

# AGRICULTURAL EXPERIMENT STATION

KANSAS STATE COLLEGE OF AGRICULTURE  
 AND APPLIED SCIENCE

MANHATTAN, KANSAS

DEPARTMENT OF HORTICULTURE

## HOME VEGETABLE GARDENING IN KANSAS<sup>1</sup>

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### TYPES OF VEGETABLE GROWING<sup>2</sup>

Vegetable growing may be divided into five types, based on the objects sought and the methods employed in producing the crop. The types are: (1) Market gardening, (2) truck gardening, (3) canning crop production, (4) vegetable forcing, and (5) home gardening. Home gardening may be subdivided into three classes: The farm garden, the suburban garden, and the city garden.

In addition to the cash value of the vegetables produced, the relation of the vegetables consumed to the health of those who grow them should be considered. Many farmers during much of the year are unable to secure fresh vegetables daily unless they grow their own supply. In addition, there are many who do not get fresh vegetables unless they are grown at home even though a market supply is available. (Table I.)

TABLE I.—QUANTITY OF VEGETABLES NEEDED FOR AN ADULT EACH YEAR.

Vegetables	Fresh	Stored or canned	Number of servings each week
Asparagus	2 lbs.	2 lbs.	1
Beans	10 lbs.	12 pints	2
Cabbage	5 lbs.	15 lbs.	1
Celery	2 lbs.	5 lbs.	1
Corn	35 ears	16 lbs.	2
Greens (a)	15 lbs.	15 lbs.	7
Melons	8 lbs.	8 lbs.	2
Onions	12 lbs.	30 lbs.	1
Parsnips	50 lbs.	75 lbs.	4
Peas	25 lbs.	15 lbs.	2
Potatoes (white)	50 lbs.	150 lbs.	7
Rhubarb	5 lbs.	10 lbs.	1
Rutabagas	10 lbs.	15 lbs.	1
Sweet potatoes	10 lbs.	15 lbs.	2
Tomatoes	30 lbs.	30 lbs.	3
Turnips	10 lbs.	15 lbs.	1

(a) Beet tops, endive, lettuce, spinach, New Zealand spinach, Swiss chard, turnip tops.

After one or two trials inexperienced gardeners are apt to feel they can buy vegetables more cheaply than they can produce them. Many will not have the vegetables unless they produce them at home, so even though

1. Contribution No. 137 from the Department of Horticulture.
2. On pages 42 and 43 of this circular will be found an "Outline and General Index" which will serve as a guide to the reader and be especially valuable for reference purposes.

it were cheaper to buy fresh vegetables than to produce them one might still profit from a garden. Vegetables can be produced on the farm or in the back yard at relatively little expense since one need not consider labor or land rent under such circumstances. Even when labor and rent are charged at the full value, there is probably no area of the same size on a general farm which produces so much in real value as a well-cared-for farm garden. Records compiled by nearly 400 farm women in Kansas over a period of four years indicate that the acre return from the farm garden in fresh vegetables and vegetables for canning and storing is about \$400 a year. The average size of the Kansas farm garden is one half acre.

### HOME GARDENING

Home gardening is one of the important types of vegetable production. According to the Bureau of the Census of 1929, the value of vegetables in home gardens of Kansas was over \$10,000,000. About 79 percent of the farms in the United States have home gardens. In addition to the vegetables grown in the farm gardens in Kansas there are hundreds of gardens in the villages, towns, and cities and the value of the products of these gardens is many thousands of dollars.

**Location of the Home Garden.**—Often there is little choice in the selection of the site for the home garden but where some opportunity for selection is afforded, there are several factors which should be taken into consideration. The first and probably the most important factor is nearness to the buildings. (Fig. 1.) Most of the labor in the home garden is done in spare



FIG. 1.—A conveniently located, well kept Kansas farm garden.

time or in odd moments. If the garden is located near the house more attention will be given it on this account. Also, fresh vegetables will be harvested as they are needed and when they are in the best stage for consumption if they are easily available. If they are some distance from the kitchen, one is apt to neglect the harvesting until the vegetables have passed their prime. The

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second factor should be nearness to a water supply, for in Kansas some irrigation is desirable almost every year. A third factor is protection from unfavorable weather. At first thought



FIG. 2.—Trees are an excellent farm garden windbreak if the vegetables are not planted too close to the trees. Birds nesting in such a shelter destroy many insects.

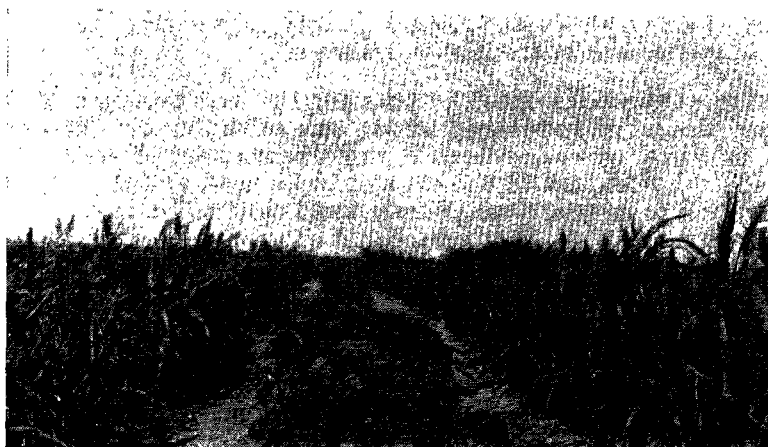


FIG. 3.—Vegetables protected from both north and south winds by tall-growing annual crops.

one is apt to think that this means protection from the north but in Kansas for the home garden, where earliness is not essential, protection in the summer from the south and the west is more important. (Fig. 2) If there is no ideal protection from

these directions two or three rows of field corn (fig. 3.) or castor beans or some other quick-growing annual will provide some protection. These will break the hot, dry winds which burn up many gardens and protect much of the garden from the late afternoon sun. The garden must be fenced to protect it from chickens, livestock, and even tractors or farm wagons. Removable ends to the garden fence facilitate plowing.

If there are several locations which fit in with these requirements it would then be desirable to secure a site which has a slight exposure to the southeast, for the morning sun is the best growing sun and the ground exposed somewhat to the south warms up more quickly in the early spring.

Sandy soil is usually reported as preferable but is not the only soil that may be used for gardens. While it is true that a sandy soil will warm up more quickly in the spring and will thus produce an earlier garden, it is equally true that a sandy soil dries out more quickly in the summer. Crops produced will thus be earlier but will suffer more quickly and severely from the summer drought and the total production may be lessened. Conversely, a heavier soil will not warm up so quickly in the spring and is more difficult to work during dry weather or after rains. Such a soil will retain moisture better, and hence the crops in it will suffer less from drought in the late summer and will continue producing over a longer period and will usually give larger yields. Larger yields and higher quality rather than earliness should be the aim of the home gardener.

**Plan of the Garden.**-The plan for the arrangement of the garden should be influenced by the size of the area to be used. Other factors to be considered in the arrangement of the garden include the evenness of the ground to be used and the type of cultivation to be practiced. Where hand cultivation is practiced the rows may be closer together and shorter than where horse cultivation is used. A soil which is unusually rich in plant nutrients will produce larger plants and consequently the rows should be spaced farther apart, while on poor soil wide spacing may be desirable because each plant needs a large area of soil. A garden which is to be irrigated will produce larger plants than one which is not irrigated and the rows must, therefore, be placed farther apart. As a rule the farm garden should be planned for horse cultivation and for irrigation. It is always better where horse cultivation is practiced to have the rows run the long way of the garden.

The size of the garden should be governed by the number of people to be fed from it and the vegetable requirements of the individuals using the garden. (Figs. 4, 5, and 6.) Its size should also vary depending on whether one wants only fresh vegetables for immediate consumption or wants to can and store the sur-

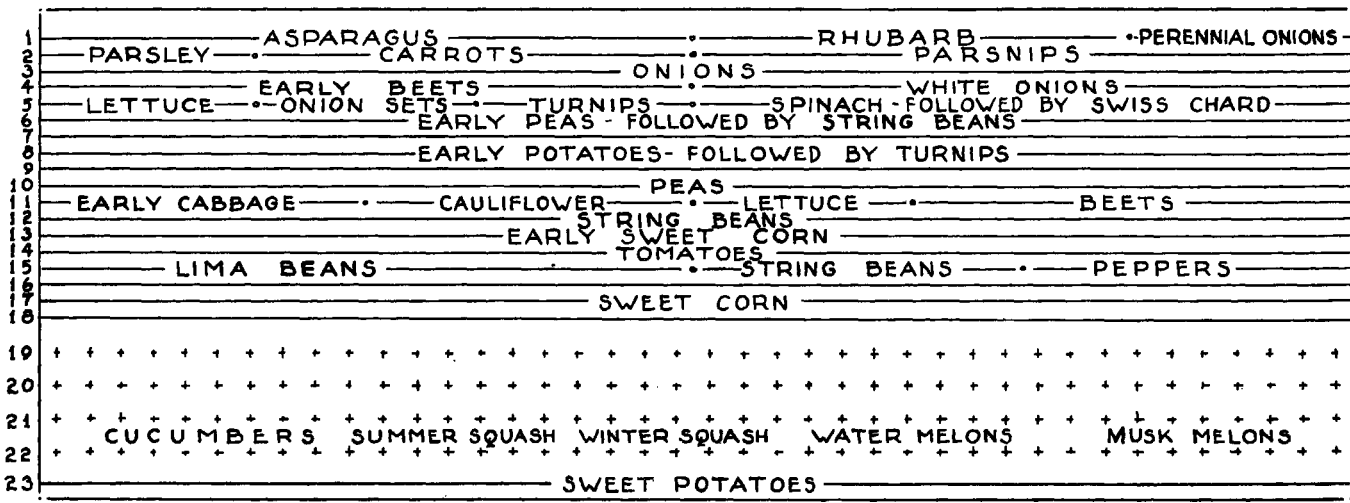


Fig. 4.—Diagram of a farmer's vegetable garden 90 by 240 feet.

First planting, about March 25.

- Row 1. Perennials: 1/2 row asparagus; 1/3 row rhubarb; 1/6 row perennial onions.
- Row 2. 1/6 row parsley; 1/3 row carrots; 1/2 row parsnips. (Marked with radishes.)
- Row 3. Onions (red).
- Row 4. 1/2 row early beets; 1/2 row onions (white). (Marked with long radishes.)
- Row 5. 1/6 lettuce; 1/6 row onion sets (white or yellow; 1/6 row turnips; 1/2 row spinach. (Followed by Swiss chard planted July 1.)
- Row 6. Peas: 1/2 row extra early smooth; 1/2 row early dwarf wrinkled. (Followed by string beans planted July 1.)
- Rows 7, 8, and 9. Early potatoes. (Followed by turnips sown Aug. 1.)

Second planting, about April 10.

- Row 10. Peas: 1/2 row early dwarf wrinkled; 1/2 row late wrinkled.
- Row 11. 1/2 row early cabbage; 1/6 lettuce; 1/3 row beets. (Marked with long radishes.)

Third planting, about May 10.

- Row 12. 1 row of string beans.
- Row 13. Sweet corn: 1/2 row extra early; 1/2 row second early.
- Row 14. Tomatoes (60 plants, 4 feet apart, 4 feet from row 13).
- Row 15. 1/2 row Lima beans; 1/4 row string beans; 1/4 row peppers. (Four feet from row 14.)
- Rows 16, 17, and 18. Sweet corn, two late varieties.
- Rows 19, 20, 21, and 22. Vine crops in hills 6 by 6 feet; cucumbers, summer squash, winter squash, watermelons, muskmelons.

Fourth planting, about June 1.

- Row 23. Sweet potatoes (6 feet from row 22).

plus. (Table I.) As a rule it is better to have a small garden and attend to it well, than to have a large garden and not care for it properly. Most of the farm gardens in Kansas are less than one half acre and by careful planning, interplanting, and succession planting, a quarter of an acre will produce all the vegetables needed for a family of six. If land is plentiful it might be desirable to harvest only one crop from a given area and grow soil improvement crops on the land the rest of the year.

