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### **Vegetable Gardening**

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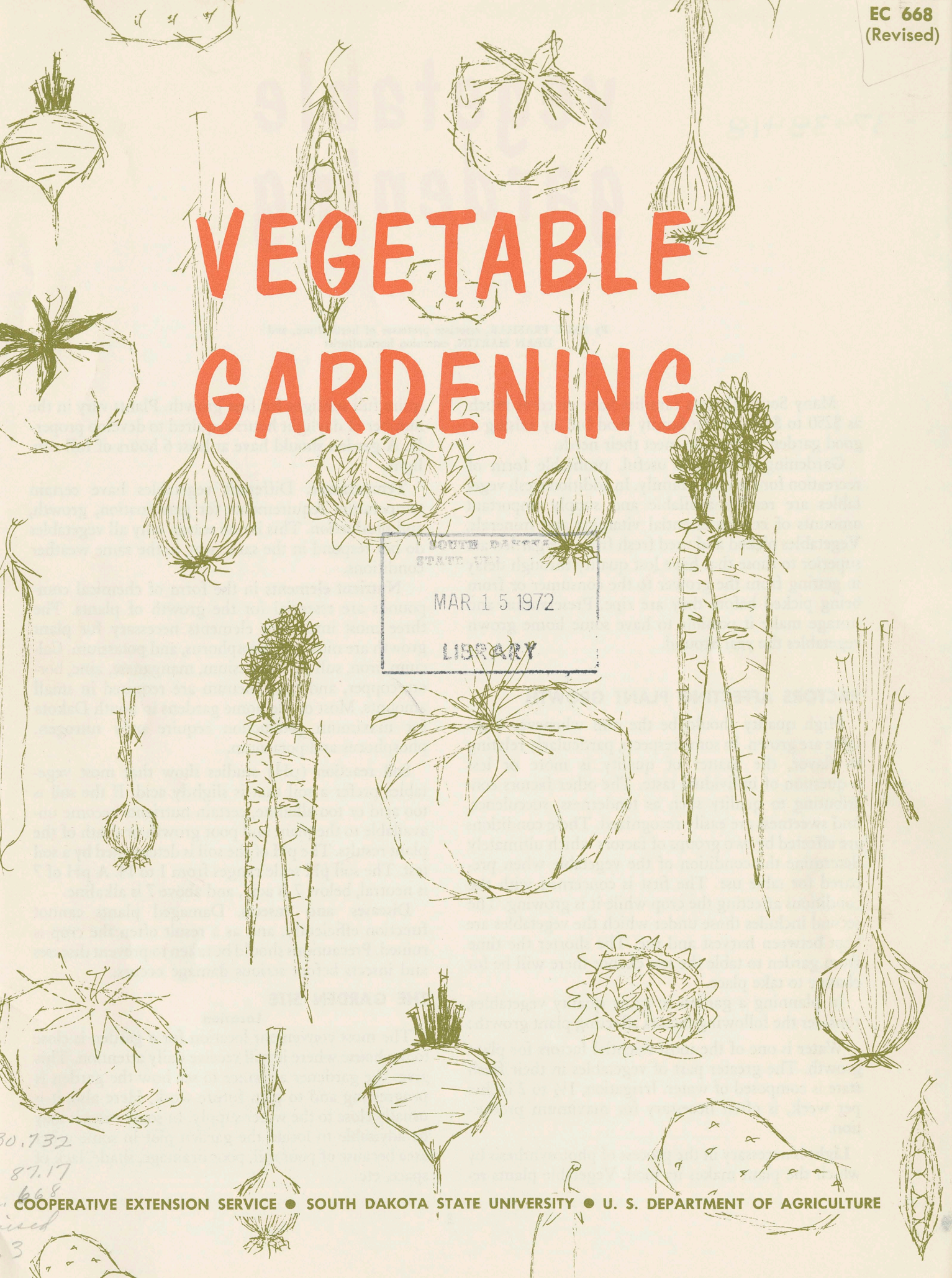
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# VEGETABLE GARDENING



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# vegetable gardening

By PAUL PRASHAR, associate professor of horticulture, and  
DEAN MARTIN, extension horticulturist

Many South Dakota families have saved as much as \$250 to \$400 on the family food bill by raising a good garden planned to meet their needs.

