant struggle among all plants for food, moisture, light, and air. The more crowded they are the fiercer is the struggle.

The aim of the gardener is to give to each plant the most favorable conditions for growth. So he allots to each the space it needs to make the most of itself. If it is naturally a large plant he leaves the seedlings far apart, and if a small one he leaves the seedlings nearer together, thinning as may seem necessary for the best growth of each.

Lesson 38: HOW TO THIN VEGETABLES.

ROOT CROPS.

Weed and thin radishes to 1 inch apart; carrots to 2 inches; parsnips 4 or 5 inches; turnips 3 or 4 inches; beets twice, once to 2 or 3 inches apart and again to 4 or 5 inches. Use the beet plants pulled to cook for greens.

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ONIONS.

Plants grown from seed should be thinned two or three times. Thin first when the seedlings are about 3 inches high to half an inch apart; second, three weeks later to an inch apart. The plants pulled up are useful for stews and salads. After this pull up plants as needed for use as raw onions or for flavoring stews, leaving the crop that is to mature about 3 inches apart.

CABBAGES AND POTHERBS.

Weed and thin cabbage seedlings growing in drills to 2 inches apart. Transplant later to rows 2 feet apart in the row. Weed and thin cabbages sown in hills to one plant to a hill.

Thin spinach twice, first the young seedlings to an inch apart; later to 4 or 5 inches, using for greens the plants pulled up.

Thin Swiss chard twice, first to 3 inches, cooking the plants pulled up. Then when the plants begin to touch, thin again, using the thinnings as needed until the plants left are about a foot apart. By this time those left will be large enough to furnish leaves for cutting, and will continue to do so for the rest of the season.

SALAD CROPS.

Weed and thin lettuce sown in drills twice: First, when the plants have two or three true leaves in addition to the seed leaves. Thin this time to 2 inches apart. Second, thin and use the plants as needed, keeping on until the plants left to head up are 6 inches apart.

Weed and thin parsley in drills twice; first 2 to 3 inches; second, to 5 or 6 inches. The plants pulled at the second thinning may be used on the table.

VINE CROPS.

When cucumber plants are small, pull up part of those which touch one another. When danger from insects is past thin to 3 or 4 plants to each hill, leaving the strongest plants well distributed in the hill.

When danger from insects is past, thin melons and squashes to 3 plants to each hill.

Lesson 39: HOW TO TRANSPLANT.

When you dig up a plant from a box, a hotbed, or a row in a garden and set it out in a new place you *transplant* it. If you are to be a really good gardener, you will need to know how to transplant several of your crops in such a way that they will grow.

You drop a seed into the open drill. You cover it with soil. The rain waters it. The sun warms it. The seed sprouts into a seedling that sends out roots below the surface and a shoot above the surface. When the seedling has been growing for a few days it becomes connected with soil particles by hundreds of tiny rootlets and thousands of root hairs.

If you dig up your seedlings most of these rootlets and nearly all of the root hairs will be broken off. This is, of course, a shock to the plant. It stops growing because food materials that have been coming through the root hairs and rootlets are no longer sent up. A new lot of these must be developed for growth to continue.

One of the best ways to prevent this injury is to grow the seedlings in a flower pot or something similar in which the roots will develop in a compact space. Then the seedling can be carefully taken out, or if the receptacle is of paper the whole may be set directly in the soil The paper will soon rot away.

The great trouble in transplanting is that the seedling wilts. This is because the water evaporates from the leaves and no water comes in through the roots to replace that which evaporates. It helps to have lots of water in the plant when it is dug up. So the soil in which the seedlings are growing should be soaked a few hours before they are dug up.

The hotter the sunshine the more rapidly does evaporation take place. So it is desirable to transplant on a cloudy, moist day, or else in the late afternoon.

The greater the leaf surface the larger the amount of water evaporated. So it is often desirable to remove the larger leaves, or cut them through the middle. This is a great help in letting the plant get hold in its new position.

It is, of course, necessary that there should be plenty of moisture in the soil about the roots. So to be sure of this we may pour water before transplanting into the hole where the plant is to go or we may pour water on the surface after it is set out. On a larger scale we will be sure the soil is freshly tilled.

It is important that the soil particles be directly in contact with the roots. This will enable the rootlets and root hairs to get moisture more easily. So in setting out the seedlings we should press the soil down firmly with the hands.

Lesson 40: MULCHES AND HOW TO USE THEM.

Every living thing needs water. This is as true of plants as of animals. In many regions the greatest trouble in keeping the crops growing through the summer is to get water enough for the plants.

In winter the soil gets saturated with water. As the days become warmer and the sunshine hotter this soil water begins to go off into the air—to evaporate as people say—just as steam comes out of the teakettle when you put it on the fire.

If the soil is not plowed or spaded in spring, the water evaporates rapidly and by early summer most of it is gone—leaving the dry soil behind. Every time the ground is stirred it holds the moisture better, and even a stirring of an inch or two of surface helps to save the soil water.

Did you ever lift up a board in summer and find that the ground was moist beneath it? The board had held the moisture so it could not escape into the air. You will find much the same condition under an old bag or piece of carpet lying on the ground, or even a pile of leaves or straw left upon the garden.

When the boards, or bags, or old carpets, or leaves, or straw are thus left upon the soil surface each acts as a mulch. For a mulch is anything placed upon the ground to stop evaporation of soil moisture.

A mulch of any kind prevents evaporation. Soil moisture is continually coming to the surface and evaporating into the air. The moisture passes up through the soil in the same way that oil climbs the wick of a lamp. This movement of soil moisture is called capillary attraction.

This movement can not take place unless the soil particles touch one another. So it happens that if you stir the soil for an inch or two at the surface you get much air between the particles of soil and make a *surface mulch*, without using straw or bags or anything but the soil itself.

A shower of rain will destroy this surface mulch, and so after each shower it is necessary to prepare another mulch. Even if no rain falls, there is generally sufficient dew to destroy the mulch after a few days. The maintenance of a mulch throughout the growing season is best for most garden crops.

Lesson 41: JOHN'S DREAM.

One fine Saturday morning in early June young John was weeding the onions in his garden. There was to be a ball game in the afternoon, and John had laid out a nice little program for the day. He was to work in his garden until 11 o'clock, then carry five bunches of radishes to Mrs. Jones who lived three blocks away, and come home for dinner, with all of the afternoon for the ball game.

It was a hot morning, and John's fine resolutions began to ooze out with the perspiration. He kept thinking what fun it would be to play ball all day. So about half past 9 he sneaked out the back gate and started for the ball ground.

On his way there he saw a large Red Cross poster labeled "A Little Starving Child Brought Back to Life." He stopped a moment to look at the picture and the one beside it of "The Greatest Mother in the World." Too bad, he thought, that any child should starve on such a fine day as this.

John practiced ball the rest of the morning and played a real game in the afternoon. He was a pretty tired boy by bedtime, and as soon as he got to sleep he began to dream of the starving child whose picture was on the poster. He saw the child crawl to the knees of the Greatest Mother in the World and beg for food. And the Great Mother's wonderful face showed anguish as she said: "Here is food for to-day, but where will I get it for to-morrow? Oh, how I wish all the boys and girls in America could see these starving children. Then they would not play all the time and let their gardens grow weeds instead of food."

John took the lesson to heart. By the end of the next week his garden was in fine shape. And then for the first time since his dream he was able to look squarely at the pictures of the Starving Child and the Greatest Mother and say: "I'm trying to do my part."

Surely the millions of children in the United States School Garden Army will follow John's example.

Lesson 42: STORIES OF BEANS AND OTHER THINGS.

The garden operations of the pupils make an excellent basis for language stories. Such stories embody real first-hand knowledge. In telling them the pupils feel the interest of a personal experience.

One advantage in developing such stories is that they can readily be adapted to the different grades. The length of the story depends chiefly upon the number of details mentioned. In the lower grades where the stories are made up of few sentences, only the principal facts are mentioned. In the upper grades details of development and structure are readily included.

The following model stories are suggestive of the work that may be expected of pupils in the fourth grade:

MY BEAN SEEDS.

Yesterday I planted half a pint of bean seeds in my home garden. I put down a line to keep the row straight. I made a furrow along the line with a hoe. I dropped bean seeds in the bottom of the furrow, one seed every 2 inches. I covered the seeds 2 inches deep. I hope they will come up soon.

MY BEAN PLANTS.

Early last week I planted some bean seeds in my home garden. This morning I saw them coming up. The stem is curved over at first. It pulls up the two thick seed leaves. Then the stem becomes straight and the large leaves begin to grow. I hope they will grow rapidly.

Such stories may be oral or written, or both. They help to make the language lessons real.

VII. GARDEN CROPS.

Lesson 43: HOW TO STUDY A CROP.

The other day a gentlemen gave a friend some beans and advised him to plant them in his garden. The friend was growing a garden for the first time and he knew very little about beans or other things.

Some two weeks later the friend met the gentlemen who furnished the beans and said to him, "Those beans you gave me were no good. Soon after I planted them they came right up out of the ground again."

Any of you who have planted beans will be likely to smile at the ignorance of this new gardener, for of course, you all know that that is the way in which all well-behaved beans naturally grow.

A good gardener is always seeking for knowledge about the crops he grows. The best part of his knowledge he gets through actual experience but he does not despise the knowledge which other people have gotten from their experience. For life is too short for any one man to learn all there is to be learned even about any one crop, let alone all the hundreds of crops that we grow in our gardens.

So when we take up the study of any crop, we want to learn many things about it. We want to learn first how many different types of the crop there are and whether it is a warm-season crop or a cool-season crop. We want to learn something of the varieties and which are the best sorts to plant, so we may select the seed properly. We also want to learn what sort of soil it prefers and when to plant it, as well as how to cultivate it and how to protect it from its enemies. Then, lastly, we want to find out what are the best ways of gathering it and if we are going to sell it, of marketing it; or if we wish to use it in the home in the future, of preserving it.

When you take up the study of a new crop the first thing to look at is a good seed catalogue. This will probably show you pictures of different types and will give you a list of the best varieties. Very likely it also will tell you something about planting the seeds. Next you will do well to read over the lesson about that crop in this manual and then to look up the subject in books and bulletins. It will add to your interest in the crop if you learn something about the history of the plant.

So in your study of any garden crop you will do well to bear in mind this little outline:

Types of structure.
Seasonal adaptation.
Varieties.
Selection of seed.
Preparation of soil.
Planting.
Cultivation.
Protection of crop.
Harvesting.
Marketing.
Preserving.
History of the plant.

Lesson 44: LETTUCE FOR HOME GARDENS.

Next to radishes, lettuce is one of the best crops for boys' or girls' gardens. The plants are ready to use a few weeks after the seed is sown. It is a cool-season crop; that is, the plants grow better in the cool weather of spring and autumn than they do in the hot summer time. So it is well to plant the lettuce seed as early in the spring as possible. There are some small-headed varieties which are especially desirable for home use. Tom Thumb is one of these.

Plan for several types of lettuce for the sake of variety in diet and garnishes, as well as to insure a good supply as needed over a long season. Buy a packet of seed of at least one variety of each of the following types: *Loose-leaf:* Black-seeded Simpson, Grand Rapids. *Cabbage-head:* Wayahead, Naumberger, Big Boston, California Cream Butter. *Crisp-head:* Iceberg, Crisp as Ice. *Cos* or *Romaine:* Trianon. A packet of seed will make two or three sowings of enough rows for family use.

PLANTING.

Prepare the soil thoroughly as soon in spring as it is in good condition to work. Apply broadcast a good dressing of commercial fertilizer. Rake it in. Line the rows 12 inches apart. Make the drills an inch deep. Sow the seed about six to the inch. Sow also a few seeds of a small early sort of radishes, about one seed to every 2 inches. Cover half an inch deep.

GROWING.

Till the soil surface at least once a week. Weed the rows as soon as the lettuce seedlings come up. Thin at least twice—first to an inch apart when the plants are small, second to about 6 inches when the plants are larger—so that those pulled up may be used on the table. Apply a light dressing of nitrate of soda or commercial fertilizer between the rows about a month after planting. Be careful not to get any soil into the crowns while hoeing, weeding, or thinning. Gather the crop as needed, pulling the plants or cutting the leaves or heads early in the morning when the blades are turgid with moisture drawn up through the roots.

Cos or Romaine lettuce is especially desirable for summer use. It stands the hot weather better than the others. The heads should be tied up with rags or raffia to blanch the inner leaves.

Look up varieties of lettuce in seed catalogues.

Lesson 45: PARSLEY.

Parsley is the favorite garnish for American foods. It is also used for flavoring soups and stews and to a less extent in salads.

Such curled varieties as Moss-curled or Dwarf Perfection are most desirable. The fern-leaved sorts are also attractive. Fifteen feet of row will furnish plenty of leaves for family use.

GROWING.

Soak the seed overnight in warm water. Sow the seeds in a drill in rich soil, 10 to the inch. Sow radish seeds also, 1 to the inch. Cover half an inch deep. Thin the young plants to 3 inches apart.

Lesson 46: CELERY.

Celery requires a little more care than many other crops but the results repay the extra trouble. You can grow your own seedlings in a hotbed or outdoor seed bed or you can buy them for about 50 cents a hundred. Look in the seed catalogue for prices.