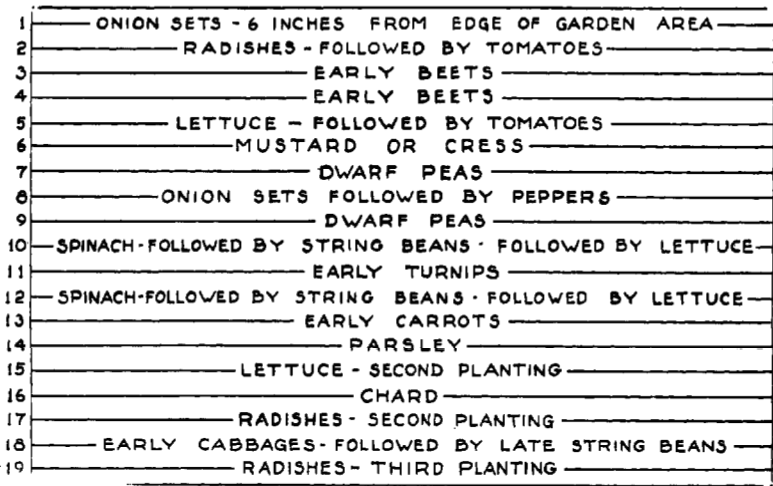


Fig. 5.—Suggested plan for a back-yard garden of limited space.

Where the same tract is to be used for a garden year after year it will be necessary to make a new plan each year and rotate many of the vegetables growing in it. The perennial crops such as asparagus, rhubarb, Jerusalem artichoke, the small fruits, and the pot herbs must, of course, have a permanent location. The selection of the place for them should be very carefully considered. The plan of the garden (figs. 4, 5, 6) should be made on paper before any work is done in the garden. The plan should show the location of the crops, the amount of space devoted to each, and the follow and inter-crops as well as dates of planting. Experienced gardeners also determine at the time the plan is made the quantity of seed that will be required for the entire season and buy it all at one time. (Table IV.)

**CLASSIFICATION OF VEGETABLES**

In planning the arrangement of the garden it is desirable to group together crops of similar cultural requirements. For convenience in this matter vegetables may be divided in general



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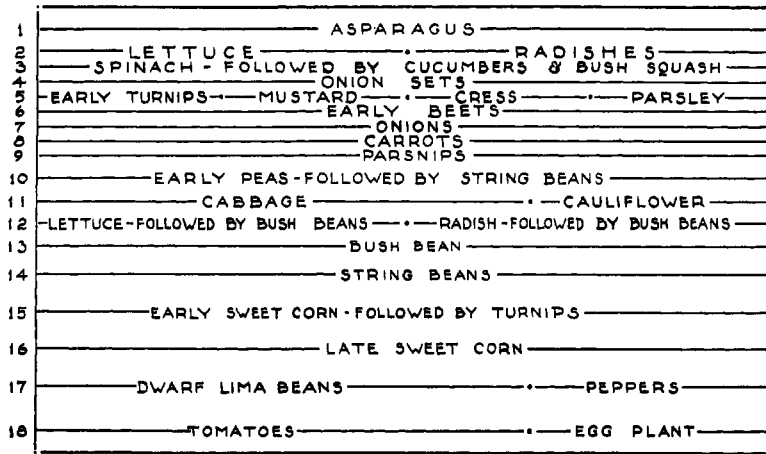


Fig. 6.—Diagram of a suburban garden 30 by 50 feet.

Early planting, beginning about March 25.

	Distance from preceding row
Row 1. Permanent row of asparagus (2 feet from edge).....	2 feet
Row 2. 25 feet lettuce; 25 feet radishes.....	2 feet
Row 3. Spinach (followed by cucumbers and bush squash planted May 20).....	16 inches
Row 4. Onion sets .....	16 inches
Row 5. 15 feet early turnips; 15 feet mustard; 10 feet cress; 10 feet parsley.....	16 inches
Row 6. Early beets .....	16 inches
Row 7. Onions from seed (red).....	16 inches
Row 8. Carrots .....	16 inches
Row 9. Parsnips .....	16 inches
Row 10. Early dwarf peas (followed by string beans planted July 1).....	16 inches

Second planting, about April 5.

Row 11. Cabbage .....	16 inches
Row 12. 15 feet lettuce; 15 feet radishes (followed by celery set July 1).....	16 inches
Row 13. Late wrinkled peas (with support).....	16 inches

Third planting, about April 25.

Row 14. String beans (green and wax).....	16 inches
Row 15. Early sweet corn (followed by 2 rows turnips sown Aug. 1).....	16 inches

Fourth planting, May 15.

Row 16. Late sweet corn .....	30 inches
Row 17. 35 feet dwarf beans; 15 feet peppers.....	30 inches
Row 18. One dozen tomatoes; 1/2 dozen eggplants.....	36 inches

Note.—These dates are average dates at the experiment gardens in Manhattan. See note in Table IV for variations according to various locations.

into three classes. The first class is known as cool-season crops. This includes those vegetables which will withstand considerable cool weather but which quickly deteriorate or go to seed as the weather gets warmer. Included in this group are lettuce, radishes, asparagus, smooth peas, spinach, and cabbage. The second class includes those vegetables which will germinate when the ground is somewhat cold and which will grow during

the colder weather but which will withstand hot weather during the latter part of their growing season. This includes such vegetables as onions, carrots, turnips, celery, kale, parsley, parsnips, Swiss chard, and New Zealand spinach. The third class includes those vegetables which will not tolerate any frost, which do poorly when the ground and the nights are cool, and which thrive during the hot weather. This includes sweet corn, beans, cucumbers, eggplant, okra, peppers, pumpkins, squashes, tomatoes, and watermelons.



Fig. 7.—The Acme harrow. The leveling harrow is a valuable tool to the vegetable grower. It is invaluable for smoothing the surface after the disk harrow has gone over the field.

In planning the garden it is usually best to plant the cool-season crops together and all at one time. About two weeks after the cool season crops are planted the second group may be planted. The third group should not be planted until all danger from frost is past if plants are used or about corn planting time if seed are used.

#### SOIL PREPARATION

Thorough preparation of the soil is necessary to successful production of all crops. It is especially important in the growing of vegetables and poor preparation often results in a poor stand of plants regardless of the quality of seed. Garden soil operations are plowing, harrowing, and dragging. (Fig. 7.) In irrigated regions leveling also must be considered as one of the operations.



**Plowing.**—Soils for vegetables should be fairly deep, however, a shallow surface soil should be deepened gradually. Too much subsoil turned into the surface is usually harmful and plowing to a depth of 6 to 7 inches is satisfactory with most soils for vegetable production.

The time for plowing depends on the kind of soil and on climatic conditions. As a rule in Kansas late fall or winter plowing is desirable. Two exceptions, when spring plowing is desirable, are in those sections of the state where there is blowing after fall plowing and on hillsides. In the western part of the state and in other parts where soil is sandy, blowing of the soil makes fall plowing undesirable. On hillsides, erosion makes fall plowing undesirable though sometimes with careful contour plowing this objection may be removed and the advantages of fall plowing may be obtained.

In the southern tier of counties or in sections where there is little or no winter freezing, fall plowing may also be undesirable as the leaching continuing throughout the winter and early spring causes a great loss of soil nutrients and hastens the removal of basic materials, resulting possibly in the development of an acid soil.

Where fall plowing can be practiced the advantages given for it are: (1) To improve the physical condition of the soil by exposing it to alternate freezing and thawing. This is particularly desirable with the heavier soils. (2) To aid in the control of insects and diseases present by exposing them to frost action and the attacks of birds. (3) To relieve the pressure of spring work and make possible earlier preparation for spring planting. (4) To aid in the decay of coarse organic material turned under. (5) To conserve moisture by collecting water and snow in the unbroken furrows. Fall plowing does not improve sandy soils to the same extent it improves clay soils. Spring plowing should be done as early as the soil is in condition to be stirred without injury to its texture.

**Harrowing.**—Before the garden is planted it should be harrowed. A disk harrow is probably most valuable on heavy clay soils and on grass land because it pulverizes the soil most effectually. After disking it is often desirable to smooth the garden by using a spike-toothed harrow.

The thoroughness with which the soil is prepared before planting determines to a large extent the ease of cultivation. The moisture content of the soil determines the efficiency of the work done by the harrow. If the soil is too dry many of the lumps will not be broken and if it is too wet the soil may become puddled. Harrowing the soil immediately after spring plowing tends to prevent surface baking and reduces the loss of moisture by evaporation and through growing of weeds.

**Dragging.** — Dragging of garden soil is not very common in Kansas. On heavy soils it helps to break up clods and lumps which cannot be acted on by any type of harrow. In preparing the soil late in the season the drag is often used immediately after the plowing and this is followed by a harrow. In some cases a drag is used before in order to break up the larger lumps and thus make the harrowing easier, and again following the harrow to crush those lumps which were missed by the two preceding operations. On light soils dragging tends to smooth the soil, making planting easier and more accurate.

### FERTILIZERS

There are two sources of fertilizers available to most home gardeners: Animal manures and chemical or commercial fertilizers.

**Animal Manures.** — Manure is a very valuable source of humus as well as a carrier of limited amounts of nitrogen, phosphorus, and potash. These are the three elements which are



FIG. 8.—A farm garden located conveniently for irrigation. The windmill furnishes the power.

most often lacking in soils and all are necessary for a successful garden. The amount of these materials present in animal manures depends on the kind of animal, the feed and bedding used, and the method of handling the manure before it is applied to the soil.

Fresh manure is not so popular with vegetable growers as is well rotted manure. It is likely to contain weed seeds and the fertilizing elements are not so readily available. Fresh manure

when being prepared or rotted for the vegetable garden should be piled in a sheltered place to protect it from loss of plant nutrients by leaching, but should be kept well moistened and turned at intervals to prevent burning. When it is well rotted it should be evenly distributed over the garden. It should be applied in time to become thoroughly incorporated with the soil before the next crop is planted. Where irrigation is practiced in Kansas, 15 or 20 tons of manure per acre can be applied to the vegetable garden every year successfully. (Fig. 8.)

**Soil Improvement Crops.** — Soil improvement crops (soybeans, cowpeas, and other legumes) used in a home garden rotation are excellent sources of green manures. They do away with the need of applying barnyard manure and if fall plowing is practiced, will be thoroughly decayed before planting the garden next spring.

**Commercial Fertilizers.** — Commercial fertilizers usually contain nitrogen, phosphorus, and potash, either alone or in various combinations. A mixture containing all three of these is known as a complete fertilizer. These elements are not chemically pure but are contained in various compounds which are known as carriers. The most common carriers of nitrogen are ammonium sulfate, sodium nitrate, dried blood, tankage, cottonseed meal, and cyanamid. For phosphorus the carriers are usually superphosphate or bone meal and for potash, muriate or sulfate of potash. For the home gardener commercial fertilizers are valuable and as a rule it is more desirable to buy mixed fertilizers than to attempt home mixing, even though the potash is usually not needed.

**Applying Fertilizers.** — The kind of fertilizer to apply will depend on the crop, on the physical condition of the soil, on the crops which have been grown on the land previously, and the care the land has had. Since these factors vary widely from farm to farm and even climatic conditions are different in the various parts of the state it is impossible to give specific recommendations.

As a rule nitrogen is deficient in sandy soils, in highly acid soils, and in soils where large quantities of straw or other plant residues low in nitrogen have been applied. Often the nitrogen in the soil does not become available to plants rapidly enough during periods of high temperatures or of excessive rainfall, or during the cool early season of the year. Under the above conditions the application of a fertilizer carrying nitrogen may be profitable.

Lack of available nitrogen is indicated by slowness in the growth rate of the plant and a yellowing of the foliage. Vegetable crops which respond most quickly to liberal applications

of nitrogen are those which are grown mainly for their foliage. These include lettuce, Swiss chard, cabbage, spinach, celery, kale, and some others.