Gardening provides a useful, profitable form of recreation for the entire family. In addition fresh vegetables are readily available and supply important amounts of certain essential vitamins and minerals. Vegetables picked and used fresh from the garden are superior to those that have lost quality through delay in getting from the grower to the consumer or from being picked before they are ripe. Preservation and storage make it possible to have some home grown vegetables the year around.

## FACTORS AFFECTING PLANT GROWTH

High quality should be the aim whenever vegetable are grown. In some respects, particularly relating to flavor, the matter of quality is more or less a question of individual taste. The other factors contributing to quality such as tenderness, succulence, and sweetness are easily recognized. These conditions are affected by two groups of factors which ultimately determine the condition of the vegetable when prepared for table use. The first is concerned with the conditions affecting the crop while it is growing. The second includes those under which the vegetables are kept between harvest and use. The shorter the time from garden to table the less chance there will be for change to take place.

In planning a garden to grow quality vegetables, consider the following factors affecting plant growth:

**Water** is one of the most essential factors for plant growth. The greater part of vegetables in their fresh state is composed of water. Irrigation, 1½ to 2 inches per week, is often necessary for maximum production.

**Light** is necessary in the process of photosynthesis by which the plant makes its food. Vegetable plants re-

quire full sunlight for best growth. Plants vary in the number of daylight hours required to develop properly. A garden should have at least 6 hours of full sunlight.

**Temperature.** Different vegetables have certain temperature requirements for germination, growth, and production. This is one reason why all vegetables do not respond in the same way to the same weather conditions.

**Nutrient elements** in the form of chemical compounds are essential for the growth of plants. The three most important elements necessary for plant growth are nitrogen, phosphorus, and potassium. Calcium, iron, sulfur, magnesium, manganese, zinc, boron, copper, and molybdenum are required in small amounts. Most of the home gardens in South Dakota for maximum production require only nitrogen, phosphorus and potassium.

**Soil reaction (pH)** studies show that most vegetables prefer a soil that is slightly acid. If the soil is too acid or too alkaline, certain nutrients become unavailable to the plant and poor growth or death of the plant results. The pH of the soil is determined by a soil test. The soil pH scale ranges from 1 to 14. A pH of 7 is neutral, below 7 is acid, and above 7 is alkaline.

**Diseases and insects.** Damaged plants cannot function efficiently, and as a result often the crop is ruined. Precautions should be taken to prevent diseases and insects before serious damage occurs.

## THE GARDEN SITE

### Location

The most convenient location for a garden is close to the house where it will receive daily attention. This gives the gardener a chance to see how the garden is progressing and to plan future work. Here also, it is usually close to the water supply. In some cases it may be advisable to locate the garden plot in some other area because of poor soil, poor drainage, shade, lack of space, etc.



Vegetable plants must have at least 6 hours of full sunlight each day for best growth. Trees and shrubs cast shade and rob the garden plants of soil moisture and nutrients. Root pruning to a depth of 2 feet between the garden and the trees or shrubs will reduce competition. Trees and shrubs can compete with other crops for a distance about equal to their height.

If space is limited, vegetables requiring a small amount of room could be planted near the house, while those requiring a larger space could be planted where more room is available.

#### Soil

The soil for a good garden should be fertile, easy to work, fairly deep, well drained, and not too alkaline or acid.

#### Protection

In South Dakota it is usually advantageous to provide some sort of windbreak if the garden is in an exposed area. Trees and shrubs are most effective and are good for a large area. Locate the garden at least 50 feet from a tree windbreak. Other desirable windbreak materials, especially for smaller areas, are corn cribbing or three to four rows of sweet corn. A single row of sudan grass planted about every 80 feet across the garden is an effective windbreak.