Celery is grown by two different methods—level culture and in trenches. If your garden soil is deep and rich there are advantages in digging out a trench a foot wide and 15 inches deep, filling in 6 inches of manure and 3 inches of soil and setting out the plants in this soil.

GROWING BY LEVEL CULTURE.

Select rich, moist, well-drained soil and prepare it thoroughly. Apply a light dressing of commercial fertilizer and rake it in. Line the rows 30 inches apart and set the plants 5 inches apart in the rows.

Hoe or rake the ground between the rows at least once a week. Be careful not to stir the soil deeper than an inch or two. Don't get any soil into the crowns of the plants. Apply commercial fertilizer or nitrate of soda between the rows two or three times: First, 10 days after setting out the plants; second, a month later; third, a month after the second application. When the plants are full size blanch the stalks by drawing the soil up and around them, not all at once but by two of three hoeings, until only the leaves project. Be careful to "handle" the stalks, keeping them together so the soil will not get into the crowns.

BLANCHING BY OTHER METHODS.

Celery stalks may be blanched by any method that excludes the light from the growing plants. Several varieties are so completely self-blanching that they are easily blanched by fastening boards a foot wide and several feet long vertically along the rows. This method is especially desirable for the early crop, because when soil is used in summer there is danger of rotting. There are also now upon the market various celery blanches which are readily put on and serve the purpose very well.

Look in the seed catalogues to find out about seeds and plants of celery.

Lesson 47: SPINACH.

Spinach is one of the best of all the plants used for potherbs or greens. It is a cool-season crop, doing best when started so early in spring that the crop can be cut before warm weather.

If seed is sown as early in the spring as the ground is dry enough to work, the crop is likely to escape attack by the leaf maggot. This pest often spoils the leaves of later crops.

Buy an ounce of seed of one or more of these varieties: Victoria, Longstanding, Round-seeded Savoy.

PLANTING.

Wait only until the soil is dry enough to work easily. Select a rich, loamy soil. Prepare thoroughly by plowing, harrowing, and raking or by spading and raking. Apply broadcast a heavy dressing of commercial fertilizer and rake it in. Line the rows 12 inches apart. Make the drills an inch deep. Sow about six seeds to the inch. Cover three-quarters of an inch deep, and firm the soil lightly.

GROWING.

Hoe or rake the soil surface between the rows as soon as the seedlings come up. Thin the young plants twice—first, to an inch apart as soon as there are two or three true leaves in addition to the slender seed leaves; second, to 3 inches apart when there are several true leaves developed. Use for greens the plants pulled up at the second thinning. Weed at times of thinning and whenever necessary. Hoe the soil surface at least once a week. Fertilize between the rows with a light application of nitrate of soda if the soil is not rich. Cut as fast as the plants are large enough to use.

Lesson 48: NEW ZEALAND SPINACH.

The common kind of spinach is good for use in spring and fall, but does not thrive in summer. New Zealand spinach may well take its place during hot weather. It withstands heat and drouth and produces plenty of greens from July until October.

New Zealand spinach is not grown as much as it ought to be. Many people do not even know about it. Let the pupils look it up in the seed catalogues.

The seeds of New Zealand spinach are quite large. They sprout soon after they are sown. They soon grow into thrifty plants that spread out and send up thick shoots well stocked with leaves. These shoots are broken off for use as greens. The plants at once begin to send out other shoots. Soon there is a bushy growth that yields a good crop.

Buy a packet of New Zealand spinach seed. Plant an inch deep in rich garden soil in hills a foot apart, two or three seeds to a hill. Thin the seedlings to one plant to a hill. Hoe frequently. Apply a light dressing of nitrate of soda between the plants a month after the seedlings come up. Do not pick until the branches are well grown; then break off the tips, taking 6 inches or so of each leafy stem.

Lesson 49: SWISS CHARD FOR SUMMER USE.

Swiss chard furnishes two distinct vegetables for table use. The young plants and the green leaf blades of the older plants are excellent to boil as potherbs and use as greens. The thick leaf stalks make a very palatable vegetable when boiled and served as asparagus or celery is served, usually with a white sauce.

This chard is really a leaf beet and thrives best in a rich soil which is not sour. If the soil is sour, it should be thoroughly limed before planting the seed. The best variety is Giant Lucullus Swiss chard.

PLANTING.

Select soil which is rich and not sour. Prepare thoroughly by deep tillage as soon as it is well dried out. Apply broadcast a liberal dressing of commercial fertilizer. Rake the surface smooth. Line the rows 14 inches apart. Sow also a few seeds of a small early radish to mark the rows. Cover about three-quarters of an inch deep. Firm the soil over the seeds.

GROWING.

Hoe or rake the soil surface between the rows as soon as the seedlings come up. Pull the radishes as fast as they are large enough to eat. Thin the young chard seedlings, which are likely to come up in little bunches, because there are commonly several seeds in the seedlike fruits you sowed, until there is only one seedling in a place, an inch or more apart. Thin again two weeks later so that the plants are at least 6 inches apart. Transplant some of the seedlings if needed to fill gaps or to make a larger planting. Weed at times of thinning and whenever necessary. Till the soil surface between the rows at least once a week until the ground is shaded by the leaves. Apply a light dressing of nitrate of soda or a good commercial fertilizer if the soil is poor or the growth of the leaves is slow. Cut the outer leaves as fast as they become large enough to use, but not so closely that the plants have not enough leafage to continue thrifty growth.

Lesson 50: ENDIVE.

Endive is used in two ways—as a salad and as a potherd for greens. It is so easy to grow that you can have plenty of it for both purposes by a little planning.

When well grown and properly blanched some of the fringed varieties of endive are very decorative. Blanching is necessary in order to remove the bitter taste and to get the white appearance desirable for salads.

The fringed and curled varieties of endive are better for salad use than those with plain leaves. Three good sorts are White Curled, French Moss Curled, and Green Curled. A packet of seed is enough for a small garden.

CULTURE.

Sow in spring in rich soil, in rows a foot apart. Make the drills an inch deep. Cover the seed half an inch deep. Thin the seedlings to 8 or 10 inches apart. If desired the thinnings can be transplanted or if large enough they can be boiled for greens. A month after the plants come up apply nitrate of soda between the rows and hoe it in.

When the plants form heads blanch the inner leaves by tying the outer leaves over the heads with raffia or strips of cotton cloth, choosing a time when the plants are dry. Or blanch by placing over the plants a box, covered drain tiles, flower pots, with holes stopped up, or even a heavy mulch of straw or leaves—almost anything that will exclude the light for two or three weeks without causing decay to set in. Do not blanch all the heads at once. Cut and use as needed.

SUCCESSION.

Sow seed late in July or early in August for the main fall crop. To extend the season of use until very late in the fall, protect some of the plants with frames or strawy mulch. Or take the plants up by the roots with plenty of soil attached and place side by side in a box in the cellar or on the cellar floor. Blanch by keeping in darkness.

Lesson 51: RADISHES: THE EASIEST GARDEN CROP.

A quick-growing, cool-season crop like radishes should be planted in spring or autumn. A rich sandy loam soil is much better for growing them than a clay soil.

Here is a little list of good varieties of the three principal types:

Round or turnip-shaped.—White-tipped Scarlet Turnip, Early Scarlet Globe, Rapid Forcing, Crimson Giant.

Oval or olive-shaped.—French Breakfast, White-tipped Rocket.

Long or finger-shaped.—Early Long Scarlet, Cincinnati Market, White Icicle.

PLANTING.

Prepare the soil thoroughly as soon as it is dry enough to work. Apply broadcast a light dressing of commercial fertilizer. Rake the surface smooth. Line the rows 8 or 10 inches apart. Make the drills an inch deep. Sow the seeds about four to the inch. Cover an inch deep. Firm the soil lightly over the seeds.

GROWING.

Thin the seedlings a week after they come up to an inch apart. Weed early and as often as needed. If the soil is not rich apply a light dressing of commercial fetilizer, between the rows, two weeks after the plants come up. Do not let it touch the plants. Pull the roots as fast as they are large enough to eat.

SUCCESSION.

Sow radish seeds between rows of long-season crops. Sow a few seeds with seeds of carrots, lettuce, beets, parsnips, parsley, and other slow-growing crops. Sow for succession whenever vacant space is available.

Be careful not to sow too many radish seeds at one time. Ten feet of row sown once a week is likely to suffice for the family supply.

Lesson 52: PLANTING TURNIPS EARLY AND LATE.

The turnip is a good crop for rich moist soils. It is not so likely to thrive on poor sandy soils or on new clay soils. It is a cool-season crop and should be grown both in spring and fall.

To be good to eat, turnips should grow right along from the time the plants come up. If they grow slowly or stop growing they get stringy or woody and are not good to eat.

Some turnips are white, others yellow. The white kinds have the mildest flavor. These are good white varieties: Early Snowball, Early Purple-top Milan, Early White Egg. Golden Ball is a good yellow turnip.

PLANTING.

Select a rich, cool, mellow soil, preferably with no manure added this season. Wait only until it is dry enough to work easily. Prepare thoroughly, raking the surface to get it in fine condition. Apply broadcast a dressing of commercial fertilizer. Line the rows 12 inches apart. Make the drills one-half inch deep. Mix the small seeds with fine sand and sow sparsely. Cover one-half inch deep and firm the soil lightly.

GROWING.

Hoe the soil surface between the rows as soon as the seedlings appear, and at least once a week afterwards until the leaves shade the ground. Thin early, pulling out a large proportion of the seedlings before they begin to crowd. Repeat the thinning two or three times at intervals of a week or two, until the plants left are 3 or 4 inches apart. Weed carefully at times of thinning. Pull as needed for use, removing each time the largest roots and thus making more room for the smaller ones to grow.

Let the pupils look up turnips in the seed catalogues. Let each learn at home the different ways turnips are cooked. Let them draw outline pictures of turnips for the booklet on vegetables.

Don't overplant the early crop of turnips. Two sowings of 15 feet of row is likely to furnish a family supply for early summer. The fall and winter crop is to be sown in June, July, or August, depending on the latitude.

Lesson 53: RUTABAGAS.

A fortunate result of the recent stress in food production is found in the rapidly increasing appreciation of the rutabaga or Swedish turnip. Not so long ago too many Americans considered these roots as of value only for feeding to live stock, but they have now discovered that rutabagas are among the most healthful and palatable of vegetables. This is one of the crops that can be grown better in northern than in southern regions. It does not thrive in hot weather and requires a longer growing season than the turnip. Seeds sown in May will develop roots for fall use and winter storage.

Plan to have, for the sake of variety, both white and yellow fleshed rutabagas. Buy a packet of seed of at least two of these sorts: *White:* Budlong's Improved, Large White French, or Rock. *Yellow:* Golden Heart. Be sure to get selected strains of seed from reliable dealers. An ounce of seed will sow about 200 feet of row.

PLANTING.

Select a rich, moist, loamy soil. Wait until the soil is well dried out and in good condition to work. Prepare thoroughly by plowing, harrowing, and raking or by spading and raking. Apply broadcast a good dressing of commercial fertilizer. Line the rows 15 inches apart.

Make the drills an inch deep. Sow the seeds sparingly; they are so small that they must be sown by the fingers with great care or mixed with fine sand before sowing. Cover three-quarters inch deep and firm the surface lightly.

GROWING.

Till the surface between the rows as soon as the seedlings appear and at least once a week afterwards until the leaves shade the ground. Thin early and repeatedly, not letting the seedlings interfere with one another until they stand 4 to 6 inches apart. Weed carefully at times of thinning. Pull the larger roots in summer or fall as needed, but leave the main crop to grow until freezing weather. Harvest in October by digging or pulling. Cut off the tops well above the crown.

STORING.

Store the roots in bins or boxes of sand or coal ashes in a cool cellar. For spring use store in a storage pit outdoors.

Look up varieties of rutabagas in the seed catalogues.

Lesson 54: BEETS FOR BOTH SUMMER AND WINTER.

Beets thrive best in a rich, sweet, mellow, well-drained soil. It is not worth while to try to grow them in a sour soil. Such a soil must be sweetened by liberal applications of agricultural lime, thoroughly worked in. Beet "seeds" are really little pods, each having several seeds, so thinning is necessary, no matter how far apart the "seeds" are sown. This vegetable is used when small for greens and the roots are cooked at all stages from the time they are large enough to pull.

Good varieties are: Crosby's Egyptian, Early Eclipse, Detroit Dark Red, Crimson Globe.

PLANTING.

Prepare the soil thoroughly. Apply broadcast a good dressing of commercial fertilizer and rake it in. Line the rows 12 inches apart. Make the drills an inch deep. Soak the seeds in warm water for 8 to 10 hours. Sow the seeds sparsely about half an inch apart. Sow also in the same drills a few seeds of an early radish. Cover about an inch deep.

GROWING.

Hoe or rake the soil surface between the rows as soon as the rows are plainly to be seen through the coming up of either radishes or beets. Pull the radishes as fast as they are large enough to eat. Weed early and carefully. Thin the beets twice, first to an inch apart and second to 2 or 3 inches apart. Use for beet greens the plants thus pulled up. Hoe or rake the soil surface every five days until the leaves shade the ground. Pull as needed, choosing each time the largest beets and leaving the smaller ones.