Phosphorus is most often deficient in the heavy soils and those of high acidity. However, many soils which do not show a deficiency in phosphorus can be benefited by an application of phosphorus, as it may make available other plant nutrients. The lack of phosphorus is often indicated by much the same symptoms as is a lack of nitrogen, that is, a dwarfing and a yellowing of the plant. The vegetable crops that most often respond to liberal applications of a phosphorus-carrying fertilizer are those which are grown for their fruits including tomatoes, peas, beans, muskmelons, and watermelons.

Potash is seldom lacking in Kansas soils and where one is mixing fertilizers, potash-carrying materials may be eliminated from the mixture. When one buys a complete fertilizer and has an opportunity to select from several formulas he can often save money by buying a fertilizer low in potash. The vegetables which sometimes respond to a potash fertilizer are the root crops such as onions, beets, carrots, potatoes, and parsnips.

**Amount of Fertilizer to Apply.** — The amount of fertilizer to apply depends on several factors. These factors include the crop being grown (Table II), the treatment the soil has had, the previous crops which have been grown on the soil, the type of soil, and the amount of fertilizer previously applied. Ordinarily mixed fertilizers in packages come prepared for the home garden and contain directions for the use of that particular fertilizer. If these directions are followed, good results are usually obtained. Using smaller quantities than recommended will save in the amount of fertilizer used but often fails to give results comparable with the recommended application. Excess use of fertilizers results in damage to the crop and may have a harmful effect lasting several years. The amount of commercial fertilizer to be used depends on the organic matter in the soil. The greater the amount of organic matter, the more commercial fertilizer one may use.

**Kind of Fertilizers to Use.** — In Table II are given specific fertilizer applications. These are for specialists who are growing a large quantity of one or a few kinds of vegetables. They will apply to the home gardener but it is usually too expensive to have on hand so many kinds of fertilizers for a small garden.

The home gardener can, as a rule, get reasonably satisfactory results from such commercial fertilizers as he may see fit to use by having just one kind or one formula on hand. As has been indicated in previous discussions Kansas soils, as a rule, are most apt to need nitrogen and phosphorus and are usually

TABLE II.—THE USE OF COMMERCIAL FERTILIZERS AND MANURE.

Vegetable	Formula	Pounds per acre (a)	Manure per acre	Method of application
Asparagus	4-4-4	125	10 tons	Hill
Rhubarb	4-4-4	225	20 tons	Hill
Spinach	4-8-4	125	Legume	Broadcast
New Zealand spinach	4-8-4	100	Legume	Hill
Chard	4-4-8	100	Legume	Row
Celery	4-12-4	300	16 tons	Row
Lettuce	4-10-1	1500	16 tons	Broadcast
Cabbage	4-10-2	1500	30 tons	Hill
Cauliflower	5-8-5	1300	30 tons	Hill
Beet	4-7-4	800	18 tons	Row
Carrot	4-7-4	800	20 tons	Row
Parsnip	4-7-4	1000	18 tons	Broadcast
Turnip	2-4-0	600	25 tons	Row
Radish	5-10-3	900	20 tons	Broadcast
Horseradish	5-10-3	1000	30 tons	Broadcast
Onion	4-12-4	1100	15 tons	Row
Potato	4-12-2	750	10 tons	Row
Sweet potato	3-8-3	800	8 tons	Row
Beans (snap)	4-12-4	500	Little	Row
Peas	4-12-4	100	Little	Row
Beans (pole)	4-12-4	600	Little	Hill
Tomato	1-4-1	1000	20 tons	Hill
Cucumber	4-12-4	300	16 tons	Hill
Muskmelon	3-12-2	600	5 tons	Hill
Watermelon	3-12-2	600	3 tons	Hill
Sweet corn	2-6-2	400	10 tons	Hill

(a) One third or one fourth of this application should be made at one time. Allow ten days to three weeks between applications. If no water has been applied between fertilizings it is probable that the material has not been used and additional applications may be omitted.

plentifully supplied with potash. Therefore, in buying a mixed fertilizer it would be well to buy one which contains little or no potash and is relatively high in phosphorus. Often a local fertilizer merchant knows which brand is satisfactory for local conditions and will suggest reliable applications for the home garden. County agricultural agents also will give one this information or inquiries can be sent to the Agricultural Experiment Station in Manhattan.

**Time and Methods of Applying Fertilizers.**—Manures are best broadcast previous to plowing or spading. Commercial fertilizers are usually best applied just previous to the last disking or before the crop is planted. They may be broadcast and disked into the land. When they are applied at planting time they may be applied to the hill or in the row near the seed or plant. Care should always be taken that seed or newly set plants are not in direct contact with the undissolved fertilizer. With the vine crops or tomatoes it is probably best to apply the fertilizer only to the hill. Where row crops are being planted and where the rows are close together, broadcasting is probably the most desirable method. Gardeners specializing in certain vege-

tables usually have attachments to the planters that will drill the fertilizer into the soil and mix it with the soil in the bottom of the furrow. It is better to make small applications three or four times during the growing season than to make one heavy application early in the season.

**Lime.** — Lime is used principally as a soil amendment, its purpose being to develop a less acid or a neutral condition in the soil. The calcium in lime is one of the essential elements in the plant but most soils contain enough calcium to supply the needs of the plant. Some vegetables grow best in soils that are neutral and still others require soils that are definitely alkaline. Those vegetables which are normally somewhat tolerant of an acid soil are beans, chicory, corn (sweet and pop), parsley, potato, radish, tomato, turnip, and watermelon. Those vegetables which prefer a neutral soil are Brussels sprouts, carrots, chard, collards, cucumbers, dandelion, endive, kale, kohlrabi, peas, pumpkin, rhubarb, squash, broccoli, cabbage, cauliflower, eggplant, martynia, muskmelon, and mustard. Those which are benefited by high liming and thus are said to be somewhat tolerant of alkaline conditions are asparagus, beets, celery, leek, lettuce, onions, parsnips, peppers, salsify, and spinach.

There is some danger of overliming even when one is attempting to grow alkali-tolerant plants on a soil which is originally somewhat acid. The injurious effect of lime under such conditions probably is due to its making unavailable certain plant nutrients which are necessary for the growth of vegetables.

Soils which have been intensively cultivated, heavily cropped, overwatered, and treated with acid-forming fertilizers are likely to become acid. In the southeastern section of Kansas there is a considerable area which is acid. In the other parts of the state there is probably more land neutral or slightly alkaline than acid.

A chemical test is the only way to be assured that a soil is acid, neutral, or alkaline. There are on the market several cheap and effective soil testers; nearly every county agricultural agent is equipped to make these tests or samples of soil for testing may be sent to the Agricultural Experiment Station in Manhattan.

**Application of Lime.** — The amount of lime applied will depend on the original acidity of the soil, the crops to be grown, and the form of lime applied. (Table III.) In applying lime there is more danger of overliming sandy soils than heavier soils. There is less danger of injury to crops when ground limestone is used than when other forms are used because the ground limestone is slower in action. Limestone may be applied by



hand, with a fertilizer attachment, or with a lime sower. One pound of hydrated lime to 25 square feet of garden each three years will correct the acidity of a very acid soil.

TABLE III.—RELATIVE RESPONSE OF VEGETABLE CROPS TO LIMING OF ACID SOIL.

High Response	Medium Response	Low Response	Indifferent
Asparagus	Cabbage	Brussels sprouts	Bush Lima bean
Beet	Cauliflower	Carrot	Chicory
Celery	Chinese cabbage	Collard	Cress
Leek	Martynia	Cucumber	Field bean
Lettuce	Muskmelon	Dandelion	Parsley
New Zealand spinach	Mustard	Eggplant	Potato
Okra	Pepper	Endive	Radish
Onions	Swiss chard	Horseradish	Rutabaga
Parsnips		Kale	Snap bean
Salsify		Kohlrabi	Tomato
Spinach		Pea	Turnip
		Pole bean	
		Pumpkin	
		Rhubarb	
		Squash	
		Sweet corn	

**STARTING VEGETABLE PLANTS**

Good seed are essential for a successful vegetable garden. As the cost of seed is a relatively small item with vegetable crops, the gardener can hardly afford to sacrifice the success of the garden for a slight saving in the cost of seed.

**Good Seed.** — Good seed must be clean, viable, free from disease, and true to name. No vegetable seed are entirely free from impurities and too frequently one finds samples which contain considerable dirt or refuse. While most vegetable seed producers are careful in supplying seed which are true to name the varieties of vegetables are not yet satisfactorily standardized. This results in considerable confusion in labeling of the varieties and is the most important reason for getting seed from an established, reliable source.

**Time of Starting Seed.**—The time and method of planting seed often determines to a large extent the success or failure of the crop. Even with good seed and properly prepared soil, successful gardens cannot be had unless the planting is done at the right time and in the proper manner.

One cannot give exact dates for the planting of vegetable seed or plants because the weather varies from year to year and, in a state as large as Kansas, in different parts of the state at the same time. In the planting table and in the garden plans, Table IV and figures 4, 5, and 6, dates are given which are the

best average dates over a period of 10 years in Manhattan. North from Manhattan, for each 100 miles, the average date is postponed about ten days and south the date is set ahead at the same rate. The exact time of planting is determined by the condition of the soil, the weather conditions, the kind of crop, and the time at which it is planned to harvest the vegetables. Since earliness is not an important factor in the home garden and since seed do not germinate, nor do plants develop, in the cool ground and during the short days of the early spring there is no need to hurry the planting of the garden. In Kansas, moisture conditions are the most important factors to be considered, and when the soil moisture is such that planting can be done without harm to the physical condition of the soil the seed of the cool crops should be sown. If irrigation is available and practiced even this factor can be controlled.

With regard to germination, vegetable crops are grouped into three classes: (1) Those which are hardy or will withstand some frost, but quickly deteriorate in the warm dry weather of the early summer. These include lettuce, radish, spinach, and similar crops. (2) Those which will withstand some frost and will germinate and grow well in the cool conditions of early spring and continue growth during the hot, dry weather of summer. These include nearly all of the root crops except the sweet potato. (3) Those which are tender and will not germinate when the ground is cool and will not grow when the weather is cool. These include the various vine crops, sweet potatoes, and peppers.

**Planting the Seed.**—Many different rules are given regarding the planting of seed. However, in general, seed can be planted about three times the depth of their greatest diameter. On light soils seed are planted deeper than on heavy soils and when there is a plentiful supply of moisture there is less need for deep planting. For this reason seed are thinly covered in the early spring.

Straight rows add to the appearance of the garden and make cultivation easier and more rapid. (Fig. 9.) This can be secured by using a line or markers of various kinds.

**Methods of Planting.**—Planting by hand is the common practice in home gardens. Commercial gardeners plant seed with drills but the small quantity of one kind of seed used does not justify the expense of the seed drill for the home gardener. For small seed a furrow may be made with a rake handle and for large seed a furrow may be made with the corner of a hoe. Small seed may be sown directly from the packet by moving it slowly over the row and tapping it lightly with the finger. Larger seed such as peas and beans should be evenly spaced and dropped

individually. Seed should be covered immediately after they are dropped in the furrow to prevent loss of moisture from the soil. If the soil is dry at planting time, the soil should be firmed by walking down the row on the ball of one's feet or tamping firmly with the back of the hoe.

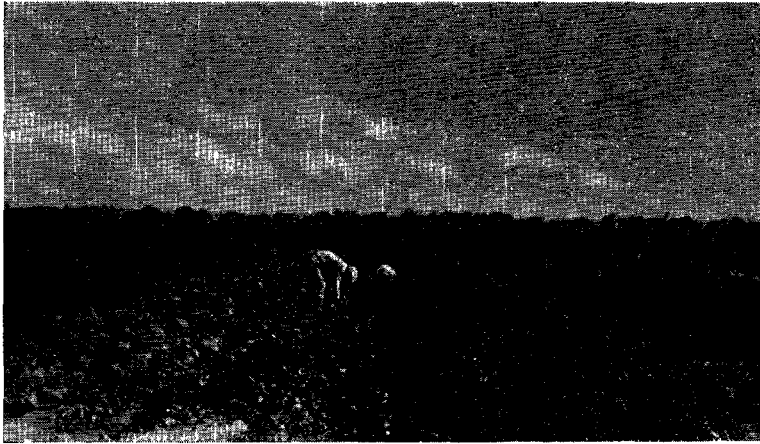


FIG. 9.—A garden neatly arranged. Straight rows at planting time also make cultivating, spraying, and harvesting easier.

**Rate of Planting.** — In determining the quantity of seed to plant one must consider the viability of the seed, the time of planting, the physical condition of the soil, the vigor of young plants, and the possible loss due to insects. (Table IV.)

Seed of low viability should, of course, be planted more thickly than those of high germination and this is the principal reason for germination tests which should be made two or three weeks in advance of the planting. Seed planted when the soil and weather conditions are not the best for germination should be planted thicker than when conditions are favorable. In order to make sure of a full stand, seed which produce weak plants such as carrots or parsnips may be planted more thickly than radish or lettuce. Plants which are very susceptible to the ravages of insects such as the cucumbers and melons are often planted more thickly than is necessary to secure a good stand. The cucumber beetle, for example, may attack a crop and destroy half of the plants and in order to secure a satisfactory stand twice the normal amount of seed must be planted.

**Thinning Vegetable Plants.** — To insure a good stand one usually plants the seed of the vegetables rather thickly. This results in a very thick stand of seedlings. These surplus seed-

lings must be removed by thinning as soon as it is seen that there are too many. When the thinning is postponed until the plants have grown to partial maturity the production is lowered, the quality is impaired, and the loss from insects and diseases increased. Crowding is as injurious to plants as it is to humans or animals, and plants once stunted by lack of moisture or plant food from crowding will never develop properly or so well as those which have been thinned early in their development. The damage done to crowded plants is due largely to the lack of moisture and plant nutrients available to each plant. Thinning of the home garden vegetables is usually done by hand and the most favorable average distance between plants in the row is shown in Table IV.

#### **HOTBEDS AND COLD FRAMES**

Commercial gardeners or others who plan to have a large area devoted to vegetable crops and who must have, for one reason or another, very early plants, can use hotbeds and cold frames to advantage. For the home gardener hotbeds which may be manure heated, flue heated, or electrically heated usually are not necessary. Information discussing the use of these types of hotbeds is available from the Agricultural Experiment Station. The cost of the frame, the labor involved, and the general hazards of starting plants in hotbeds reduce the possible saving for home gardeners. Such plants as head lettuce, cabbage, and peppers, which will not mature under ordinary conditions unless set out as plants, can be purchased more economically from a commercial gardener. Plants produced by a reliable commercial gardener are more apt to be satisfactory in that they are properly grown and hardened off and are in the proper condition for transplanting at the time when this should be done.

Recently it has become a custom to import from other states young vegetable plants for setting out in the gardens in Kansas. These plants are usually cheaper than home-grown plants but often are infected with disease, such as wilt of tomatoes or cabbage, or other pests such as nematodes causing the "club root" of many of our vegetables.

While it is probable that every effort is being made by southern growers to prevent the shipping of such infected plants, too many cases of infection of gardens from this source are found in Kansas to warrant the use of these plants. Once the gardens become infested with diseases or nematodes it is almost impossible to eradicate the pests. They will spread rapidly and far. For the welfare of one's garden as well as the vegetable industry of the state it is undoubtedly desirable to use home-grown plants for the garden even if the cost is thus increased.

### CULTIVATION

**Benefits of Cultivation.**—There is a great deal of misconception as to the reasons for or the benefits derived from cultivation of garden soils. The conservation of moisture and plant nutrients, otherwise used by the weeds thus destroyed, has been found to be the major benefit derived from cultivation. The conservation of moisture by the formation of a soil mulch, formerly held to be of importance, has been shown to be of minor significance. Another reason given for cultivation is the increased nitrification resulting from a more rapid warming in spring and better aeration. Raising the temperature of the soil may increase early nitrate formation somewhat, particularly in heavy soils, but on light soils a dust mulch apparently has little effect on warming, aeration, or moisture conservation.

It is conceded that cultivation usually increases the yields of crop plants but this increased yield is apparently due almost entirely to weed control. Consequently only such cultivation as is necessary for weed control is to be recommended. Experiments conducted at some agricultural experiment stations indicate that frequent deep cultivation of the soil is actually harmful to vegetable crops for most of the feeding roots are found in the upper 2 to 4 inches of the soil. Consequently frequent deep cultivations tend to cut these feeding roots and thus have a harmful effect on plants. This probably explains why allowing the soil in the garden to become firm and scraping the weeds off as they appear produces as good crops as does deep cultivation.

**Hoeing and Weeding.**—For the farm garden, cultivation by a horse-drawn cultivator is probably the best, the quickest, and the most satisfactory method of accomplishing this necessary work. For larger gardens which are not horse cultivated, wheel hoes are satisfactory. For the smaller gardens, hand hoeing has no equal. No matter which type of cultivation one uses in the vegetable garden, considerable hand weeding is necessary. It is impossible, even with hand hoeing, to work between small, young plants without injuring them. Therefore, one must pull by hand the weeds between the seedlings. No weeds should be allowed to go to seed even late in the fall after harvest. If a garden has been properly cultivated for two or three years weed seed in the garden soil will be reduced to such a low point that weeding should occupy but a small amount of the gardener's time.

**When to Hoe.**—Weed control is the most important function of cultivation and, therefore, hoeing should be done at a time most favorable for the destruction of weeds. This, of course, is while the weeds are small. The best time, therefore, to culti-

vate is just after the weeds break through the surface of the soil for at that time roots are small and the plants are easily destroyed. Cultivation at this stage also may be shallow and as has been mentioned, deep cultivation is not desirable in the vegetable garden. There is no reason for the somewhat common practice of cultivating the garden at regular intervals. Under some conditions it is necessary to cultivate more than once a week and under others a month between cultivations might be permissible. As a rule it is desirable to cultivate the vegetable garden soon after a rain or an application of irrigation water. Cultivation immediately after a shower of less than one half inch is apt to do more harm than good as it hastens the drying of the surface soil which contains practically all of the moisture from such a rain.

**Mulching.**—Mulching vegetable gardens has become a common practice in Kansas. In general two types of material are used for this purpose. One is the heavy paper known as mulch paper; the other is straw, grass clippings, or similar material. Experiments conducted indicate that the use of the mulch increases the yields of practically all crops, but that this increase is less with root crops than with other crops. Where straw a year or more old is available, or where grass clippings and similar materials can be used, these have been found to be satisfactory, but where they are not available the use of paper mulch can be recommended. Whenever these materials are used for mulching the garden they should be removed and burned at the end of the garden season. This burning will destroy insects and disease spores and lessen the danger from the accumulation of excessive amounts of organic matter.

#### GROWING VEGETABLES

Perennial crops occupy the land for many years and must be located where they will not interfere with plowing the garden. In the home garden they should be planted to one side so the remainder of the garden can be treated as a unit. Asparagus and rhubarb are two commonly grown perennial crops for Kansas gardens.

**Asparagus.**—Asparagus can be grown on nearly all kinds of soils but a deep, fertile, loose soil is to be preferred. The soil for asparagus should be thoroughly prepared, for the crop occupies the land for many years and there is little further opportunity for improving the soil after the roots are planted. The land should be well plowed but the old practice of deep plowing and trenching or subsoiling need not be practiced. Before plowing, the ground should be well manured. It is often desirable to spend two or three years in preparing the land for asparagus so that large quantities of manure may be worked into the soil



and weeds brought under control before asparagus plants are set out. Asparagus does not do well on acid soils and where such soils are prevalent, liming is necessary.

It was once considered necessary to salt asparagus beds. Experimental results with the use of salt have been conflicting and are not very conclusive but in Kansas salting certainly is not essential, for good asparagus is grown without the use of salt. Proper weed control will give the same good results that salting will without its dangers.

One-year-old crowns are generally recommended for planting. Only crowns containing large buds should be used. The depth of planting varies from 4 to 12 inches, depending on the kind of soil. The practice of planting 16 to 18 inches deep is unsatisfactory as it delays growth and results in decreased yields. The rows may be spaced from 3 to 5 feet apart and the usual spacing between plants in the row is from 16 to 20 inches. The crowns should be planted as early in the spring as the soil can be got in good condition, certainly before growth begins. The crowns are set in furrows and the roots should be spread out by hand. As soon as feasible the crown should be covered to a depth of 2 or 3 inches with loose soil. When the crowns send shoots through the soil, new soil is drawn in and this is repeated so that before the end of the growing season the furrows are filled. The crowns should never be covered to a full depth of the furrow at first for many buds are apt to be smothered before reaching the surface.

The first year after the crowns are planted no cutting should be made from the asparagus. Only two or three cuttings should be made the second year. The third year a cutting of two or three weeks' duration may be recommended and after the third year a six weeks' cutting will do no harm. A mature patch may be cut as long as the quality of asparagus cut is satisfactory.

After frost has completely killed back the tops they should be removed and burned. When the ground has frozen to a depth of 3 or 4 inches the entire area should be mulched. In the spring the mulching may be removed from each hill after the weather has warmed up and growth is commencing. The mulching material may be left on the ground during the early part of the summer and if this is done hoeing and weeding will be reduced to some extent. Before the plants get too bushy in the summer the excess mulching should be removed and the balance spaded into the ground. Though of value, this mulching is not necessary in Kansas.

**Rhubarb.**—The rhubarb plant is resistant to cold and dry conditions and, therefore, thrives in Kansas. A dormant period does not seem to be essential but the tops of the plants are killed at temperatures slightly below freezing. Rhubarb is grown on

many kinds of soil but it seems to do best on a fertile, sandy loam. The preparation of the soil is the same as that recommended for asparagus.

Rhubarb is best grown from divisions of old plants for there is too much variation in plants produced from seed. The old crowns may be cut in as many pieces as there are good strong buds. The rows are usually spaced 4 feet apart and the plants are set from 2 to 3 feet apart in the row. Spring planting is recommended. Year-old roots are planted in the garden. In Kansas early spring planting is preferred.

The preparation and subsequent care of the land for rhubarb are the same as for asparagus. The harvesting season is short, rarely extending over two months. The leaf stalks are pulled, not cut, from the plant and only the largest and best leaves are used. After the harvesting season is past, the plants are allowed to grow as they will and tillage is continued when needed to control weeds. The more luxuriant the growth one year, the better the crop the following year.

After a rhubarb planting has stood for several years it begins to produce a smaller crop each year in spite of the best of care. This is due in part to a depletion of the soil nutrients and in part to an overcrowding of the plant roots. Usually it is better when this condition begins, to prepare a new place for the crop, and by using new roots, continuous rhubarb production is possible as one need not destroy the old patch until the new one begins to produce. When sufficient land for such practice is not available one can renew the planting by root pruning. Root pruning is accomplished by trimming the roots where they stand with a plow or a spade, breaking off the strong projecting parts. This reduces the overcrowding of roots and renews the plantation satisfactorily.

**Annual Crops.**—In a general bulletin for the home vegetable gardener, it is not necessary to go into great detail regarding the culture of each garden crop grown. The commercial gardener can secure publications dealing with the growing of individual crops on a large scale.

In this publication vegetables have been divided into three groups. The care of the vegetables in each of these groups is very much the same. Those vegetables which it is recommended be planted before the middle of April have three requirements in common. They are: A soil rich in nitrogen, large amounts of soil moisture, and a relatively short growing period. Vegetables which are to be planted after the middle of April but before May will not germinate so well under the cool conditions of the very early spring but will grow well during the hotter weather of late summer. Those vegetables which are to be planted after the first of May are very susceptible to frost injury.

They will, however, grow very rapidly during the heat of the summer and are killed by the first frost in the fall.