SUCCESSION.

The main crop of beets for fall and winter use should be planted several weeks after the early crop. In middle and northern regions June is a good month for sowing the main crop, and Detroit Dark Red is a good variety for the purpose.

Lesson 55: CARROTS FOR EVERY GARDEN.

Carrots are among the most healthful and delicious of all root crops. They are easy to grow. They may be readily stored for winter use. There are three main types of carrot roots: The short or round, the half-long, and the long. Earliest Short-horn or French Forcing is a good variety of the first. Chantenay and Danvers Half-long are good varieties of the second. The half-long sorts are desirable for the main crop.

PLANTING.

Wait until the ground is well dried out so that it can be easily worked. Prepare thoroughly by plowing and harrowing or spading and raking. Apply broadcast a dressing of commercial fertilizer. Rake the surface smooth. Line the rows 12 inches apart. Make the drills an inch deep. Sow the seeds sparsely in a continuous row, being very careful not to sow too many of these very small seeds. Sow also in the same drills a few seeds of early radish like Early Scarlet Globe to mark the rows. Cover one-half inch deep.

GROWING.

Hoe or rake the soil surface between the rows as soon as they are plainly to be seen through the coming up of either radishes or carrots or both. Pull the radishes as fast as they are large enough to eat. Weed early and carefully. Thin the seedlings twice, first when they have two or three true leaves in addition to the slender seed leaves, to about an inch apart, and second, two weeks later, to 2 inches apart. Hoe or rake at least once a week until the tops shade the ground.

SUCCESSION.

Early in spring sow French Forcing or Early Scarlet Horn for early summer use. At the same time or a month or two later, sow Coreless, Chantenay, or Danvers for late summer and winter use.

Look up varieties of carrots in the seed catalogues.

Lesson 56: PARSNIPS.

The parsnip is one of the most desirable vegetables for the home garden. It is easily grown in deep, rich, mellow soil if planted early in the spring, so that it may have the long season for development that it requires. It is one of the few crops that may be left outdoors over winter and harvested as soon as the frost is out of the ground in spring. The climatic conditions in the Northern States are more favorable to the growth of parsnips than in the South.

There are three distinct types of parsnip roots—the *Long*, the *Half-long*, and the *Short* or *Round*. For many years the standard variety was the Long Hollow Crown, which is still very largely grown. A more recent variety of this type is the Long Smooth Full Crown, which has the advantage that the shape of the crown prevents much of the damage to the tops of the roots when left in the ground through the winter. The Guernsey or Student is the only important variety of the Half-long type. The Early Round or Short Round French is about the only well-known variety of the short type.

CULTURE.

Select a rich, deep, loamy soil. Prepare it thoroughly to the depth of 15 inches early in spring. Apply a good dressing of commercial fertilizer and rake it in. Line the rows 15 inches apart. Make the drills an inch deep. Sow the seed six to the inch. Sow also a few radish

seeds. Hoe as soon as the radishes mark the rows and once a week thereafter until the parsnip leaves shade the ground. Weed the rows early. Pull the radishes as fast as they get large enough to eat. Thin the parsnip seedlings early to 4 or 5 inches apart; if left for later thinning the long taproots are hard to pull out. Pull any weed that appears after hoeing stops. A large part of the root growth takes place after the first of September.

HARVESTING AND STORING.

The best way to get the long parsnips out of the ground is to dig a trench along the sides of them as far down as the small tips of the roots. Then take hold of the tops and pull toward the open trench. In this way the roots will not be broken or bruised and so will keep in good condition. Dig the roots which are needed for use in fall and winter in October. Wash carefully and store in moist sand in the vegetable cellar. About the time the ground freezes cover the others with a mulch of straw, lawn clippings, or fallen leaves held in place by boards or brush. Let them remain in this way until the frost is out of the ground in spring.

Lesson 57: SALSIFY OR VEGETABLE OYSTER.

This is one of the crops every young gardener should learn to grow. It requires a rich, mellow soil and a long season of growth. So it is very important to sow the seed as early in spring as the ground is in good condition to work.

Only one variety of salsify is commonly listed in our seed catalogues. It is called the Mammoth Sandwich Island Salsify. It is important to get the seed of reliable dealers who have selected it carefully from plants having large smooth roots.

Prepare a rich mellow soil; apply commercial fertilizer and rake it in; line the rows 12 inches apart and make the drills an inch deep; sow the seed an inch apart; sow a radish seed every 2 inches; cover an inch deep.

Hoe as soon as the rows can be seen, and then at least once a week until the salsify leaves shade the soil. Thin the seedlings early to at least 2 inches apart and pull the radishes as fast as they get large enough to eat. Dig part of the roots late in the fall, cut off the tops, and store in sand in the vegetable cellar. Leave the rest in the ground and protect with straw or leaves held in place by brush or boards. Dig in spring as soon as frost is out of the ground.

Lesson 58: CABBAGES.

The cabbage is one of the most useful garden vegetables. It is served in a great variety of ways and is an important element in the family food supply. It requires a rich mellow soil, with constant surface tillage and should be kept growing steadily from start to finish. If growth is checked the heads are liable to burst open later. The plants grow best in cool weather, so the crop should be planted early from seedlings started under glass that the heads may mature before midsummer, or late, so that the chief growth will take place after midsummer. A new part of the garden should be chosen for cabbages each year, as diseases are likely to develop without such rotation.

It is important to get carefully selected cabbage seed of such good varieties as these: *Early:* Early Jersey Wakefield, Charleston Large Wakefield. *Medium:* Copenhagen Market, Early Summer, Succession. *Late:* Danish Ballhead, Autumn King, Warren's Stonemason. Unless you have a hotbed or greenhouse it is best to buy the plants for the early crop of cabbages. The price is about 15 cents a dozen or a dollar a hundred.

GROWING THE CROP.

Set out the plants in the garden as soon as the soil is in good condition, late in April or early in May. Line the rows 2 feet apart for hand cultivation, 3 feet for horse cultivation. Set the plants 18 inches apart in the rows and put each a little deeper than it was in the cold frame. Wrap the stalk of each plant with cardboard to protect from cutworms. Till the soil surface thoroughly every four days, hoeing well up to each plant. Continue this surface tillage until the heads are about formed. Apply a light dressing of nitrate of soda between the rows two weeks after the plants are set out and again a month later. Cut the heads as fast as they become full size and pull up the rest of the plants, feeding them to poultry or burying them in the garden. Do not leave them in place to breed insects and fungi.

PLANTING LATE CABBAGE.

Prepare thoroughly in May or early in June an outdoor seed bed of rich mellow soil. Rake the surface smooth. Line the rows 16 inches apart. Make the drills an inch deep. Sow the seed five to the inch. Cover half an inch deep. Thin the seedlings to an inch apart. Till the soil surface frequently. Weed and water as necessary. Keep the seedlings growing vigorously until they are about 3 or 4 inches tall. Transplant these seedlings to permanent places as soon as they are large enough.

Lesson 59: KOHLRABI FOR YOUNG GARDENERS.

It is always interesting to grow a crop new to your garden. It gives you a broader knowledge and increases the amount of food you can grow. Kohlrabi is one of the best crops for you to try.

Kohlrabi is so little grown in home gardens that most people think it is hard to raise. But it may be grown as easily as the turnip, and you know that anyone can grow turnips. A few weeks after the kohlrabi plants come up, the stems just above the ground swell out to a diameter of 2 or 3 inches, making an edible ball that is delicious when picked early and properly cooked. After standing too long the balls become woody and worthless.

Kohlrabi is one of several edible members of the cabbage group. Like its relatives, it is hardy to frost and thrives best in cool weather. While it is sometimes started under glass in the same way as early cabbage, the crop is usually grown outdoors from the first.

CULTURE.

Buy a packet or an ounce of seed of Earliest Erfurt or Early White Vienna Kohlrabi. Prepare rich, mellow soil thoroughly as soon in spring as it is in condition to work. Apply a dressing of commercial fertilizer and work it in. Line the rows 15 inches apart. Make the drills an inch deep. Sow the seeds sparsely three or four to the inch. Weed as needed. Hoe early and often, but do not get the soil into the swollen part of the stem. Thin to 6 inches apart. Pull the plants and cut off the swollen parts of the stem as they reach a diameter of 2 inches.

SUCCESSION.

Plant two or three crops in the spring at intervals of two weeks. In August sow seed for a fall crop. Store any surplus stems of this fall crop in sand in the vegetable cellar.

Kohlrabi is subject to attack by many of the same enemies as the cabbage, so it is well not to plant it in soil where cabbages grew the year before. As a rule, there is very little trouble from insect enemies.

Courtesy of Van Evrie Kilpatrick.

Kohlrabi is an excellent crop for the young soldiers of the School Garden Army. This boy was successful in New York. See if you can do as well. What service badge is he wearing?

Lesson 61: ONIONS FROM SEED.

To grow onions from seed is more difficult than to grow many other crops. It is worth doing, however, and is one of the best ways to get good value for the money expended on the garden. One of the commonest causes of failure is that the seed is sown too late. Many experiments have shown that onion seed should be planted in spring as soon as the ground

is in good condition to work. It is quite essential that the soil in which onions are grown should be very rich.

Standard varieties are: Danvers, Yellow Globe, Southport White Globe, Southport Red Globe, Prizetaker.

PLANTING.

Select a level place where there will be no washing by rains, and where the soil is rich and fairly free from weed seeds. Wait only until the ground is dry enough to work. Prepare thoroughly by plowing and harrowing or spading and raking. Apply broadcast a good dressing of commercial fertilizer. Rake the surface smooth. Line the rows a foot apart. Make the drills an inch deep. Sow the seed sparsely, eight to the inch. Sow also the seeds of a small early radish, about one seed to every 2 inches of the row. Cover half an inch deep. Firm the soil lightly.

GROWING.

Hoe the surface between the rows carefully as soon as the radishes come up and once a week afterwards. Weed early and often. Thin early to an inch or more apart. Pull the radishes as fast as they become large enough to eat. Pull every other onion as they become large enough for use as scallions or for soups and stews. Apply a light dressing of nitrate of soda or commercial fertilizer between the rows about the middle of June, if the soil is not rich. Pull when the tops turn yellow and leave the onions to dry on the surface of the ground for a few days. Stir up two or three times with a wooden rake to get even drying. Gather in baskets or crates.

STORING.

As soon as the tops ripen off, pull or dig the onions carefully and, if the weather is fair, leave them on the ground to dry out thoroughly; but if necessary, cover them at night to prevent freezing. If the weather is unfavorable, place them on the floor of a porch or shed until they are well cured. Store them in open boxes or slatted onion crates. Select out all bruised, soft, or otherwise imperfect bulbs for immediate use, as these will not keep well and will contaminate the others. Place the sound bulbs in the crates and store in a dry, cool place where there is no danger of freezing, with an air space around each crate.

Lesson 60: GROWING ONIONS FROM SETS.

Next to radishes, the vegetable crop that can be raised the quickest is probably that of the small bunch onions or "scallions" grown from onion sets. Planted in April, these will be ready to pull in a few weeks and later will furnish an early crop of large onions for more general use.

Buy a pound or more of one of these kinds of onion sets: Yellow, white, red, potato onions, top or button onions. These are commonly quoted at about 30 cents a pound. Order as early as possible, before the sets have begun to sprout.

Prepare the soil thoroughly as early as it can be worked. Rake the surface smooth. Line the rows 8 inches or more apart. Make the drills 2 inches deep. Place the sets in the drills 1 or 2 inches apart, right side up with care. Cover an inch deep.

Give good surface tillage between the rows from the time the sprouts come up. Weed thoroughly. Pull the onions as soon as they get large enough to eat. Leave any not gathered to grow larger for later use. Do not try to save these large onions until winter.

Lesson 62: POTATOES.

In any garden which is large enough to grow a lot of vegetables some potatoes may well be planted. If there is not room to grow enough for the family supply, some early potatoes may be planted to bridge over the time when the new crop comes in at a high price.

Beginners often plant too many potato eyes in a hill. From each eye a stalk is likely to come. The more stalks in each hill the smaller will be the potatoes, because the plants crowd one another. Two or three good plants will produce more potatoes of the right size than a dozen will.

So cut the seed potatoes to pieces that have two or three eyes each. But leave a good deal of the white part on each piece. They should weigh at least two ounces each in order to give the shoots a good start.

VARIETIES.

These are good varieties of early potatoes: Early Ohio, Early Bovee, Irish Cobbler. And these are good for the main crop: Green Mountain, Carman No. 3, Gold Coin.

PLANTING.

Prepare the soil thoroughly, choosing where possible a piece of ground that has had much manure worked into it in previous seasons. Line the rows 2 feet apart. Dig the furrows about 5 inches deep. Work into the bottom of the furrows a light dressing of commercial fertilizer, mixing it well with the soil. Drop the cut tubers 12 or 14 inches apart. Cover 4 inches deep. Hoe or rake the soil surface two or three times after the plants come up. In northern regions, where danger of injury by long periods of drouth is not great, hill the rows at the third hoeing. For early sorts hill the rows anyway. Spray with Bordeaux mixture and arsenate of lead two or three times, beginning when the plants are about 8 inches high. Dig the early crop as soon as the potatoes are large enough to eat. At first instead of pulling up the whole plant and thus checking its further production reach in beside the hill and pull out the larger tubers.