In planning the garden it is convenient to put the plants of each of these groups together so early plantings will be consecutive and those vegetables which do not produce satisfactorily during hot weather may be removed from the ground and the ground either replanted to vegetables which tolerate heat or kept fallow and free from weeds for the planting next spring.

#### SOME SPECIAL CULTURAL REQUIREMENTS

**Beans and Peas.** — This group of plants for Kansas includes the broad bean, kidney bean, scarlet runner or multi-flora bean, lima bean, tepary bean, soybean, cowpea, and pea. While beans and peas belong to the same family (*Leguminosae*) their cultural requirements have few points in common. Nearly all of the beans grown in America are warm-season plants, while the pea is relatively hardy and grows best under cool conditions. Beans and peas, in common with other legumes, are capable of utilizing atmospheric nitrogen by the aid of bacteria found in nodules on the roots of the plants. As soil improvement crops, they are of little if any value to vegetable gardeners.

As beans are very susceptible to frost injury the seeds are planted after all frost danger is past and the ground has warmed up considerably. Seed should be secured from very reliable sources to insure freedom from bean anthracnose, a seed-borne disease not controllable by seed treatment or spraying but destructive to seedlings and mature plants. It also attacks the pods thus reducing yields.

Bean foliage is attacked by aphids and by chewing insects. Aphids are easily controlled by spraying with a contact insecticide. Chewing insects such as shot-hole beetles and worms present a more serious problem for the arsenate of lead usually recommended for control of these pests burns the bean foliage, causing more damage than the insects. Hellibore or pyrethrum must be used instead of arsenate of lead.

Because of the long growing season required by beans they are not successful in the fall garden but by using various types: namely, wax, bush, lima, and pole, and by making several plantings, one may have beans throughout the summer.

Peas, though also legumes, are very different culturally. They will withstand late spring frosts and deteriorate very quickly in warm weather. They are satisfactory for a fall garden. Aphids often attack pea plants and will quickly ruin the crop. Thorough and frequent spraying with a contact insecticide will control them. Peas require a plentiful supply of nitrogen and moisture.

TABLE IV.—VEGETABLE VARIETIES

Vegetable	Varieties Recommended	Date plant
Asparagus .....	Palmetto, Martha Washington.....	March 1*
Bean (bush) .....	Golden Wax, Stringless Green Pod.....	May 10 ..
Bean (Lima) .....	Bush Lima .....	May 10 ..
Beet .....	Crosby's Egyptian, Detroit Dark Red.....	April 5 ..
Cabbage (spring) .....	Marion Market,** Golden Acre .....	March 25
Cabbage (fall) .....	Copenhagen Market .....	June 15*
Carrot .....	Chantenay, Danvers Half Long.....	April 5 ..
Celery Cabbage .....	Chain Giant Smooth.....	April 5 ..
Corn (sweet) .....	Stowell's Golden Bantam.....	May 10 .
Corn (sweet, late).....	Honey June, Colonel.....	June 10 .
Cucumber (pickling)...	Boston Pickling .....	May 10 .
Cucumber (slicing)....	Arlington, Davis Perfect.....	May 10 .
Eggplant .....	Black Beauty, Florida High Bush.....	May 10*
Kale .....	Green Curled .....	April 5 ..
Lettuce (head) .....	Mignonette, New York.....	March 25
Lettuce (leaf) .....	Grand Rapids, Black Seeded Simpson.....	March 25
Muskmelon .....	Hearts of Gold Pollock.....	May 10 ..
Okra .....	White Velvet .....	May 10*
Onion (sets) .....	White, Red, Yellow.....	March 25
Onion (seed) .....	Yellow Danvers, Prizetaker, Red Globe.....	March 25
Onion (plants) .....	Spanish, Bermuda .....	March 25
Parsley .....	Dark Moss Curled.....	March 25
Parsnip .....	Hollow Crown .....	March 25
Peas (early) .....	Perfectah,** Benah,** Little Marvel.....	April 1 ..
Peas (late) .....	Mardelah** .....	May 15 ..
Pepper .....	Ruby King, World Beater.....	May 10*
Potato (Irish) .....	Cobbler, Early Ohio, Triumph.....	March 17
Potato (sweet) .....	Nancy Hall, Jersey, Porto Rico.....	May 10*
Pumpkin (early) .....	Small Sugar .....	May 1 .....
Pumpkin (late) .....	Winter Queen, Hubbard.....	May 20 ..
Radish (early) .....	Scarlet Globe, Grand Rapids.....	March 25
Radish (summer) .....	White Strasburg .....	June 20 .
Rhubarb .....	Flare, Lianius .....	March 1*
Salsify .....	Sandwich Island, Mammoth.....	April 20 .
Spinach .....	Bloomsdale, Savoy .....	March 10
Spinach (New Zealand)	Everlasty .....	May 1 .....
Squash .....	White Bush, Hubbard, Acorn.....	April 30 .
Swiss Chard .....	Lucullus .....	April 25 .
Tomato (red) .....	Louisiana Red,** Rutgers,** Marglobe**.....	May 10* .
Tomato (pink) .....	Louisiana Pink,** Gulf State Market**.....	May 10* .
Turnip (early) .....	Purple White Top.....	March 30
Turnip (late) .....	Purple White Top.....	July 25 ..
Watermelon .....	Kleckley, Tom Watson.....	April 30 .

\* Date for setting plants in garden.

\*\* Disease resistant.

Note.—Varieties recommended are those found desirable in the trial grounds of the Agricultural Experiment Station at Manhattan. In most cases the first variety is the one found most desirable for the home garden, irrespective of earliness or quantity of yield. The second and third varieties are recommended

IST AND PLANTING TABLE.

	Amount of seed	Plants or seed for a home garden	Planting distances	Days to maturity
....	1 oz. to 800 plants.....	30 plants .....	18" x 36".....	3 yrs.
....	1 lb. to 50 ft. ....	4 lbs. seed.....	4" x 16".....	75 to 80
....	1 lb. to 50 ft. ....	1 lb. seed.....	6" x 16".....	72 to 82
....	2 oz. to 50 ft. ....	1½ oz. seed.....	4" x 16".....	40 to 55
....	1 oz. to 2,000 plants....	60 plants .....	18" x 24".....	90 to 110
....	1 oz. to 1,500 plants....	75 plants .....	2' x 3'.....	115 to 125
....	1 oz. to 100 ft. ....	½ oz. seed.....	4" x 16".....	110 to 125
....	1 oz. to 100 ft. ....	½ oz. seed.....	6" x 18".....	80 to 90
....	1 lb. to 100 hills.....	1½ lbs. seed....	20" x 40".....	110 to 120
....	1 lb. to 100 hills.....	1½ lbs. seed....	2' x 4'.....	90 to 110
....	1 oz. to 50 hills.....	½ oz. seed .....	6' x 6'.....	100 to 120
....	1 oz. to 50 hills.....	¼ oz. seed .....	6' x 6'.....	100 to 120
....	1 oz. to 1,500 plants....	18 plants .....	20" x 30".....	110 to 130
....	1 oz. to 2,000 plants....	¼ oz. seed.....	8" x 30".....	100 to 125
....	1 oz. to 2,000 plants....	¼ oz. seed.....	4" x 16".....	90 to 110
....	1 oz. to 150 ft. ....	½ oz. seed.....	6" x 16".....	70 to 80
....	1 oz. to 50 hills .....	½ oz. seed.....	6' x 6'.....	80 to 100
....	1 oz. to 1,500 plants....	3 plants .....	12" x 30".....	100 to 120
....	2 lbs. to 100 ft. ....	1 lb. sets.....	4" x 16".....	55 to 65
....	1 oz. to 100 ft. ....	1 oz. seed.....	4" x 16".....	115 to 120
....	1 pt. to 25 ft. ....	1 qt. ....	4" x 16".....	75 to 120
....	1 oz. to 100 ft. ....	¼ oz. seed.....	6" x 16".....	50 to 60
....	1 oz. to 40 ft. ....	¼ oz. seed.....	4" x 16".....	130 to 145
....	1 lb. to 50 ft. ....	1 lb. seed.....	6" x 16".....	70 to 80
....	1 lb. to 50 ft. ....	3 lbs. seed.....	6" x 18".....	65 to 75
....	1 oz. to 1,500 plants....	15 plants .....	18" x 30".....	110 to 135
....	1 bu. to 5,000 ft. ....	2½ bus. ....	9" x 30".....	100 to 110
....	33 slips to 100 ft. ....	35 plants .....	36" x 36".....	120 to 130
....	1 oz. to 90 hills.....	½ oz. seed.....	6' x 8'.....	90 to 110
....	1 oz. to 30 hills.....	½ oz. seed.....	6' x 6'.....	90 to 110
....	1 oz. to 100 ft. ....	1 oz. seed.....	2" x 16".....	25 to 35
....	1 oz. to 25 ft. ....	2 oz. seed.....	6" x 16".....	50 to 60
....	1 oz. to 50 ft. ....	12 plants .....	3' x 4'.....	2 yrs.
....	1 oz. to 30 ft. ....	⅓ oz. seed.....	6" x 16".....	100 to 110
....	1 oz. to 50 ft. ....	¼ oz. seed.....	4" x 16".....	50 to 55
....	1 oz. to 50 ft. ....	1 oz. seed.....	6" x 16".....	90 to 110
....	1 oz. to 50 hills.....	½ oz. seed.....	6' x 6'.....	90 to 120
....	1 oz. to 50 ft. ....	½ oz. seed.....	6" x 16".....	75 to 85
....	1 oz. to 2,000 plants....	60 plants .....	4' x 4'.....	100 to 140
....	1 oz. to 2,000 plants....	½ oz. seed.....	4' x 4'.....	100 to 140
....	1 oz. to 100 ft. ....	⅓ oz. seed.....	3" x 16".....	115 to 130
....	1 oz. to 100 ft. ....	½ oz. seed.....	Broadcast .....	100 to 110
....	1 oz. to 50 hills.....	½ oz. seed.....	6' x 6'.....	100 to 120

primarily for commercial production. Dates given are the average dates in Manhattan. For each 10 miles north or south of Manhattan, add or subtract one day. With careful planting of good seed, smaller quantities than those recommended may be used. Planting distances are minimum. In very rich soil, space farther apart. Where irrigation is practiced, plants may be set closer. Days to maturity are days from planting seed to production of usable quantities.

**Bulb Crops.**—The onion is the only bulb crop grown to a great extent in Kansas. It is hardy and thrives best in relatively cool growing seasons. The bulb crops belong to the same genus, *Allium*, of the family *Liliaceae*, and their cultural requirements are similar.

The onion is divided into the Spanish, or foreign group of varieties, and the domestic, or American group. The Spanish types are not adapted for general growing in Kansas as they require a longer growing season than the state normally has and are difficult to cure for home storage.

Seed or sets may be used to start the plants. Yields are greater with sets, but the increased yield seldom pays the increased cost of sets. Seed planted where the plants are to mature are the cheapest and usually the most satisfactory method of growing onions. If seed are planted two or three times as thick as the final stand desired the extra plants can be pulled for green onions. All extra plants must be pulled before the bulbs begin to crowd each other in order to lessen losses due to insects, diseases, and small or malformed onions. Early green onions are grown from sets.

Thrip and spider are two serious insect pests of the onion. Wide spacing of the plants, weed control, and general garden sanitation for prevention are the most practical means of controlling these pests. Diseases of the onion are not common in a clean well-cared-for garden.

Onions for storing should not be pulled until the tops have died down. Rolling the plants or otherwise treating them to kill the tops reduces yields. After onions are pulled they should be air dried either in the field or in a shed and then stored in slatted crates in a cool, dry, light place.

**Cole Crops.**—Cole crops (cabbage, cauliflower, broccoli, Brussels sprouts, kohlrabi, Chinese cabbage, and sprouting broccoli) are hardy and thrive best in cool weather, being started in hotbeds in order to mature before the heat of summer. They belong to the same genus, *Brassica*, and most of them to the same species. The cultural requirements for all the crops in the group are very similar and many of the same diseases and insects attack them. Kale and collards are cole crops but for convenience they are included with pot herbs or greens.