Lesson 63: PEAS.

Garden peas or English peas are among the most valuable of all vegetables. This is a cool-season crop, making its best root growth in early spring. Because of this it is well to plant then several sorts that mature in succession.

Here is a little list of good varieties of wrinkled peas: *Early:* Sutton's Excelsior, Gradus. *Midseason:* Thomas Laxton, Telephone, Alderman. *Late:* Potlatch, Champion of England.

GROWING.

Prepare the soil thoroughly. Apply broadcast a rather heavy dressing of commercial fertilizer or of wood ashes. Wait until the heavy frosts are past. Line for double rows with 6 or 8 inches between each pair. For dwarf sorts have the pairs of rows 15 or 18 inches apart. Make the drills 3 inches deep. Sow the seeds about 1 inch apart in the rows. Cover 2 inches deep. Thin only as necessary when the seedlings are too crowded. Weed early and often. Hoe the surface only, being careful not to disturb the roots. If the growth in rich soil is very rank, pinch off the ends of the vines.

GROWING IN TRENCHES.

In regions where the season is too hot and dry for peas to succeed by the ordinary methods of culture, dig long trenches. Cover seeds with 2 inches of soil. After the seedlings are a few

inches high fill in the trenches gradually at each hoeing until the soil is level. This gives the root a chance to develop in the deeper, cool soil.

Look up varieties of peas in the seed catalogues.

Lesson 64: FIVE-PURPOSE BEANS.

The bean is one of the most important crops for the School Garden Army to plant. It is easy to grow. It thrives even on poor soils. It has great food value. It can be used at different stages of growth. It is easily preserved.

Many years experience in growing, using, and canning beans at the Framingham (Mass.), Normal School shows that certain varieties of string beans may be used in these five ways:

1. Pods cooked as snap beans.
2. Pods canned as snap beans.
3. Green beans cooked as shell beans.
4. Green beans canned as shell beans.
5. Pods allowed to ripen and harvested as dry beans.

The best varieties for such continuous use are these: Red Valentine, Bountiful, Early Six-weeks, Green-podded Refugee.

PLANTING AND GROWING.

Select the lightest loamy soil in the garden. Prepare thoroughly and rake in a light dressing of commercial fertilizer. Wait until the soil has warmed up. Line the rows 18 inches apart. Make the drills 3 inches deep. Sow the seeds singly 2 inches apart, or in hills a foot apart with five or six seeds in a place. Cover 2 inches deep.

Thin the seedlings when the first true leaves are full size to about 3 inches apart in the rows or to three or four plants to a hill. Never disturb the plants when the leaves are wet: it increases danger of disease. Weed at time of thinning. Hoe at least once a week, especially after each heavy rain, but not before the leaves are dry.

Let the pupils look up these four varieties of beans in the seed catalogs. Have them report whether any of these varieties have been grown in their home gardens.

Lesson 65: SWEET CORN TO EAT AND TO CAN.

Sweet corn can be grown to advantage in those home gardens that have room for the cultivation of the larger vegetables. Corn can be canned or dried if desired and kept for winter use.

The Indians used to plant corn at the time in spring when the oak leaves are as large as squirrels' ears. This is a good rule to-day. It is about the time of the last killing frost. Later plantings should be made for succession.

In growing sweet corn it is important to have a good-sized patch. One or two rows alone are likely not to do well, because the yellow powder, called pollen, that comes from the tassels is blown away. To get good ears, some of this pollen must fall upon the silk of the young corn ears. So it is a good plan to have the corn in a square block rather than in long rows.

When two gardens are near together it will help to have the corn plots in the two gardens next to each other. You thus double the chances for the pollen to do its work.

A good succession of varieties is Golden Bantam or Golden Giant, Country Gentleman, and Stowell's Evergreen. A pint of seed is sufficient for 200 feet of rows.

PLANTING.

As soon in spring as the ground has warmed up and danger from frosts has about passed, prepare it thoroughly. Apply commercial fertilizer broadcast and rake it in. Line the rows 30 inches apart for dwarf varieties; 3 feet apart for tall kinds.

For drills, make the furrows 2 inches deep and sow a kernel of corn every 4 inches. Cover 2 inches deep.

For hills, hoe out a space every 2 feet and scatter six kernels in each hill, having each kernel at least an inch away from the others. Cover 2 inches deep.

GROWING.

Hoe and weed the corn plants as soon as they are up and continue hoeing the surface at least once a week. A month after the corn comes up thin the plants—if in drills to 10 or 12 inches apart; if in hills to three plants to a hill. Leave always the most vigorous plants to grow. It is sometimes advised to pull off the suckers at the base of the corn plants, but careful experiments have shown that it is better to leave them to grow.

Lesson 66: CUCUMBERS FOR SALADS AND PICKLES.

Cucumbers are warm-season plants, easily injured by frost. They require a rich mellow soil and are commonly grown in specially fertilized hills. In very fertile soils they may be grown in continuous rows without these hills.

BUYING.

Buy a packet or half ounce of seed of a selected strain of one or more of these varieties: Improved White Spine, Davis's Perfect, Cool and Crisp. A packet of seeds will plant about 10 hills and a half ounce 25 hills.

PLANTING.

When danger from frost is past, prepare the soil thoroughly. Line the hills 4 feet apart. Hoe out each hill to a depth of a foot and a diameter of 2 feet. Fill the hole thus made nearly full of old manure or rich compost. Work a little soil into this and top off with a layer of soil 2 or 3 inches deep. Scatter into this top soil a handful of commercial fertilizer. Sow about 10 cucumber seeds on the surface and cover with half an inch of fine soil.

COMPANION CROPPING.

To prevent wasted land in connection with cucumbers, adopt this method: Prepare the hills 4 feet apart each way. Sow on each hill a dozen cucumber seeds and a dozen radish seeds, having every seed in a place by itself. Cover all with nearly an inch of fine soil. Half way between the cucumber hills in one direction sow a row of bush beans. Hoe or rake the soil surface often. When danger from insects is past, thin the cucumbers to four or five plants to each hill. Pull the radishes as fast as they become large enough to eat. Pick the beans as fast as the pods are ready, and pull the bean plants as soon as the crop is all gathered.

PROTECTION.

Protect the young plants as soon as they come up by a liberal dusting or spraying with arsenate of lead, or cover the hills with cheesecloth to prevent injuries by the cucumber beetles and the flea beetles. After the plants get two or three true leaves apply arsenate of lead again. Trap the black squash bugs by laying around each hill two or three shingles or small pieces of board and collecting the bugs from beneath these traps early in the morning. Pick off all bugs seen upon the vines and cut off the egg-masses.

Lesson 67: WINTER SQUASHES.

Winter squashes require more room than many other crops, so they can usually be raised only when the garden is of good size. Often, however, you can place the hills along the outside next the grass or fence and plan to have the vines run out in that direction.

If you will look up varieties of squashes in the seed catalogues you will find pictures of at least two distinct types. One is the Marrow type; the other is the Turban type.

In general, the Hubbard varieties are the best for home gardens. The Blue Hubbard is of good size and fine quality. The Warted Hubbard has a very thick skin, and so is a fine keeper. The Golden Hubbard is notable for the number of squashes produced by the vines.

An ounce of squash seed will plant 30 or more hills. The seed retains its vitality for several years, so any surplus may be saved over from season to season.

Winter squashes are produced on running vines that cover the ground for several feet around the hills. So the hills should be placed 7 or 8 feet apart.

PLANTING.

Prepare the soil thoroughly. Dig out each hill a foot deep and 18 inches wide. Fill in two or three shovelfuls of old manure or leaf mold. Mix a little soil with it and spread a 3-inch layer of soil over the surface. Have this surface raised only a little above the surrounding level. Apply a little commercial fertilizer over the top of this hill and work it into the soil. Scatter 10 seeds on the surface and cover with an inch of fine soil. Firm the soil carefully and scatter a little loose soil over it to prevent baking.

GROWING.

Do not let the soil bake over the planted hills. As soon as the plants come up stir the surface between them and see that there are no open spaces around the stems where striped beetles may crawl down. Use cloth protectors or mulch the hills with tobacco powder or spray the seedlings thoroughly with arsenate of lead. If two plants come up nearly touching, pull one up. Give frequent surface tillage to the hills and ground between them. When the plants are well developed, with three leaves in addition to the seed-leaves, and danger from the beetles seems past, thin to three vigorous plants to each hill, selecting to remain three which are not near together.

Lesson 68: SETTING OUT TOMATO PLANTS.

The tomato is one of the most valuable garden crops. It is easy to grow. It thrives on a great variety of soils. It yields an appetizing food that can be used in many ways, both fresh and preserved.

When the ground is warmed up and danger from frost is over, prepare the soil thoroughly and rake in a dressing of commercial fertilizer. Line the rows 3 feet apart. Set the plants the distances apart in the rows, according to the method of training to be adopted, indicated below:

	Inches.		Inches.
Trained to single stakes	18	Trained to horizontal trellises	30
Trained to hoop trellises	24	Untrained, to spread on the ground	36

Set each plant deeper than it was before, burying part of the stalk. Fasten a piece of tin or a cardboard collar around each stalk to protect it from cutworms. Hoe once a week. Two weeks after setting out apply nitrate of soda near the plants and hoe it in.

A large proportion of the tomato plants set out are bought in small boxes. The best of these have been growing in these boxes for several weeks and have a well-developed root system.

Sometimes, however, plants are dug up from hot beds and set in the boxes at the time they are offered for sale. Such plants are not so good as the others. One can learn about it by pulling gently on the stalk. If it comes up easily with few roots attached, it has not been growing long in the box.

Lesson 69: TRAINING TOMATO PLANTS.

The three most important systems of training tomato plants are these:

I. Single-stake training.
II. Barrel-hoop training.
III. Trellis training.

I. Drive a stout stake 4 or 5 feet long down beside each tomato plant. Cut off all the suckers near the root, so as to send up only the main leader. Tie this to the stake with rags or raffia, tying anew from time to time as the leader grows upward. Pinch off the side branches back to the first fruiting stem. Continue this treatment as the vine grows until you have a tall plant loaded with ripening fruit.

II. Drive three stakes about 4 feet long down around the plant at such a distance that a barrel hoop will fit them snugly. Nail one hoop to them about 15 inches from the ground and another at 30 inches. Pinch off some of the branches at the base of the plant so as to have three or four leaders growing up. As these reach the first hoop, tie them to it with cotton rags or raffia, and start them up to grow inside the second hoop. When they reach this tie again.

III. To make a single trellis, drive a stake down by each plant, having it project 3 or 4 feet above ground. Fasten two or three strands of light wire horizontally on the stakes, having the first about 15 inches above the ground. Pinch off the suckers at the roots and tie the main shoot to lower wire as soon as it is tall enough. Let the side branches run along the wires, tying if necessary. Train on the second wire when it is reached.

A double trellis may be made in this way: Drive stakes down each side of the row 6 inches away from the plant, with their tops about 15 inches from the ground. Nail narrow strips along the tops of the stakes, and as the tomato plants grow train the branches over the strips.

Lesson 70: EGGPLANTS.

The eggplant is one of the most desirable vegetables for the home garden. It is difficult to grow good plants to set out unless one has a greenhouse, as the seeds require a high temperature to germinate, and the seedlings grow slowly. Consequently, it is best for the average amateur to buy the potted plants ready to set out. They are offered by the seedsmen at 60 cents a dozen.

CULTURE.

Buy a dozen or more pot-grown plants of one of these varieties: Black Beauty, New York Improved Spineless. Set out in June, when ground has warmed up, in rich soil, 2 feet apart in the row. Wrap a cardboard around each stalk to prevent cutworm attack. Spray with arsenate of lead to prevent injury by flea beetles and potato beetles. Hoe soil surface often and bring some soil up around each plant; or mulch heavily with fresh grass or lawn trimmings. If any fruits touch the ground, tie stems with rags to small stakes. Cut the fruits off carefully when matured.

PROTECTION FROM PESTS.

Flea beetles and adult potato beetles attack eggplants persistently. Keep all surfaces of leaves and stems covered with arsenate of lead or Bordeaux arsenate from the hour the plants are set out.

Lesson 71: SWEET PEPPERS.

There are two groups of peppers—the sweet peppers or mangoes and the hot peppers or cayenne peppers. The sweet peppers are the more desirable for home gardens. Select one of these varieties: Pimiento, Baby Bell, Ruby King. Pimiento is the best variety.

The pepper is a warm-season crop, sensitive to frost. In the Northern States seeds must be started indoors, but farther south they may be grown outdoors from the first. Good pot-grown plants are offered by the larger seed houses in May and June at about 60 cents a dozen.

GROWING.

When the soil has warmed up and all danger of frost is past, transplant the pepper plants in the garden. Line the rows 18 inches apart and set the plants 15 inches apart. Hoe once a week and mound a little soil around the base of each stem as the plant grows, to hold it erect. If the plants are in danger of blowing over, tie each with rags or raffia to a stake thrust into the ground beside the stem. Cut off the fruits as they reach the desired maturity—green or ripe-red—leaving an inch of stem on each fruit. If especially large fruits are desired, pinch off the ends of the branches after the first blossoms have set.

GROWING FROM SEED OUTDOORS.

In regions not too far north, peppers may be successfully grown by sowing the seed outdoors. Prepare the soil where they are to grow thoroughly and rake in a light dressing of commercial fertilizer. Line the rows 18 inches apart. Make the drills 2 inches deep. When the ground warms up enough to plant beans, sow 3 seeds every 15 inches in these drills. Cover 1 inch deep. Thin the seedlings when they have two or three well-developed leaves, leaving in each case only the one best plant in the hill. Give good culture throughout the season.

Look up varieties of peppers in the seed catalogues.

VIII. GARDEN PESTS.

Lesson 72: THE CABBAGE WORMS.

The cabbage worms are the worst enemies of cabbages and cauliflower. They are greenish caterpillars that may easily be found in the garden at almost any time. They eat the leaves of the growing plants, giving them a ragged appearance. As the cabbages head up they eat the inner leaves and often ruin the heads.

Like other insects, this cabbage worm has a life story which is worth telling:

Some fine morning a common white butterfly may come to your garden. She stops to lay an egg on the cabbage leaf and then flies away. A week later the egg hatches into a tiny green worm or caterpillar.

The little caterpillar nibbles at the green surface of the leaf, and begins to grow. It nibbles away for a week or so. Then it has eaten so much that it has become too large for the skin with which it was born. So it sheds this skin or molts and crawls out with a new skin which had been formed beneath the old one.

After the first molt the caterpillar feeds again upon the leaf, and keeps this up for several days before it is ready to molt the second time. Then it sheds its skin as before.

The caterpillar keeps on feeding and shedding its skin for about a month. Then it is full grown so far as this part of its life is concerned. It now crawls to the underside of a cabbage leaf or a stone, or board, and fastens itself by a mat of silken threads. Here it sheds its skin for the last time and becomes what is called a quiet chrysalis.

After another week the quiet chrysalis changes to a white butterfly like the one that laid the egg.

HOW TO PROTECT YOUR CABBAGES.

The injuries of cabbage worms may be prevented in these ways:

1. Dusting the young cabbages with road dust, ashes, or something similar, which prevents the laying of the eggs.
2. Catching and killing the butterflies that lay the eggs.
3. Dusting or spraying the young plants—*before they begin to head, never after*—with arsenate of lead.
4. Dusting or spraying the plants with hellebore after they begin to head.
5. Pouring on hot water—at a temperature of 130° to 150° F.

Lesson 73: SPRAYING FOR BITING INSECTS.

Insects that feed on plants take their food in two ways; some bite out the substance of leaf, stem, or fruit, while others insert a pointed beak into the tissues and suck up the sap. On this account some insects may be destroyed by placing arsenate of lead or other poison upon the surface of the part eaten, while others are uninjured by such application. The latter must be destroyed by some substance which gets directly upon their bodies and kills them as a result.

Cabbage worms, flea beetles, potato beetles, celery caterpillars, and tomato worms are good examples of biting insects. Aphids, or plant lice, leaf hoppers, squash bugs, scale insects, and various plant bugs are good examples of sucking insects. As a rule, the biting insects are rather easier to destroy than the sucking insects, because it is only necessary to dust or spray

the plant at almost any time before the insects attack it. In the case of the sucking insects it is necessary to apply the insecticides at the time when the pests are present and to repeat it until all are killed.

The one universal remedy for biting insects now is arsenate of lead. This may be purchased from all seedsmen and florists, as well as at most hardware and paint stores in either of two forms: A paste which is especially intended for spraying, or a dry powder which may be used either for spraying or dusting. In spraying it is only necessary to mix an ounce or two of poison to a pail of water, applying preferably with some kind of spray pump.

In using the dry powder it is only necessary to dust it upon the leaves or stems of the plant to be protected so thickly that it shows distinctly as a white coating upon the surface. The best way to apply it is by means of a powder bellows. One great advantage of arsenate of lead is that either as a liquid spray or a dry powder it may be applied at almost any strength without danger of injury to the foliage.

Remember that arsenate of lead is a deadly poison. It must never be left where young children can get it.

Lesson 74: APPLYING ARSENATE OF LEAD.

Arsenate of lead is the most generally useful insecticide for protecting crops from plant-biting insects. It may be applied in these ways:

1. Apply the dry powder with a powder bellows, powder gun, or duster to the leaves and stems, preferably early in the morning before the dew has evaporated. This is the easiest and simplest way to destroy most plant-biting insects.

2. Spray with lead arsenate powder in water by means of a small pump or hand sprayer in this strength:

Three level teaspoonsful lead arsenate powder to 1 quart water; or,
One ounce lead arsenate powder to 1 gallon of water; or,
One pound lead arsenate powder to 25 gallons of water.

3. If the paste form of lead arsenate is used instead of the powder, use twice as much lead arsenate in each case.

4. If there is difficulty in making the lead arsenate stick to the leaves, as in applying to cabbage and asparagus, add resin fish oil soap at the rate of 1 ounce to each gallon of water. Dissolve the soap in hot water before mixing with the lead arsenate water.

Let the pupils report what garden insects are destructive in your locality.

Lesson 75: THE TOMATO WORMS.

During August and September one can often find tomato vines with the leaves eaten off the stems. A little searching of such stalks will generally reveal the cause—a large greenish or brownish caterpillar with a horn on the hind end of its body. It is called the tomato worm, and is the most common pest affecting tomato vines in late summer.

The life-story of the tomato worm is full of interest. Some warm June evening a large grayish hawk moth flew swiftly into the garden. She sipped the nectar of flowers through her long coiled beak—poising before the lilies and the honeysuckle like a humming bird—and stopped occasionally on a tomato plant long enough to lay an egg upon a leaf. Then she flew off into the night.

But the round white egg upon the tomato leaf stayed in place. When it was laid it was simply an outer shell inclosing a jelly-like mass suggestive of the white of a hen's egg. In the midst of the tiny mass there was a germ cell that began to grow—much as the germ cell in the

egg beneath a setting hen begins to grow so that the egg may hatch into a fluffy chicken. The germ cell in this moth egg, however, grows until it forms a little caterpillar, which is fully formed within the shell about a week after the egg was laid. Then it eats its way out of the shell, very much as a tiny chick pecks its way out of its shell.

The little caterpillar that has thus hatched from the white egg soon begins to feed upon the tomato leaf, nibbling daintily at first but soon feeding more freely. In a week or so it casts off the skin with which it came from the egg and comes forth from it in a new and larger skin by which it can increase in size. This process is called molting. A week or 10 days later it molts again, and so it continues for a month or more, feeding a week or so and then molting, becoming larger each time.

The full-grown tomato worm works its way into the ground and forms an oval cell in the soil. Here it casts its skin once more to become a brown chrysalis. In northern regions it remains in this chrysalis until early the following summer. Then the chrysalis works its way to the surface and changes to a hawk moth similar to the one that laid the egg so long before.

The tomato worm is one of the enemies for which the Garden Army Soldiers should always be scouting. When you see a tomato plant partly eaten look and look until you find the culprit.

Lesson 76: THE BLACK SQUASH BUG.

The black squash bugs are among the most troublesome garden pests. They insert their sharp beaks into the stems and leaves and suck the sap. Often they seem to inject a poison, also, that causes a withering of the leaves.

When the squash plants are well started the bugs lay their eggs in close groups upon the leaves. The eggs are brown and hatch 10 or 15 days later into small bugs. These soon begin to suck the sap from leaves and stems.

A week or so after hatching from the eggs the young squash bugs molt or shed their skins, in much the same way that a snake casts its skin. They soon become larger, and then begin to suck the sap from the leaves again.

This process of feeding and molting continues for a few weeks until each young bug or nymph reaches its full size. It then has wings, and is exactly like the squash bugs that attacked the vines earlier in the season.

REMEDIAL MEASURES.

The black squash bug does not bite out particles of the leaf, so it can not be destroyed by putting poison on the leaves. It pushes its sharp beak in between the poison particles to reach the sap inside.

It is difficult to kill these bugs even with contact killing insecticides like kerosene emulsion. The surest way to get them is to hand pick them either direct from the vines or from trap boards laid upon the ground. If shingles or small pieces of boards are laid upon the ground many of the squash bugs will seek shelter beneath them at night. They are then readily caught by turning over the boards early in the morning.

Lesson 77: THE APHIDS OR PLANT LICE.

The aphids or plant lice are probably the most generally troublesome garden insects. They attack nearly all crops, and often cause the withering or death of the plants.

These aphids are sucking insects. Each has a sharp beak that it sticks into leaf, stem, or fruit. Then it sucks out the sap. Although these pests are so small, they increase in num-

ber very rapidly. Each gives birth to many young ones, and these young aphids grow up in a week. So one aphid upon a plant may soon cause it to be covered with the little green, brown, or black flies. The large number of sucking beaks soon kills the leaf or plant.

Flowers as well as vegetables are commonly attacked by these little creatures. A black kind is often found in large numbers on nasturtiums. A brown kind attacks chrysanthemums. Several sorts of green aphids may be found on other flowers.

Because these pests get their food by sucking the sap instead of biting out pieces of the leaf, they can not be killed by putting poisons like arsenate of lead or Paris green on the surface of the plant. When you spray or dust such arsenical poisons on potato leaves, the bits of poison are eaten by the potato beetles and the beetles die. But the aphids, or any other sucking insects, simply push their beaks between the bits of poison to reach the sap within the leaf, and are not hurt by such poisons.

The best thing to use to kill aphids is the nicotine poison in tobacco.

In using nocotine washes or sprays against these little pests you must not be content with spraying but once. You should spray your plants two or three times, because if only a few aphids are left they will soon multiply into a great number.

You should use a sprayer that makes a fine mist which will reach all parts of the plants that are being attacked. In the case of vine crops, like melons and cucumbers, you should also spray the under surfaces of all leaves.

Lesson 78: KEROSENE EMULSION.

The two most important remedies for aphids and other insects that suck the sap from the green leaves and stems of crop plants are kerosene emulsion and the nicotine extracts of tobacco.

Kerosene like other oily substances kills any insects that it touches. The oil penetrates through the breathing tubes to all parts of the body, causing death. But kerosene alone is also fatal to the green tissues of leaves and stems. Consequently it can not be freely applied to crops infested by insects.

When kerosene and hot soapsuds are mixed together they make an emulsion which can be applied to the green surfaces of plants without injury. Yet fortunately the emulsion retains its ability to kill insects. So kerosene emulsion becomes a very useful insecticide.

The facilities needed to make a supply of kerosene emulsion are a pail, a small spray pump and a place to heat water. The emulsion is easily made by following these directions:

Heat one half gallon of water to boiling. Slice half a bar of soap into pieces and stir in the water until dissolved. Remove it from the fire and pour these hot soapsuds into a pail into which a gallon of kerosene has been placed. Then pump the mixture back and forth into the pail until the free kerosene is all emulsified.

When this kerosene is thus emulsified it can at once be diluted with water, mixing readily while still warm. One part of emulsion should be mixed with 10 parts of water.

When the emulsion cools it becomes a jellylike mass, suggestive of soft soap. This will keep for months if stored in a cool place. Some of it may be used at any time, diluting with 10 parts of water to one part of emulsion. If it is first mixed with a little hot water it dilutes more readily.

A small quantity of kerosene emulsion may be made by dissolving one cubic inch of soap in half a pint of hot water and then shaking violently with a pint of kerosene until emulsified. This is then to be diluted with ten parts of water.

Lesson 79: SPRAYING WITH TOBACCO SOLUTIONS.

Garden crops are attacked by two great groups of insects—those that bite the leaves and those that suck the sap.

The potato beetle is a biting insect. So you can kill it by putting arsenate of lead upon the leaves. The insect eats the poison with the leaf and is killed.

The green fly or aphis is a sucking insect. It inserts its sharp beak into the leaf and sucks out the sap. So it must be killed with something that destroys it by contact.

The nicotine poison in tobacco is one of the best of these contact-killing insecticides. It may be obtained by boiling tobacco stems in water or extracted by various other processes.

Many liquid nicotine preparations are upon the market. The best of these contain about 40 per cent of nicotine sulphate. It is to be very much diluted, generally to 1 part of nicotine sulphate to 1,000 parts of water.

These liquid nicotine preparations may be used in this way unless different directions are printed on the package.

Spray promptly any plants on which plant lice, thrips, leaf hoppers, or other sucking insects appear either with a spray pump or hand sprayer. Dilute the nicotine preparations as follows:

One teaspoonful nicotine sulphate (40 per cent) to 1 gallon of water. Add to this one 1-inch cube of hard soap dissolved in a pint of hot water.

One fluid ounce nicotine sulphate (40 per cent) to 8 gallons of water. Add to this ½ pound hard soap dissolved in a quart or two of hot water.

One-half pint nicotine sulphate (40 per cent) to 50 gallons of water. Add to this 2 pounds soap dissolved in a gallon of hot water.