The plants should be set out as early as possible. Fall cole crop seed should be sown in early June and the seedlings kept actively growing until harvest. The cole crops are all subject to insect attacks and must be watched carefully to control them. A contact insecticide for aphids and arsenate of lead for cabbage worm are satisfactory and safe sprays, if the plants are carefully washed before being eaten or sold.

Cole crop diseases are largely soil-borne and are avoided



by using locally-grown plants, liming the soil, and practicing rotation. Plants grown in other states and shipped into Kansas are the source of much disease loss in cabbage and if locally-grown plants are available they should be used.

**Cucurbits or Vine Crops.** — The cucurbits or vine crops are tender annuals grown for their fruits. They include cucumber, muskmelon, chayote, watermelon, pumpkin, and squash. These crops thrive only in hot weather and will not withstand frost. All of them belong to the same family, *Cucurbitaceae*, and all have similar cultural requirements as well as many of the same disease and insect pests. The plants in this group are monoecious, the stamens and pistils being borne on separate flowers on the same plant. The various kinds may be grown in adjacent hills without affecting the quality of each other.

Red spiders, cucumber beetles, borers, and aphids all attack these plants and must be watched for carefully. Leaf spot diseases are also serious in some years but can be controlled by spraying with Bordeaux mixture. Soil-borne wilt is also a disease of this crop and is prevented by rotation and liming.

**Greens.** — Greens crops (spinach, New Zealand spinach, chard, kale, mustard, collards, and dandelions) are grown for their foliage, therefore, they must make a rapid growth in order to be crisp. The crops mentioned in this section are of easy culture and are in greatest demand in the spring and fall, except chard and New Zealand spinach which do best during the warmer portion of the growing season. Many wild plants such as dandelion, several species of dock, lambs quarter, wild cress, pokeweed, milkweed, and others are used as greens, as are turnip and beet tops.

The need for green food has been greatly emphasized during recent years on account of the increased knowledge of the value of the essential salts found in green plants, and especially because such plants are rich in vitamins.

Spinach, mustard, kale, and dandelions are cool-weather crops and are excellent for spring or fall gardens. All are started from seed and deteriorate rapidly in the summer heat. All are attacked by aphids which can be controlled by contact insecticides.

Swiss chard and New Zealand spinach are excellent summer greens. Swiss chard is a member of the beet family but does not produce a fleshy root. The yellow-green leaves are used and must be harvested while tender. The chard plant can be cropped all summer if one will pull a few leaves each time leaving the rest of the plant to continue growing and producing new foliage. It is not attacked by insects or diseases of economic importance.

New Zealand spinach is not a member of the spinach family. It is a low vining plant which grows best in hot weather. Seed

are sown about corn planting time or sometimes are started in pots in hotbeds. The plants will spread to a diameter of 3 to 4 feet so they should be widely spaced when set into the field. The tips of the branches are the edible parts which are cut 3 or 4 inches long. A dozen plants will supply a family of four with hot weather cooking greens for the summer.

**Potatoes.**—The average annual production of potatoes in Kansas is now about 3,000,000 bushels. The potato contains nearly 80 percent water in its uncooked state. Most of the remainder consists of about 2 percent protein and 18 percent starch. The potato is one of the cheapest and most common sources of carbohydrate food,

In Kansas potatoes should be planted as early as possible, in good corn soil, using northern-grown seed which have been treated for rhizoctonia. The seed piece should weigh 1½ ounces, have at least one eye, be planted three to four inches deep, 9 inches apart in the row with the rows 18 to 40 inches apart, depending on the method of cultivation. The successful grower must spray for potato bugs and, for maximum yields, not dig until the vines are all dead. Cultivation should be only for weed control.

Potatoes should be stored in a relatively moist room at about 40 degrees F. As a rule Kansas-grown potatoes will not store profitably beyond Christmas.

**Root Crops.**—Commonly grown root crops are beet, carrot, parsnip, salsify, scorzonera or black salsify, scolymus or Spanish salsify, turnip, rutabaga, radish, horseradish, turnip-rooted chervil, skirret, and celeriac. These crops thrive best in a cool season and in a deep friable soil. Those requiring only a short growing period do better in spring and fall than in midsummer. As all the root crops are hardy they may be planted early in the spring and may be left in the garden until late in the fall. Seed are nearly always sown where the crop is to mature. The roots of some of them, as parsnip, may be left in the field during the winter, being harvested as needed.

**Salad Crops.**—Salad crops include celery, lettuce, endive, witloof chicory, parsley, chervil, cress, and corn salad. These plants, in general, thrive best during the cooler parts of the growing season, and, to be of the highest quality, growth must be fairly rapid and continuous. Such growth is obtained in soils rich in nitrogen and plentifully supplied with water. These crops do not thrive during the warmest part of the growing season in Kansas, though when planted in August they add to the fall garden if irrigation is practiced.

Salad crops are appreciated more than ever before because of the increased knowledge of their value in the diet. They

are especially valuable for their vitamin content and the bulk they supply. These crops generally are eaten without cooking and are the main ones so consumed.

**Solanaceous Fruits.**—These include tomato, eggplant, pepper, and husk tomato. They are all frost-tender plants produced for their fruits and usually started in hotbeds. Of these plants the tomato is the most important. Details regarding its culture may be found in Agricultural Experiment Station Circular 172, "Growing Tomatoes in Kansas."

Culturally the other three plants in this group can be considered together. The seed are slow in germinating, require higher temperatures than any of the other garden vegetables, and the seedlings are slow in growing. The plants are attacked by aphids and several chewing insects all of which are easily controlled by proper spraying.

**Sweet Corn and Okra.**—These two crops are placed together because they do not fit into the other groups, and not because of any special similarity. They are both warm-season annuals, are tender to frost, and are grown for their fruits. Sweet corn is of greater importance in the home garden, okra is produced mainly in the South, but is an easily-grown crop of some value in Kansas.

Sweet corn can be produced throughout the summer by using quickly maturing varieties with a succession of planting. The crop is subject to Stewart's disease which is recognized by a stunting and a wilting of the plants. The use of varieties resistant to the disease and rotation of crops are recommended for its control. Corn ear worms are the only serious insect attacking the crop. Their control is difficult but the injury can be greatly reduced by dusting the silks regularly with arsenate of lead. The poison does not reach the edible part of the corn and therefore is not dangerous.

**Sweet Potatoes.**—The sweet potato is often called "potato" in the South and the potato is called "Irish potato" or "white potato." It is a standard food article in the South, being served baked, fried, candied, and as filling for pies.

Some varieties of sweet potatoes, especially those having a moist, soft texture when cooked, are often called "yams" to distinguish them from the dry-fleshed varieties. It is unfortunate that the term yam has been used in connection with the sweet potato since the true yam is an entirely different plant, belonging to the genus *Dioscorea*. These two plants are not even closely related.

The sweet potato does well in a sandy, fertile soil. Plants or slips should be started in hotbeds from certified stock. Care should be taken in the choice of varieties, and for the home

garden it is usually most satisfactory to buy locally grown plants. The slips are set in the field about two weeks after field corn is planted. Set the plants about 10 inches apart in the row with the rows 4 to 6 feet apart. Cultivate only to control weeds and stop cultivation when the tools disturb the vines. Pruning the vines is decidedly harmful, reducing the crop in direct proportion to the amount of pruning done. Sweet potatoes should be harvested as soon as the vines are killed by frost. They should be cured at high temperatures and stored at about 60 degrees with relatively low humidity.

**Perennial Crops.**—Perennial crops of interest in Kansas include asparagus, rhubarb, artichoke, Jerusalem artichoke (Girasole), sea-kale, and horseradish.

These crops occupy the land for a period of years and therefore should be located in very well prepared, fertile land and where they will not interfere with tillage operations needed by annual garden crops. They have little in common as far as cultural practices are concerned. After perennial crops have been planted manures and fertilizers are supplied mostly as surface applications.

The Jerusalem artichoke is a member of the sunflower family and is propagated from tubers planted about corn planting time. The tubers are set about 4 inches deep and 15 to 18 inches apart in rows 3 or 4 feet apart. There are no diseases or insects of economic importance attacking the crop. The only care the plants need is weed control. After frost has killed the tops the tubers are dug and dried. These are used as a substitute for potatoes, being high in a form of starch said to be safe for those suffering from diabetes. Once a planting is made enough tubers will be left in the ground each fall after digging to insure a stand the following year. Yields are greatly increased by heavy fall manuring.

The globe artichoke also is a member of the sunflower family. Its cultural requirements, however, are similar to those of cabbage which it resembles in appearance. It should be planted in heavy, well-manured soil on a side hill protected from the north. It is propagated from off-shoots and when once established renews itself from the roots though the tops die each winter. The edible portion consists of bracts produced on tall stems. It is very popular in France, but not well known in Kansas.

Sea-kale is a perennial of the mustard family. It is grown for its young leaves which are used in salads. It is propagated from seed or cuttings and requires large quantities of water. It is not well adapted for growing in Kansas.

Horseradish is one of the most easily grown vegetable crops. If not kept under control it may become a pest but if

given good care there is a gradual increase in quantity and quality of edible roots produced. It is propagated from root cuttings which are planted 3 or 4 inches deep, in a deep, rich, well-drained, well-manured, thoroughly-prepared soil. Cuttings are planted 12 to 16 inches apart in the row with the rows 3 or 4 feet apart. In home gardens it needs no care other than weed control. The roots are hardy and may be left in the ground until needed, though generally it is better to dig those needed in the fall and store them in a cool, damp cellar. The roots are spaded or plowed out, the tops and side shoots burned, and the longer thicker roots stored. Unless the roots are very thoroughly removed, enough will be left in the ground to furnish plants for the next year. These will grow without further attention.

#### INSECTS AND DISEASES OF THE GARDEN

The prevention of insects and diseases in the vegetable garden is the cheapest and most satisfactory way to control these pests. Among the methods of prevention are rotation of crops, destruction of refuse which harbors diseases and insects, growing of resistant varieties, fall plowing, use of plant protectors, use of trap crops, and seed treatment. Of these, rotation and destruction of refuse are the simplest and most important precautions and no one can be successful in gardening without heeding them. Where they are available, resistant varieties are, of course, the easiest methods of prevention of disease, but resistance to insect attacks among the vegetable crops has not developed sufficiently yet to be of importance.

Where methods of prevention have not proved entirely satisfactory one can resort to spraying or dusting. There is considerable difference of opinion as to the value of dusting compared with spraying but, in general, the vegetable garden experiments indicate that spraying is of greater value because the spray material adheres to the plants more tenaciously and consequently the treatment is effective over a longer period. Dusting is desirable when there are large areas which must be treated quickly and as a rule dusts are more easily prepared and applied than liquid sprays.

#### INSECT CONTROL

**Chewing Insects.** — The chewing insects are those which have biting mouth parts and which bite out a bit of the plant. These include the so-called worms of various kinds. These can be controlled by spraying the plants after the insects appear, or when it is known that they are in the neighborhood, with arsenate of lead or some other stomach poison.

**Sucking Insects.** — The sucking insects are principally the plant aphids which are commonly known as plant lice. The mouth parts of these insects are such that they are able to in-

roduce a tube through the outer layers of the plant tissues and reach the cell sap. They then suck out the cell sap and devitalize the plant, weakening it and thus reducing the yield as well as making it more susceptible to disease injury. These insects cannot be controlled by stomach poisons but must be killed with what are known as contact insecticides. These contact insecticides include the various tobacco and oil products and are available in many forms. Since the insects to be controlled must be suffocated, the material cannot be applied until the insects are present. Then there must be a complete covering of every insect with the contact insecticide in order that there may be satisfactory control.