Always mix the liquid thoroughly, stirring it up just before spraying. Apply with a fine nozzle that will reach every tiny insect on the plant.

Lesson 80: SQUASH AND CUCUMBER BEETLES.

Squashes, cucumbers, melons, and other vine crops are injured by many insects. The young plants are attacked by flea beetles, striped cucumber beetles, and spotted cucumber beetles. These all bite the leaves or stems.

The injuries of these pests may be prevented in either of two ways: We may cover the hills with netting or cheesecloth or we may protect the plants with poison.

An easy way to shelter the hills is this: Cut a barrel hoop in halves. The hoop may be either of wood or wire. Put the cut ends of these halves into the soil of the hill in a way to make a cross arch, like the middle arch of a croquet ground. Put over the arch a piece of cheesecloth or mosquito netting large enough to protect the hill. Cover the edges of the cloth with soil to hold it in place.

This protection is to be left in place until the growing leaves crowd against it. Then remove it and store the hoop pieces and the cloth in a dry place, so that they may be used another season.

The following measures are also helpful against these pests:

1. Cover the hills as soon as the plants come up with a heavy mulch of tobacco powder.

2. Dust the young plants when wet with dew thoroughly with arsenate of lead powder. Cover the stalks and both surfaces of the leaves.

3. Spray the young plants very thoroughly with arsenate of lead or with a combination of arsenate of lead and Bordeaux mixture.

4. Destroy both vine and green fruits as soon as the crop is gathered. If the beetles are able to feed upon green squashes left in the garden through the fall they are more likely to survive the winter to attack the crops next spring.

Remember always to keep arsenate of lead and other poisons out of the reach of young children.

Lesson 81: CUTWORMS.

Sometimes you may set out a row of nice tomato plants and find a few days later some of them lying on the ground with the stems cut off at the bottom. If so, dig carefully down beside each plant. You will probably find a smooth, brownish worm, about an inch long, and nearly as thick as a lead pencil. This is a cutworm and it belongs to a troublesome tribe.

These cutworms seem commonplace enough, but they really lead eventful lives. When they become full grown in this worm or larva stage each makes a little cavity in the soil and changes to a brown pupa or chrysalis. A few weeks later the skin breaks open and a dark-colored moth or miller comes out. You can often see these moths flying about lights on summer evenings; or you can really find them under boards or behind the blinds on houses.

These moths soon lay eggs on or near the stems of grasses and other plants. The eggs hatch into caterpillars that feed upon grasses. A lot of them are likely to be half grown when winter comes. Then they find shelter in the ground or under stones and wait until spring. They are pretty hungry by that time and wander over the garden looking for stalks to nip off.

You can prevent injury by cutworms in two ways—killing them before they hurt the crops or protecting the plants by collars around the stems. In a good-sized garden in which there are no hens or other poultry, poisoned bran bait may be used. This is made in this way:

Mix 2 ounces of Paris green or lead arsenate with 2 pounds of bran. Chop half a lemon up fine and stir it in, also. Mix with enough water, sweetened with molasses, to make a pasty mash.

Scatter small doses of this poison bait over the garden after the ground has been spaded or plowed and harrowed. The cutworms wandering around at night will eat it and be killed. But be very careful where you leave the poison if children or domestic animals are around.

Tin, paper, or pasteboard collars around the stalks of tomatoes, peppers, cabbages, and other plants will prevent their being cut off.

Whenever you find a plant cut off, dig down beside it and find the worm. Then kill the pest.

Lesson 82: THE CORN-EAR WORM.

Sweet corn is often attacked by a greenish caterpillar that burrows inside the husks and feeds upon the tender kernels. It is called the corn worm or corn-ear worm.

To understand how this pest happens to be in the garden, we should know this little story of its life:

Early in summer a yellow-brown moth flies among the corn plants. She stops occasionally to lay an egg upon a leaf or stalk. Then she flies away.

The eggs remain in place for four or five days. Then each hatches into a small caterpillar that crawls around until it finds the end of an ear of corn. Here it begins to eat the delicate green silks and the ends of the green husks, gradually burrowing inside. As it grows it eats the husks, the tender silks, and the succulent kernels, often going far down the cob and ruining the ear.

The caterpillars remain thus inside the ear for some weeks. They increase gradually in size until they become full grown. Each is then a little more than an inch long. It has completed its growth in this caterpillar or larva stage, and is ready to change to a quiet chrysalis.

So each corn-ear worm works its way out of the shelter of the ear by eating a round hole through the husk. Then it either crawls down the corn plant or drops to the ground, where it makes an oval cell in the soil. Here it changes to a chrysalis or pupa, to change later into a moth, similar to the one that laid the egg in the beginning.

So this insect has gone through the four great stages of its life—the egg, the caterpillar or larva, the chrysalis or pupa, the adult or moth.

REMEDIAL MEASURES.

One of the surest ways to prevent damage by corn-ear worms is to dust the silks of the young ears with powdered arsenate of lead. This is easily done, and is pretty safe, because there is no chance for the poison to reach the kernels.

Another way is to keep watch of the ears and pick out the worms by hand as soon as they begin work.

As a general preventive measure, fall plowing is helpful. It is likely to cause the death of many of the insects during the winter.

Lesson 83: HOW TO FIGHT POTATO PESTS.

From the time potatoes are planted until they are harvested various enemies are likely to attack them. The potato beetles are the worst of these. The oval, brownish, black-striped beetles live over winter in the soil and come out in time to find the earliest potato plants as the leaves push through the ground.

The potato beetles feed upon these leaves, biting holes in them. They also lay clusters of yellow eggs upon the leaves. These eggs soon hatch into dark grubs that feed in colonies upon the foliage. The grubs grow rapidly and if not killed soon strip the plant of its green blades.

In a few weeks the grubs become full grown. Then they go into the soil and change into pupæ—the stage that is like the chrysalis of a butterfly. Here they remain 10 days or so and then come out as beetles again. So there are two broods of the beetles each season, and in some localities there may be more.

These beetles and grubs are leaf biters. So they may be killed by putting poison on the potato leaves. The best poison to use is arsenate of lead. Spray or dust this on the vines soon after they come up and repeat whenever the insects are seen in numbers.

OTHER POTATO INSECTS.

Flea beetles are very small and lively. They hop about over the plant, eating small pits from the leaves. Spraying with arsenate of lead helps to kill them but a combination of Bordeaux mixture and arsenate of lead is better.

Later in the season the slender black or gray blister beetles attack potato vines in some regions. They may be controlled by hand picking or by spraying with arsenate of lead.

The potato stalk borer is the caterpillar of a moth that eats into the stem of the potato plant. All infested stalks should be pulled and burned. The insect also feeds on various weeds and these should be pulled and promptly burned early in autumn.

POTATO BLIGHTS.

There are two blights that affect potatoes; one occurring early in the season and the other later. Bordeaux mixture should be used for each. In the early blight spraying should be done when the plants are about eight inches high. Repeat several times at intervals of two weeks. Spray for later blight about the end of July.

POTATO SCAB.

This is a fungous disease. The spores of the fungus live over the winter in the soil or on the tubers. To prevent it, soak seed potatoes in weak solution of formaldehyde. Use one-third pint of formaldehyde to 10 gallons of water.

Lesson 84: PLANT DISEASES.

Garden crops are subject to injury by two principal groups of enemies—plant-feeding insects and parasitic fungi. The plant-feeding insects may attack any part of the plant from the underground root to the ripened fruit. Parasitic fungi also may attack root, stem, leaf, flower, or fruit, causing various maladies, which are commonly spoken of as fungous diseases. Were it not for these two great types of enemies the work of the gardener would be much easier.

While most insects are of such comparatively large size that they are readily seen, the parasitic fungi reproduce and spread from plant to plant by spores so minute that they are practically invisible to the eye. Consequently, in attempting to prevent fungous diseases, it is necessary so to treat the crops likely to be attacked that the spores of the disease will be unable to get started. Of course, this may sometimes involve spraying a crop which possibly might never be attacked if it were not sprayed. But such spraying should rightly be considered an insurance against loss, and in many cases it has been found that such fungicides as the Bordeaux mixture have a tonic effect upon the health of the plant that makes it worth while, even if there were no danger from disease.

There are now available from seedsmen, florists, and other dealers a great variety of fungicides in prepared form, ready to be diluted and sprayed or dusted upon the crops. For the average amateur these are cheaper and more convenient than any homemade preparation, and as a rule they are more likely to be successful, because they are prepared by experts under the best scientific conditions. The most important of these fungicides are the Bordeaux mixture, lime-sulphur solution, Bordeaux-arsenate of lead, and various special preparations.

There are better ways, however, to combat some fungous diseases than by spraying with fungicides. Sometimes injury may be prevented simply by rotating the crop; sometimes by care in selecting seeds that are free from spores; sometimes by planting disease-resisting strains.

The convenience of preventing injuries by insects and fungi depends very largely upon the apparatus one has for the work. Fortunately there are now available a great variety of small, efficient, and inexpensive sprayers and dusters which are very useful. One of the best types of sprayers for gardens is a small brass sprayer that gives a continuous spray.

Lesson 85: THE CHIMNEY SWIFT—THE GARDEN ACE.

During the great war the most thrilling battles "over there" were fought when one airship met another far up among the clouds. Both aviators flew swiftly about—up and down, to one side and then the other—piercing the air with machine-gun bullets while each strove to get into a position to send his enemy crashing to the ground.

Sometimes a hero became so adept that he outclassed his fellows. He could fly better and shoot more surely than the others. When he had brought down several enemies, he was called an ace—a term of honor that his mates were proud to give.

The ace is provided with the best of airships. It is frequently one of the small machines with which he can fly through the air like a swallow, gliding up and down or turning suddenly, as suits his fancy.

We have above our gardens a bird which always reminds me of one of these aces over the battle fields of France. I mean the chimney swift—the most compact bunch of feathers that darts above the earth. You have all seen him winging his way hither and thither, flying low before a rain, high at other times, or suddenly dropping out of sight into some convenient chimney.

Whether we know it or not, these garden aces are fighting our battles for us. The other day I caught a chimney swift as it was coming down a chimney with a mouthful of insects

to feed its young. As gently as possible I got the bird to let me have this particular mouthful, and then let it go to get another breakfast for the birdlings.

I took the mass of insects to a Government scientist in Washington and asked him to look them over. This is what he found: Two hundred insects and 3 spiders. Among the insects were 56 aphids or plant lice, 59 leaf hoppers, and 63 two-winged flies. So these three groups of garden enemies made up much the largest part of the morning meal.

If one chimney swift catches 200 garden insects for 1 meal, how many will 100 catch for 100 meals?

Lesson 86: THE TOAD—THE GARDEN TANK.

You have all heard of the tanks that helped so much in winning the latest Battle of the Marne, as well as many other battles of the war. You know these tanks are clumsy looking monsters that crawl along the ground with their hidden machine guns sending forth a hail of deadly bullets into the ranks of the enemy.

Sometimes when a war is on one of these tanks gets into a good position and stops to fire away at whatever enemy target shows itself. The tank is so camouflaged by its dull-brown color that it is hard for the enemy to see it at a distance, and it is so protected by its outer shell of steel that even cannon balls do not destroy it.

Did you ever stop to think that you have a helper against your garden enemies that may well be called the garden tank? You have often seen the clumsy brown toad half buried in the soil. Probably you have dug him up in hoeing potatoes or other vegetables, and have wondered why you did not notice him before. Now, this toad tank in your gardens is one of the most useful weapons you can use in fighting your garden enemies. He selects some good location, partly buries himself in the soil, and sits quietly until some insect comes passing by. Then he shoots out his long sticky tongue, strikes the insect, pulls it quickly inside the great jaws and swallows it for food.

The toad is so camouflaged by it brown color and its partial covering of brown soil that its victims come within striking distance without seeing the danger. And it is so protected by its thick, slimy, poisonous skin that birds and animals leave it alone.

So when you see a toad in your garden, say in a loud cheerful voice: "Good morning, Mr. Toad Tank; I am glad to see you. You are very welcome to make my garden your home."

And should your garden have none of these useful tanks, find one along the roadside and bring it gently home. It will do no harm to have several of them fighting your battles for you.

Lesson 87: THE MOLE—THE TUNNEL MAKER.

Did you ever stop to think that most of the things done by men are patterned after things done by lesser creatures ever since this world began? Of course we all know that the airplane was invented because a man saw the buzzards sailing through the air, and that the wasps made paper out of wood pulp a million years before man even thought of doing so. But it is also true that the animals made the first tents, the first houses, the first bridges, the first tunnels, and many other things for which we give them no credit.

When you go to any large city you are likely to ride from place to place in street cars that run through tunnels or subways beneath the streets and buildings. It is an easy way to get about and you are sure to feel glad you did not have to encounter all the obstacles that interfère with progress above ground.

In our lawns and gardens we can often find evidence of a similar system of subways just below the surface. Some morning you may see a slight mounding up of the soil in a long curving

line. If you dig down a little way you find that there is a tunnel large enough for a mouse to run through. In fact many such runways are made just beneath the soil surface by the pine mouse—a little creature, with molelike habits, which is widely distributed in the United States. The common kinds of meadow mice work in the grass above the soil surface, but the pine mouse is a tunnel builder.

But the mole is the one best little tunnel maker in all the world. Its whole structure adapts it to the work. Its nose is so pointed that it can literally nose its way through the soil. Its front feet are flat spades with which it can make the dirt fly with surprising rapidity. It is practically blind, so there is no chance to get its eyes filled with dirt. Its fur is soft and thick and finely adapted to shedding water and loose earth. It is indeed as well adapted to its life underground as is the chimney swift to its life in the air.

The mole feeds upon white grubs and other insects as well as upon the roots of many plants. When it is present in a garden it is likely to do much more harm than good. So it is commonly caught in mole traps set in its runways or is killed by poisoned grain placed in the tunnels.

Lesson 88: WITCH GRASS—THE ROOT OF GARDEN EVIL.

You have heard that "the love of money is the root of all evil." But this does not apply in the garden. For there we may well say: "Witch grass is the root of garden evil."

New England farmers will tell you that "An inch of witch grass root will seed an acre of ground." And they will also say: "The only way to get rid of witch grass is to dig out the roots carefully, place them on a rock to dry in the hot sunshine and burn them." Then your wise friends will add this caution: "But be very careful where you put the ashes."

You may be sure that advice of this sort comes from long experience. Probably the commonest cause of failure of beginners in gardening is that of not digging out the witch grass roots before planting. Many people think that these roots can safely be buried below the surface and any grass blades that come from them be hoed away. But too often they learn better through bitter experience. For such buried roots are worse than the fabled dragons' teeth—they send up shoots by the thousands and for every blade hoed off they send up a dozen more.

Many new gardens for the young soldiers of the School Garden Army in the Northeastern States will be started on sod land. Such land may be a witch grass sod or it may be sod of other less troublesome grasses. If it is full of long white underground stems with pointed tips it is pretty sure to be the witch grass.

To win the battle in a garden of such sod you have a fight before you. But what of that? If you do your part you are just as sure of victory as were the brave boys who fought over there. But begin your fight this fall and get it well over before the ground freezes. Then you will be ready for planting time next spring. And all winter you can be learning how to be a good gardener, knowing that your garden is waiting for you to plant it.

If your garden is large enough to be plowed, have it plowed as soon as possible. Let the turned-up sods dry out. Then begin to shake out the white witch grass roots, getting all the soil off before you take them away. But use only a digging fork or a tined potato digger—not a hoe or anything that cuts the roots up. They are easier to get out as long roots than as short ones.

If your garden is so small that it must be spaded rather than plowed, spade it up and go at it in the same way. Get out all the roots possible this fall. Then next spring go over it again before you plant your crops.

The whole Garden Army Company should help on these witch grass gardens.

IX. GATHERING AND DISPOSING OF THE CROP.

Lesson 89: QUALITY VEGETABLES FROM THE GARDEN.

One great advantage of the home garden is that with it one can have fresh vegetables for daily use. These are much better than the wilted products of the market.

But knowledge and skill are needed to get the best results even with fresh vegetables. Most of these have a certain period of growth when they are best for use. To know this period and to take advantage of it is the sign of a good gardener.

String beans furnish an example of the truth of this statement. There is a brief period—perhaps two days—after they reach full size when they are best for use. Soon after this they become stringy and less desirable. You can readily learn the right stage for picking by breaking one or two—they snap readily, without strings, and the tips are soft and pliable.

Shell beans must of course be left on the vines until the beans are of good size, but no pods should be allowed to become dry until toward the end of the season. If some are left to mature the plants are likely to stop sending out blossoms and so will cease to produce. These statements apply both to bush and pole shell beans but are especially important in the case of the latter.

Lima beans are best for use when of full size but before they become too hard. To determine this without opening the pod press upon the tip with your finger. A spongy feeling shows that the beans are ready for use.

Kohlrabi is too little grown in American gardens. One reason is because its excellence is too little known. This excellence, however, depends upon gathering the thickened stem bulb before the outer skin becomes at all tough. About the time this part is half the size of a baseball it is likely to be of the best quality.

Every experienced gardener knows that the best time to gather sweet corn is soon after the silks turn black. Not all know, however, that the sugar content of the kernels is lost rapidly after picking. The sooner it is cooked the sweeter it will be. And if it is steamed for about 20 minutes its sweetness and flavor will be preserved better than if it is boiled.

If you take good care of your garden all through the season, following the directions given in this manual, you may expect to gather a good crop. This table tells you when to gather several kinds of vegetables that you will grow.

Crop.	Time to gather.	Remarks.
Beets	When young	Beet greens, when tender, make a delicious dish.
Brussels sprouts	After frost	Cold improves this vegetable.
Cabbage (early)	When three-fourths headed	May be left until frost.
Carrots	When young	Should always be gathered young when used for soups.
Chard	When outside leaves are about 1 foot high.	Cut lightly at first. Midribs of leaves can be used like asparagus.
Kohlrabi	Before skin hardens	The bulb should be about two-thirds as large as a baseball.
Lettuce	While leaves are tender	Small, young lettuce leaves make best salads.
Lima beans	While still green	Pods should be spongy at the tip.
Melons	When they crack around the stem	Let your melons ripen on stem if possible.
Potatoes	When vines are dry	Harvest a few at a time except at end of season.
Radishes	When young	Radishes get tough and spongy with age.
String beans	When they snap readily	Tips should be soft and easily bent or twisted.
Shell beans	When pods are well filled	Do not let them dry on vines.
Sweet corn	When it has just come to milk with blackened silks.	Should be used as soon as picked.

Lesson 90: SELLING YOUR VEGETABLES.

After your own home table has been supplied with all the vegetables that it needs, you should sell your extra products as fast as they are ready for the market. Your home needs should be supplied first before you attempt to sell to your neighbors. If you raise enough vegetables to supply the needs of your own family, you are doing a patriotic duty, because in so doing you are making it possible for other vegetables to go to hungry people.

You should not only supply your family needs and pay for the cost of your garden, but you should make a neat profit on the vegetables you raise. Don't you think it would also be a fine idea to invest your vegetable profits in war savings stamps?

Most selling from our village or city gardens is done by peddling among our neighbors. This encourages thrift and business system on your part. It is a training that you boys and girls ought not to neglect. To sell your vegetables readily, there a few rules that should be followed.

1. Gather all vegetables when they are ripe and ready for the market. Do not pick half-ripe fruits; choose only those that are ready for a quick sale.

2. Grade your vegetables according to size and quality. Do not have a mixture of large and small sizes and good and poor vegetables.

3. Make your display of fruit attractive. Customers will buy more quickly and pay more if the goods offered for sale look neat and clean.

4. Do not put the best vegetables on top while poorer ones are hidden beneath. It would be better to separate the kinds and sell them separately.

5. Be honest. Do not claim for your goods what they will not show. Try to keep your customers by honest dealing.

6. Whatever boxes or baskets are used for selling or displaying your vegetables, make them attractive.

Build up a reputation for yourself for honesty and fair dealing.

Lesson 91: STORING YOUR VEGETABLES.

The storing of vegetables that are not used as soon as gathered is very important, as it is a fine way to lay up food for future use. It is a way to Hooverize many vegetables that you can't eat at once. Especially at this time, we must save and use every product possible, and we must not have any waste.

Potatoes, carrots, onions, beets, turnips, and many other of your garden products may be kept for winter use by storing. You will get the best results from storage if care is taken regarding the proper temperature and ventilation needed, the amount of moisture necessary, and the quality of the vegetables when first put in storage.

Some vegetables may be stored on your mother's pantry shelves, while others should be put in the cellar, and still others kept in outdoor pits. Sometimes several neighbors join together and build a pit or storage cellar for their vegetables. This is known as community storage. When several gardeners do this, the cost to each is small, and the vegetables can be handled more easily.

If you store your vegetables in the cellar, you must take care to see that there is enough ventilation and that the proper temperature may be easily kept. The cellar should have a good dirt floor, or, if it has a concrete floor, the floor should be covered with 3 inches of sand. This floor should be kept moist. Beets, celery, cabbage, parsnips, turnips, and potatoes may be stored in the cellar.

The best way to store vegetables outdoors is to use a pit. To build this, dig a hole in the ground 6 inches deep and as wide and long as necessary to hold the vegetables to be stored when piled up. Before putting the vegetables into the pit it should be lined with hay or straw. Cover the piled vegetables with several inches of hay or straw, and then cover the mound with 4 or 5 inches of soil. As cold weather comes on, add 10 or 12 inches of soil to the covering of the pit.

Lesson 92: STORING ROOT CROPS.

The root crops to be kept through the winter are apt either to rot or to shrivel. In order to prevent rotting, you should store only unbruised specimens and separate the roots more or less by sand or sifted coal ashes. The storing in sand or ashes also helps to prevent shriveling.

As another precaution against rot you might soak the roots a short time in a weak solution of formalin—a teaspoonful to two gallons of water. This treatment will destroy millions of the spores that are liable to cause decay.

In digging root crops for winter storage it is important to treat them so carefully that there shall be no bruising, shriveling or injury by frosts before they are put away. One of the commonest causes of shriveling is that of pulling or digging them and leaving them on top of the ground for some time before cutting off the tops. Under such conditions evaporation from the leaves takes place and as there are no roots connected with the soil the water evaporated comes from the root. This brings about a loss of moisture. To avoid this, cut off the tops soon after the roots are dug.

Another common cause of injury to newly dug roots is that of leaving them out over night. This may not seriously injure them so far as their food content is concerned, but it is likely to injure their appearance, taking away the fresh look so desirable; especially is this true of parsnips.

BEETS.

Dig carefully without bruising the skin. Cut off the tops about an inch above the beet. Pack carefully in separate layers. Cover each layer with an inch of sand. If the cellar is dry, cover the top of the box with a piece of burlap or old carpet and moisten occasionally.

CARROTS.

Dig so as not to bruise the skin and cut the tops off at once about an inch above the root. Pack carefully in boxes, laying the roots on their sides and covering each layer with clean sand. Use boxes not more than fifteen inches deep, filling with alternate layers of carrots and sand.

TURNIPS AND RUTABAGAS.

For winter storage select the hardier later sorts. Dig carefully and cut off the tops promptly. For early use store in boxes covered with burlap or old carpet, which in a dry cellar should be moistened often enough to prevent shriveling. For later use pack carefully in sand as described for carrots.

Lesson 93: HARVESTING AND STORING SQUASHES.

The first general principle for you to keep in mind in planning to save your fruit and vegetables for winter and spring use is that different things require different treatments. You can keep a squash until next spring in a cellar or attic where a carrot or a turnip would soon become worthless.

Squashes will stand a higher temperature in storage than almost anything else. They require a dry air and will keep much better in a modern cemented cellar than in the old type of cellars with earth floors. In the cellars with dirt floors they are gone before Christmas, but in the modern cemented cellar they can easily be kept until May.

It is time for you to pick your squashes as soon as the first light frost kills the leaves. Don't let them stay in the garden until a hard frost injures the skin. Cut off the vine stalks near the squash stems. Be sure to leave the stem on the squash. Then place the squashes carefully in an airy, sunny place. Notice that the side which was on the ground as the squash grew is lighter colored than the rest of the surface. This, of course, is because that part of the skin did not get any sunshine. So give this part sunshine by turning the light parts of the squashes to the sun.

When you gather eggs—those of you who are lucky enough to have any to gather—you handle them carefully. When you gather squashes, think of them as eggs and handle them so carefully that even the tender outer skin will not be bruised, for the skin of a squash is meant to protect it and a bruise is apt to become a spot where decay or "rotting" begins.

Leave your squashes in the September sunshine for a week or so. This ripens the pulp and hardens the skin. Then take them carefully to the storage room—down cellar if your cellar is dry and well cemented on bottom and sides—or to a cool room where they will not freeze. Don't pile them on top of one another. It is better if they don't even touch one another.

Lesson 94: DIGGING AND STORING POTATOES.

The potato is one of the most important food crops you can grow. Very likely your gardens were too small this year to grow many of them. If so, see if you can't find another piece of ground where you can grow them next year. And if you do, be sure to get the soil spaded up this season and some fallen leaves dug in.

If you did grow potatoes, it's up to you to harvest them so carefully that there shall be no waste. After the vines are dead dig the potatoes with a tined potato digger or a digging fork. Be careful to push the tool down on one side of the hill so as not to injure any of the "murphies" as you pull them out. Sometimes careless diggers will injure nearly half the crop by cuts and gashes. There is no excuse for this sort of thing now when every bit of food is needed.

If possible, dig the potatoes on a dry, sunny day. Let them lie on top of the ground for a few hours, then gather them carefully in baskets, bags, or boxes and take them to the shelter of a shed or cellar. Never leave them out on the ground overnight. There is much danger of injury if you do this.

The better you have treated your crop from the time you selected the potatoes to plant until you dig them the better they will keep. If you soaked them in formalin before planting to kill the spores of potato scab, you probably will have smooth tubers that will keep well. If you sprayed the vines with Bordeaux mixture and arsenate of lead to prevent injury by blight and beetles, the potatoes will be likely to be solid and not be infected by the rot disease.