**Applying Spray Materials.**—In all spraying, whether it be for chewing or sucking insects, thoroughness and timeliness are important considerations. If only a part of the plant is sprayed the chewing insects may destroy a large part of it before they reach the sprayed parts, and thus do considerable damage before they are controlled. If only a few of the sucking insects are covered with a contact insecticide, those which are left will be able to do a great amount of damage and multiply faster so they are really benefited, rather than controlled, by careless spraying. Thoroughness, in the case of spraying vegetable plants, would include the use of sprayers which apply the material under pressure and the complete coverage of the entire plant, including both sides of the leaves. It is important too that spraying be done as soon as the first signs of insect attack are noted. To delay spraying even one day often invites disaster from the pests.

**Stalk Borers.**—Stalk borers are those insects which burrow into the stem of the plant, usually at the ground, and then burrow upward or downward inside of the stem. In this way they destroy the stem and consequently cause the death of many plants. The tomato and the vine crops are especially susceptible to these insects. There is no way to save these plants after these pests have attacked them, so prevention is the only means of control. Prevention of these pests is obtained by rotation, fall plowing, and the removal and burning of all dead or dying plants and plant parts. This should be done after the garden has stopped producing vegetables but before fall plowing. When the plants are dying and the cause is thought to be stalk borers, it is a very good practice to split the stem open and find the borer, which is a rather large larva or worm, and destroy it.

**Cutworms and Grasshoppers.**—Another group of insects, which include cutworms and grasshoppers, are those which cannot be controlled by any of the practices already mentioned. They are, however, very easily controlled by the use of poisoned



bran mash. Directions for making this poison may be secured from the Agricultural Experiment Station, Manhattan, Kansas.

**The Thrip and the Red Spider.**—There are two pests of the garden which are, strictly speaking, not insects but which are commonly so called. These are the thrip and the red spider. Both of these pests are so minute they cannot be seen with the naked eye. They appear in great numbers during hot dry spells and eat the outer layers of the plant tissues. The result is a slow drying and yellowing of large areas of the leaves or fruit. The control of these is very difficult under gardening conditions. Frequent spraying with water during the daytime will control them to some extent for they do not tolerate damp conditions and they will then leave the plant and hunt drier locations. Spraying is of some value but is not a very satisfactory means of controlling them and it is better to pull up the plants which are affected and burn them. In this way the spread of these pests is stopped and they are destroyed in such large numbers that they will be less likely to appear in destructive numbers again that season.

#### **DISEASE CONTROL**

Many of the diseases in the vegetable garden are prevented by the methods already suggested. When there is an outbreak of some disease it is usually cheaper and more satisfactory to remove and destroy, by burning, all plants or plant parts infected than it is to spend time in attempting control by spraying. This not only prevents the spread of the disease by removing the source of infection but lessens the danger of another attack the following year. If one cares to spray, nearly all of the controllable vegetable diseases can be checked by spraying with Bordeaux mixture. Bordeaux mixture is a combination in the proper proportions of lime, copper sulphate, and water. For commercial gardeners its home manufacture is cheaper and very satisfactory, but for the home gardener the prepared Bordeaux mixture available in nearly every community from seed stores is not expensive, is satisfactory, and is probably better than the home-mixed material. It is important that spraying or dusting for diseases be timely and thorough. The reasons for timeliness and thoroughness apply in disease control as they do in insect control.

#### **STORAGE**

Much of the value of the vegetable garden is lost if no provision is made for the storage of the surplus. Many vegetables can be canned and home canning is the most satisfactory method of saving them. Others cannot be satisfactorily or economically canned and they must be stored.

**Requirements for Storage.**—For successful storage of vegetables one must first have a good product. Diseased, poorly-grown, carelessly-harvested, and dirty or poor-quality vegetables cannot be stored satisfactorily. In the storage cellar one

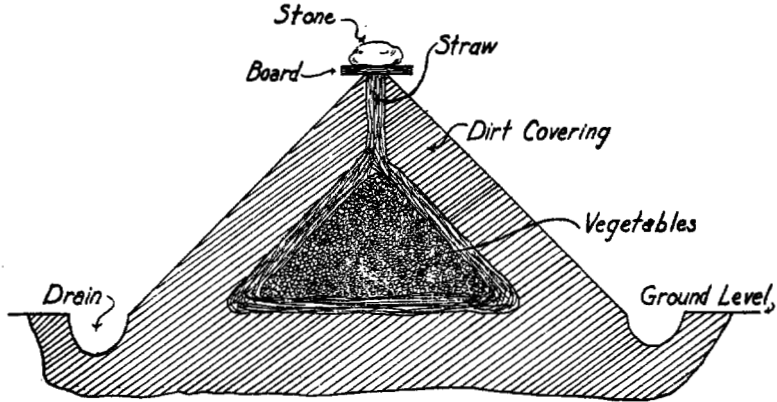


FIG. 10.—An easily-made mound for home storage of vegetables.

must have proper moisture and temperature conditions. Under commercial storage great care is taken that a particular temperature and a certain humidity be maintained for each particular vegetable. For home-storage conditions this is not possible, but there are three general types of storage which may be practiced. These are storing in the field, storing in cellars, and storing in above-ground houses.

**Storing in the Field.**—Storage in trenches, pits, or mounds on the surface of the ground is satisfactory for the home storage of

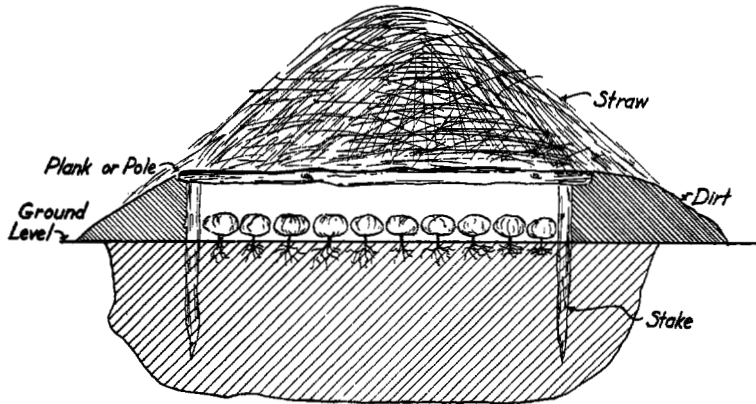


FIG. 11.—A very good type of mound for home storage of vegetables.

many vegetables. (Fig. 10.) Trenches may be used for storing cabbage, celery, beets, beans, carrots, parsnips, potatoes, and sweet potatoes. The covering of soil must be heavy enough to prevent severe freezing. The products can be removed only with difficulty when the ground is frozen or very wet and the labor required to place them in storage and to remove them from storage is rather great. The advantages of field storage are that it is always available; that it requires no investment in building or material; and that any amount of space may be used. When labor is taken into consideration it is an expensive method of storing and is not commonly practiced in Kansas.

For root plants a mound above the surface of the ground is

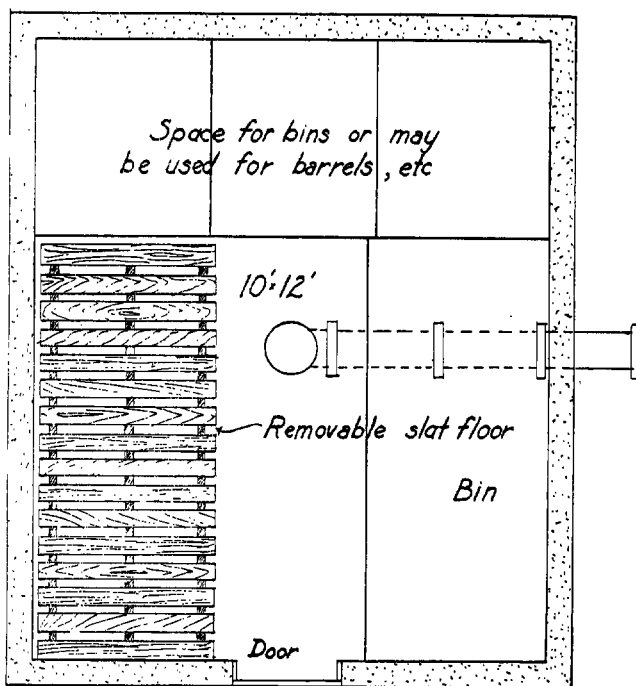


FIG. 12.— Plan for utilization of space for vegetable storage in a home cellar or garage.

fairly satisfactory. (Fig. 11.) One should select a well-drained location so no water runs into the base of the mound. The surface is then levelled and two small trenches across the bed and at right angles to each other are made to provide for ventilation at the bottom. Usually boards are placed over these trenches, and at the intersection of the trenches a small open box is set on end to form a flue up through the pile of vegetables. The

earth floor is covered with 5 or 6 inches of clean straw or hay and the vegetables are placed on this in a conical pile around the flue. After the vegetables are in place they are covered with several inches of straw and over that is put a layer of soil. The soil layer should be only 2 or 3 inches thick at the beginning but after the vegetables have cured and the weather becomes more severe the amount of soil should be increased. The ends of the trenches and the flue should be kept open for ventilation

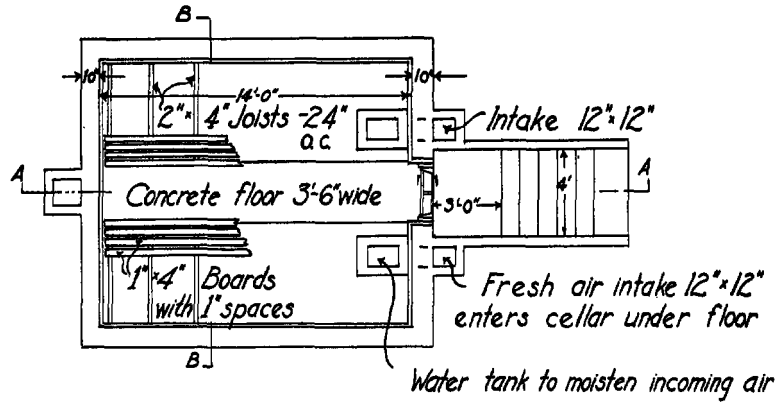


Fig. 13.—Plan for a section of a basement arranged for vegetable storage.

until it becomes necessary to close them to prevent freezing. These openings should be made rodent proof. (Fig. 11.)

**Storing in Cellars.**—With very little expense an ordinary house cellar can be used satisfactorily for the storing of the root

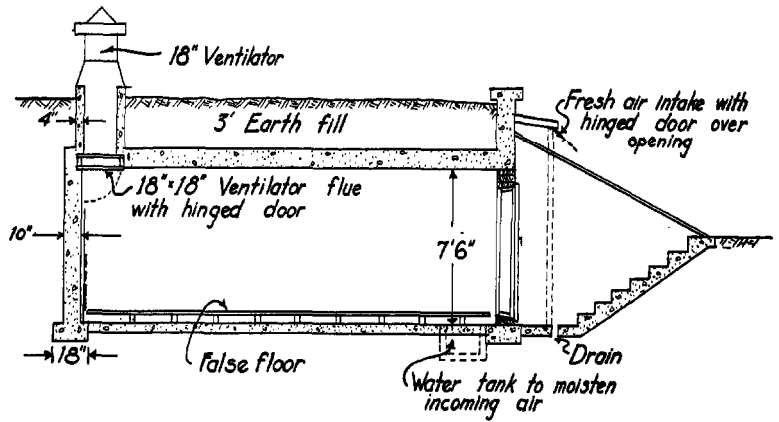


Fig. 14.—Diagram of outdoor cellar or cave which makes a very satisfactory permanent home vegetable storage place.

crops raised in the home garden. (Figs. 12 and 13.) The storage room in the cellar should have an opening to the outside for ventilation and a false floor under which should be water to increase the humidity. The room must be walled off from the remainder of the basement and kept cool by the control of ventilation.

Outdoor cellars or caves usually give better results than house cellars. (Fig. 14) Such cellars should preferably be on a side hill and should be covered with at least two feet of earth.