Sort over your crop. Pick out and use now any injured ones. Store the others if you can in boxes, bins, or barrels in a fairly cool, dry cellar.

Lesson 95: PREPARING ROOT CROPS FOR FAIRS AND EXHIBITIONS.

The late summer and fall fairs and exhibitions offer many opportunities for the young soldiers of the School Garden Army not only to show the public what they have been able to accomplish in the production of food, but also to obtain many valuable prizes. All such fairs are likely to offer premiums for displays of beets, carrots, parsnips, radishes, turnips, and other root crops. Some suggestions as to the preparation of these for exhibition may be helpful.

Young people often fail to understand that the judges who award the prizes at these fairs expect, first, that the requirements as laid down in the premium lists shall be met. If a prize is offered for the five best beets, they can not award it to a plate of four, and if they award it to a plate of six or eight, they must first take out the extra ones. It is safer for the exhibitor to take these out first and show only the number called for.

Many people also think that size is the main point to be considered by the judges. This is a mistake, especially with root crops. An over-large beet or turnip is almost certain to be coarse in texture and of very little value for food. The judges consider this and select those of medium size which are solid and desirable.

Uniformity of size and appearance is another point considered by the judges. Where five beets or carrots are shown they should be as uniform as possible.

Every root displayed should of course be free from injuries or blemishes of any sort. To be sure of this result they should be carefully dug up with a spade or digging fork, taking enough soil with them to prevent bruising. Then shake off the soil, soak in water, and wash off with a sponge or cloth—not a brush. Select the best and most uniform roots which show by their size and appearance that they are solid throughout.

Beets vary greatly in their inner structure. The best types are of medium size, with solid red or red-streaked pulp. Cut open some to learn how to select the right ones.

Lesson 96: TYPES OF MARKETING.

Even in small gardens there is likely to be at certain times a surplus of some vegetable over what the family can use. The larger the garden, of course, the more the surplus, and many a boy or girl can easily raise enough produce to make considerable profit from the garden.

Such surplus produce should not be allowed to go to waste, but should be sold to someone who needs it. This selling may be simply the carrying of it to near-by neighbors, who are likely to be eager to buy fresh vegetables, or it may be the taking of it to a market and selling it from there. There is, of course, a great variety of ways in which such produce can be marketed. The more important types of these are indicated below:

Community types:

(*a*) Children's community market in an attractive central location.

(*b*) Children's space in the municipal market.

(*c*) Children's market at the school.

Individual types:

(*a*) Children's markets at home. This plan provides for sale to those who call at the home, as well as that sold to neighbors.

(*b*) By use of parcel post.

Cooperative types:

(*a*) Provision for sale of produce through the U. S. S. G. A. officers at central location in city, at school, or in the municipal market.

THE MARKET

Preparation:

(*a*) All produce should be in the best possible marketable state.
(*b*) Produce should be graded according to size.
(*c*) All produce should be clean, fresh, and crisp.
(*d*) Produce should be graded according to quality.

Display of vegetables:

(*a*) Make the market display attractive.
(*b*) Use uniform and inexpensive containers.
(*c*) See that all produce is free from defects.
(*d*) Arrange the display according to types.

Some examples of various types:

(*a*) Root type—Carrots and turnips.
(*b*) Head type—Cabbage and head lettuce.
(*c*) Stem type—Celery and potatoes (underground).
(*d*) Leaf type—Leaf lettuce and spinach.

X. FALL GARDENING.

Lesson 97: KALE FOR SEPTEMBER SOWING.

Those who know kale only from the large, coarse, wilted leaves offered in the markets have little idea of how excellent it is when the young, tender leaves freshly picked from the garden are served. The crop is easy to grow at any season, has few enemies, and remains in good condition to use for a long period. Fifty plants will supply the needs of a good-sized family.

Kale is one of the comparatively few crops that can be planted early in autumn for use in spring. In the most severe climates it needs a protecting mulch of straw, but over the southern parts of the Northeastern States region it will survive without protection.

Two of the best of the several varieties of kale are Dwarf Scotch Curled and Imperial Long Standing. The latter is perhaps a bit hardier than the other. A packet of seeds costing 10 cents if carefully sown will supply the needs of the home garden.

CULTURE.

For fall sowing select a place at one side of the garden where the kale plants need not be disturbed by spring tillage. Spade it up thoroughly. Apply a light dressing of commercial fertilizer and rake it in. Line the rows 18 inches apart. Make drills an inch deep. Sow the seed six to the inch. Cover one-half inch deep. When the kale seedlings come up thin them to 5 or 6 inches apart. The following spring thin again if necessary. Pick the outer leaves before they reach full size, but always let enough remain on the plant for it to continue to grow.

Lesson 98: PLANTING ONION SETS THIS FALL.

You can save some time next spring in getting an early crop of bunch onions if you will plant your onion sets this fall. If you live in Maryland, New Jersey, Pennsylvania, or other more southerly sections of the Northeastern States you can leave these onions in the garden over winter without protection. If you live farther north you will do well to cover them with straw or fallen leaves.

Choose a side or corner of the garden where the onions need not be disturbed when the rest of the soil is spaded or plowed. Be sure it is a place where water will not settle during the wet weather of late fall and early spring. Spade it up thoroughly and rake it smooth.

You can buy onion sets by the pound or quart of your local seed store or of the seed houses that send out catalogues. The price will be about 30 cents a pound if sent by mail.

Several varieties of onion sets are generally offered. It does not make much difference which you buy. If you get more than 1 pound it is well to buy at least two kinds. For much much of the pleasure of gardening comes from the experience of growing different kinds of vegetables and so really learning which are the best for our own gardens.

Line the rows for the sets 8 to 10 inches apart. Make the drills 2 inches deep. Push the sets into soil at the bottom of the drill, right side up, about 2 inches apart. Cover them up with soil and firm it over them.

Plant these onion sets in September so they will get a good start this fall. When the ground freezes throw a few leaves or some lawn clippings or straw over them to keep the surface from frequent thawing and freezing. Of course, you will keep the weeds out of your little onion patch.

Next spring these onions will start into growth almost as soon as the ground thaws out. And you will have good little onions to pull very early in the season.

Lesson 99: GETTING READY FOR SPRING.

The soil for your garden should be spaded or plowed if possible in the fall. If this can not be done, then you should do it as early in the spring as possible. If your garden is too small to be plowed with a team, you should spade it deeply with a spading fork. Deep plowing and spading followed by a thorough harrowing and raking puts the soil in the best condition to make your plants grow. When the soil is spaded, each spadeful as it is turned over should be broken up by striking with the back of the spade. When your garden soil crumbles in your hands, it is just right.

Vegetables are heavy feeders and therefore they need a rich soil. Many experienced gardeners use what is known as compost on their gardens. A compost heap is made of a mixture of meadow sod, leaves, straw, grass, lawn clippings, unused portions of food and vegetables, sweepings from unoiled streets, lime or wood ashes, stable manure, and soil. The plan usually followed is to first spread out a layer of manure about 4 inches deep, then one of leaves or straw or vegetable waste. Upon these sprinkle a small quantity of lime or wood ashes; then follow with a layer of earth an inch or two thick. Repeat this until all your material has been arranged in layers and placed in piles. Alternate layers of leaves or straw prevent the plant food contained in the stable fertilizer and street sweepings from being washed out and lost.

Turn over your compost heap with a spading fork about twice a season. This mixes the materials more thoroughly and makes them decay more. In a dry climate you should pour water on the heap occasionally.

As soon as part of your compost heap has rotted down enough to mix readily with the soil it should be spaded in wherever needed. The coarser portions which are slow to decay may well be buried in the bottom of border beds for perennial flowers or vegetables.

The thorough working into the soil of any stable or commercial fertilizer is important. Garden soils composed largely of clay are very likely to be sour, but you can fix this by putting 1 pound of air-slacked, burned, or hydrated lime; 2 pounds of ground limestone; or 3 pounds of unleached wood ashes on every 25 square feet of garden space. Coal ashes will help to loosen up a clay soil.

The proper preparation of the soil and thorough working of all fertilizers into the soil are of utmost importance. The success of your garden will depend very largely upon the thoroughness with which your seed bed has been prepared.

Lesson 100: HOW TO MAKE YOUR COLDFRAME.

A coldframe is made like a hotbed, except that no manure is used. Enough heat is secured from the sun.

A coldframe is used to harden plants that have been grown in a hotbed, or to continue the growing of certain plants during the winter months. If you should take plants like the tomato directly from the hotbed and plant them in the open field, they would probably die. They can not stand the quick, great change from warm to cold conditions. If, however, such plants are first hardened by being transplanted to a coldframe, they are able to stand a good deal of cold without injury.

Coldframes should be made in the fall so that they will be ready for spring work. It is sometimes well to have two or three coldframes in your garden, especially in the north, as they will save your plants during the cold spells of spring.

In the middle of the day, when the air is warm, the glass or canvas above the frame may be raised. This gives the plants a better ventilation and at the same time hardens them. As

night comes on the plants should be covered. Later on, the frames may be kept open for a large part of the day, but only when the day is warm. Before the plants are taken up and planted in your garden the sashes should be kept off the frame for several days.

Vegetable seeds may be planted much sooner in coldframes than outside. Thus tomatoes, cabbages, cauliflower, onions, etc., may be given an early start.

Leaf vegetables, such as lettuce, are better if grown entirely in a coldframe. They may be protected from frost, from too much heat, and from birds.

In many of the Northern States you can not grow plants in a hotbed or coldframe during winter unless more protection is given. This is sometimes done by placing straw or hay over the glass. Hay mats are very useful for this purpose.

Lesson 101: HOW TO MAKE YOUR HOTBED.

If your garden does not have a hotbed for raising early plants you should build one during October when time can be given to it. Making a hotbed is not difficult and gives you a fine opportunity to show how much of a carpenter you are. Every garden supervised by the school authorities should have a hotbed and the building of this should be one of the earliest garden duties. If your bed is properly made in the fall it will be in excellent condition for the next spring work.

In making your hotbed, a pit is dug from 2 to 3 feet deep and from 5 to 6 feet wide. Glass sashes are used to cover the pit. These sashes are generally 6 feet long and 3 feet wide, but other sizes may be used if necessary. Make the pit long enough to fit the size of the sash chosen.

Place a 2-inch plank, 12 to 15 inches wide, on edge, on the north side of the bed. Then on the south side of the pit place a plank about half the width of the one used on the north side. The sash, resting on these boards, will then slope toward the south and you will get better results from the sunlight. The ends of the bed are closed with boards cut to fit snugly and soil is banked up all around the framework to keep out the cold. The pit should be dug and the framework arranged in the fall.

The sashes may be hinged at the top and held up by strong sticks when the pit is opened, or they may be hinged on the side and thrown back when the pit is opened. Sometimes the sashes are made to slide in and out on strips of wood set into the sides of the hotbed. The opening of the sashes is necessary to ventilate the bed properly and to allow you to work in the pit.

About 10 or 12 weeks before the time of out-door planting the pit should be filled with well heated stable manure. This manure is covered with 6 or 8 inches of rich soil, finely powdered. Keep the soil moist while it is being heated by the fermenting manure. Keep a soil thermometer in the pit and carefully read the temperature from day to day. When the temperature falls to 90 or 85 degrees, it is safe to sow your seeds. If the bed has been properly made it will give out enough heat to grow plants during a period of five or six weeks.

If you can not buy glass sashes, you can stretch strong white canvas across the pit.

Lesson 102: YOUR ASPARAGUS BED.

You have all seen the fine bunches of asparagus in the shop windows every spring. How good they look. And how good they taste served hot on toast or with cream sauce. And also how much they cost. So much, indeed, that most people can't afford to buy asparagus for food.

If you have a garden that you can depend upon working for several years it is almost as easy to grow asparagus as it is to grow radishes. The main difference is that you have to wait a good deal longer before you can get the crop. But on the other hand you only have to plant your asparagus bed once to keep on getting crops from the time you are in the sixth grade until you have been to college and even longer.

So planting an asparagus bed is a good deal like buying war-savings stamps. You make the investment of a very little money in buying the aspargus roots and a little work in getting the soil ready. Then you keep the weeds down next summer and the summer after. And in 1921 you begin to gather your asparagus and keep it up every year until 1940. Thus your asparagus investment matures two years earlier than the war-savings stamps, and keeps on coming for many years afterwards.

Here is how to plant your asparagus bed:

Select one side or one end of your garden for the site of the asparagus bed. Dig it over carefully to get out all the stones and witch grass roots. Plan if possible for 50 roots to be planted 2 feet apart in rows 3 feet apart. Dig out a trench 15 inches deep for each row. Fill in the lower 8 inches with manure or leaves mixed with a little soil. Buy 50 one-year asparagus crowns. Set in the trenches on this soil. Spread out the roots horizontally. Cover with 7 inches of soil, and firm it down.

Your asparagus bed is now planted. Mulch it for the winter with manure or leaves. Next season keep out the weeds and grass and let the plumy asparagus shoots grow.

It is a good plan to prepare your asparagus bed in the fall. Then you can plant it either in the fall or spring.

Make a diagram of 50 asparagus roots planted as directed above. How much garden space will they need?