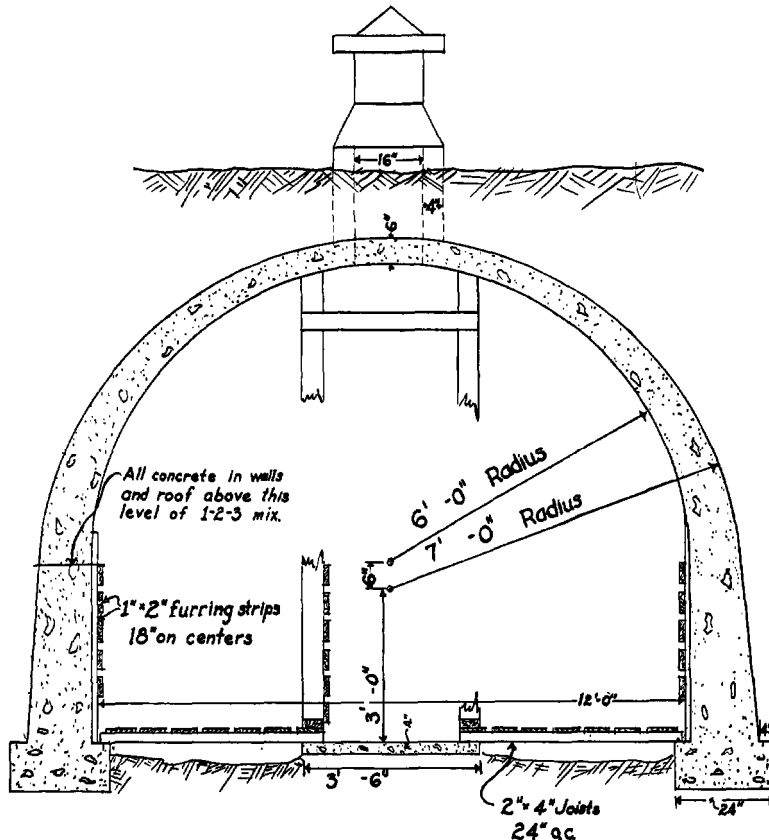


FIG. 15.—A type of storage house which is difficult to build. It is not expensive, however, and is very satisfactory.

and provided with ventilation. Doors should be double and windows and flues should be made rodent proof. Outdoor cellars are well adapted to the storage of root crops.

**Storing in Above-Ground Houses.**—Above-ground storage houses are commonly used for the storage of sweet potatoes, cabbage, and onions. (Figs. 15, 16, 17.) The advantages over the other types mentioned are that the air humidity can be controlled more readily and the vegetables can be taken out with less work and less discomfort. Such houses are rather expensive to construct and for the home gardener are usually not worth the investment required. There are several publications which deal with the home storage of vegetables that can be obtained from many sources. As an economic proposition home storage of vegetables is of questionable value and usually the cost of the storage is greater than the increased price when purchased for consumption over that received when sold at har-

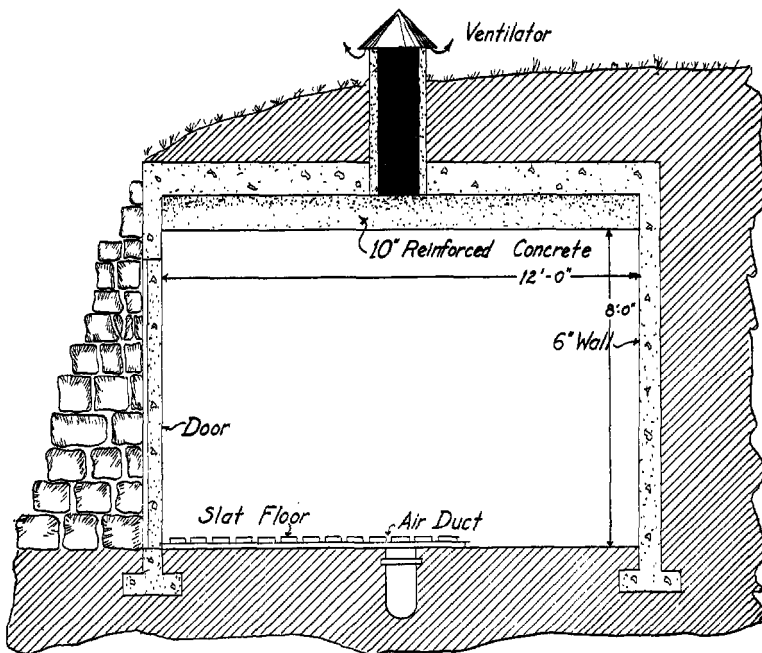


FIG. 16.—A diagram of a very good underground vegetable storage room or cave.

vest time. However, a surplus of vegetables may be stored without a large cash outlay and this should be considered as it will materially lessen the need of cash and increase the family's use of vegetables throughout the winter months. On this account the home storage of vegetables from the farm garden may be recommended even if it is a rather uneconomical and unsatisfactory way of conserving food.



In figures 14, 15, 16, and 17 are given detailed plans for above-ground home storage houses. All of these and variations of them are in actual use on one or more Kansas farms and have proved satisfactory. Although concrete is indicated because of its durability one may use stone, brick, or lumber. Wood is the cheapest but the heavy dimensions required make the first cost high and the upkeep of such non-permanent material adds much to total investment.

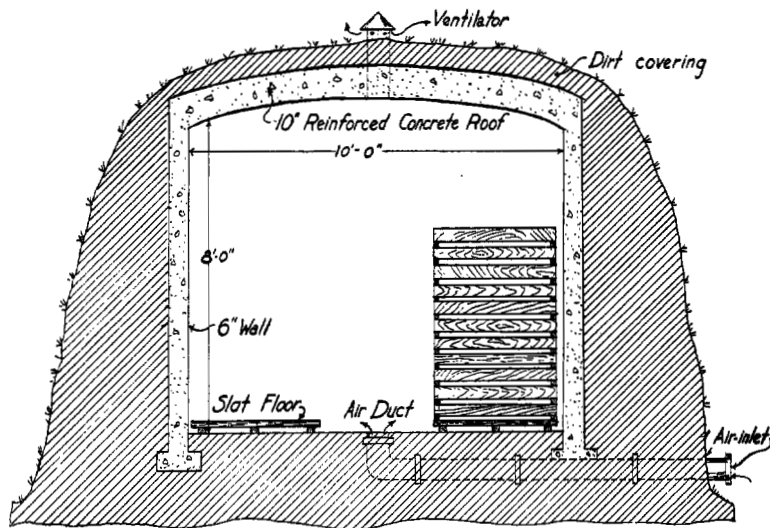


FIG. 17.—A diagram of an easily-built underground storage house which may be built on the ground near the house and then covered with several feet of soil to serve as insulating material.

### THE CULINARY HERBS

With the exception of tarragon, which is sterile, the herbs are all easy to raise from seed. Angelica is the only one which must be sown from strictly fresh seed and should be planted in midsummer as soon as the seed are ripe. It is a good plan to start the others indoors in February or March. If one has no hot-house or cold frame, seed will germinate satisfactorily if started out of doors in May, in a sunny, well-drained location and in a soil which is not too rich but which has been worked until it forms an excellent seedbed. Most of the labiates, such as hyssop, thyme, mint, and savory, can be increased from cuttings set in sand in cold frames, in late summer. The seed of many can be bought from American seedmen and those not listed in catalogs may be obtained by special request.

Below are listed the more common herbs together with their uses.

**ANNUAL HERBS**

- Anise (*Pimpinella anisum*). Seeds and leaves used for flavoring.
- Basil, sweet (*Ocimum basilicum*). Leaves used for flavoring hot and cold dishes, especially dishes made with tomatoes, and Italian bean soup.
- Basil, bush (*Ocimum minimum*). Same as above.
- Borage (*Borago officinalis*). Leaves and flowering tops used for flavoring cold drinks.
- Chervil (*Anthriscus cerefolium*). Leaves used for flavoring and as a garnish.
- Coriander (*Coriandrum sativum*). Seeds used for flavoring desserts and candies.
- Dill (*Anethum graveolens*). Seeds used for flavoring, and the leaves in pickles and fish sauces.
- Marigold, pot (*Calendula officinalis*). Petals used for flavoring.
- Marjorumm sweet, knotted (*Origanum majorana*). Leaves and flowering tops used for flavoring hot dishes and cream cheese.
- Nasturtium (*Tropaeolum minus*). Stems and buds used for salads; seeds used for flavoring sauces.
- Rosemary (*Rosemarinus officinalis*). (A perennial sub-shrub, but since it is not hardy it should be raised annually from cuttings or seeds.) The leaves are used for flavoring soups and meat dishes.
- Savory, summer (*Satureja hortensis*). Leaves and flowering branches used for flavoring.
- Sorrel (*Rumex scutatus*). Leaves used for flavoring spinach and to make soup.

**BIENNIAL HERBS**

- Angelica (*Angelica archangelica*). Seeds used for flavoring sweets; the stems are eaten as a vegetable.
- Caraway (*Carum carvi*). Seeds are used for flavoring; the roots are eaten boiled as a vegetable and the leaves can be used as a garnish.
- Clary sage (*Salvia sclarea*). Leaves used to flavor omelets.

**PERENNIAL HERBS**

- Burnet (*Poterium sanguisorba*). Leaves used to flavor cool tankards and in salads.
- Lavender (*Lavendula vera*). Flower calyces used before flowers open for pot-pourris.
- Sage (*Salvia officinalis*). Leaves used for flavoring.
- Savory, winter (*Satureja montana*). Leaves and tips of the branches used for flavoring.
- Tarragon (*Artemisia dracunculoides*). Leaves used for flavoring.
- Thyme, English (*Thymus vulgaris*). Leaves and flowering tops used for flavoring.

### THE FALL GARDEN

The extremely dry and hot summers sometimes experienced in Kansas cause an almost complete failure of the summer garden even where irrigation is practiced. When this occurs the fall or late summer garden becomes of increased importance and value.

Except for the planting dates the fall garden does not differ materially from the spring or early summer garden. The dates given in the paragraph below are the latest dates for planting the various vegetables to enable them to mature a fair crop before frost in Manhattan. As one goes south from Manhattan the dates would be later at the rate of about 10 days for each 100 miles. To the north the latest date would be earlier in about the same proportion.

While testing of varieties for the fall garden has not been studied so intensively or for so long a period as the testing of varieties for the spring and summer garden (Table IV), the experiments that have been completed indicate that the varieties which do best in the spring also do best in the fall garden, except cabbage and radish. For cabbage, experiments indicate that Snowball is to be preferred. The greenhouse forcing types of radish, such as Grand Rapids, seem best for the fall garden.

One can hardly expect to have fall garden if he cannot irrigate the garden immediately after planting, in order to start the seed. Additional irrigation may be needed, depending on the rainfall, but usually irrigation is less necessary to mature the vegetables in the fall garden than it is in the spring garden.

On May 16, late cabbage should be planted; June 16, carrots and sweet corn; July 1, kale, white potatoes, and green onions; July 1 to 16, beans; August 1, peas and turnips; August 1 to 16, beets and spinach; August 16 to 30, lettuce; and September 1, early radish.

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**MIMEOGRAPHED CIRCULARS**

Important Apple Varieties.  
Bulb Culture.  
Flat Headed Apple Tree Borers.  
Garden Fertilizers.  
Recommended Fruit Varieties.  
Garlic Culture.  
Rock Gardens.  
List of Books Relating to Horticulture.  
Horseradish Culture.  
Hotbeds— Their Management.  
Sulphurized-linseed Oil (Rodent Control by).  
Growing Mushrooms from Spawn.  
Bacterial Shothole of the Peach.  
Acidulated Corrosive Sublimate Treatment of Seed Potatoes.  
Elthylene Chlorhydrin Treatment for Seed Potatoes.  
Peach Leaf Curl.  
Perennials for Kansas.  
Forcing Rhubarb.  
Some Ornamental Shrubs for Kansas.  
Killing Green Timber.  
Tomato Blossom Dropping.  
Two Common Tomato Diseases.  
Some Common Ornamental Trees for Kansas.  
Native Woody Plants for Kansas.

Copies of these publications in which the reader may be interested may be secured as long as they are available by addressing a request to Department of Horticulture, Kansas State College, Manhattan, Kansas.