In some cases it may be desirable to fence the entire garden with woven wire to keep out livestock, rodents, and other pests.



Figure 1. A single row of Sudan grass provides wind protection for the melon planting.

## PLANNING THE GARDEN

### Plan

A plan is one of the most important steps for an orderly, efficient garden. Sketch the plan, preferably to scale, well ahead of spring planting. By doing this you will know what to plant, when to plant, and how much to plant when the time comes.

### Size

Family size, use of products, and time available influence the size of the garden. Generally the larger

the family, the larger the garden. Plant more of vegetables to be stored or preserved. Never plant more than you can easily care for. A small garden given good care is far better than a large one that becomes a weed patch. Good care affects the appearance of the garden as well as the quality and quantity of the vegetable crops.

### Arrangement

Consider these points in arranging a garden to meet your specific needs:

1. It is generally a good idea to divide the garden into three areas containing the following groups of crops:

**Perennial crops (asparagus and rhubarb).** Plant on one side (at one end) of the garden so they will not be disturbed from year to year.

**Short season, early planted crops.** Plant at one end of the garden. This makes it easier to replant after these crops are harvested. Short season crops include peas, spinach, lettuce, beets, kohlrabi, radishes and onions for bunching, cabbage, cauliflower and broccoli.

**Long season crops.** These are usually warm season vegetables that require most of the growing season to mature and be productive. Examples of long season vegetables are tomatoes, peppers, potatoes, the vine crops, and sweet corn.

2. Plant tall growing vegetables at one end of the garden far enough from low growing vegetables so as not to shade them.
3. Save space by intercropping. For example peas could be planted in between rows where tomatoes or cucumbers are to spread later.



Figure 2. A row of squash planted between the row of cabbage and radish gives more room to squash vines later in the growing season after the other crops have been harvested.

4. Rotate the garden or the crops in the garden from year to year to help reduce insect and disease problems.



5. Long rows are easier to cultivate with wheeled equipment than short rows. It makes little difference whether rows lie east-west or north-south.



Figure 3. Straight, long rows of vegetable crops are easier to cultivate and spray.

6. Mark each row of each variety with a stake or label. You can keep the varieties separate and identify those which perform best.



Figure 4. Label each variety with waterproof ink to compare variety characteristics.

7. Do not plant too much of one kind of vegetable at a time. Unless you want large quantities for canning or freezing, this is a waste of time, space, and food.
8. Plan to include some vegetables high in vitamins A and C. These two vitamins are lacking in the diet of many people. Below are some vegetables which contain high amounts of these two vitamins.

**Vitamin A**

Spinach  
Carrots  
Swiss Chard  
Beet greens  
Winter squash  
Muskmelons  
Broccoli  
Kale

**Vitamin C**

Green pepper, raw  
Broccoli  
Muskmelons  
Tomatoes, raw  
Cauliflower  
Cabbage  
Kohlrabi

**SUCCESSION PLANTING**

Every gardener should get the most possible from his garden because much labor and expense are involved, and in many cases, space is limited. One way of doing this is to make succession plantings of some crops.

As used here, succession planting means (1) planting a crop 1 to 2 weeks apart on two or more dates, and (2) replanting a row of harvested vegetables with some other vegetable. An example of (1) would be three or four plantings of beans. An example of (2) would be to plant snap beans in the row from which you had just harvested peas.



Figure 5. Planting snap beans at two week intervals provides fresh and tender beans for a long period.

There are several reasons for making succession plantings. Many vegetables are at their prime edible stage for only a short time. Thus a single planting of beets, corn, or snap beans would mature and be good eating for less than 2 weeks. If two or three plantings were made 1 to 2 weeks apart, the vegetables would be available for a longer time. Secondly, a family can consume only so much of a vegetable in a short time. Three 5-foot rows of beets, planted at three different dates, will have a greater chance of being used than a 15-foot row planted at one time. Since you spend time, money, and effort in gardening, you should get the most benefit you can from it by having a crop growing and producing all the time. When the peas have quit bearing, dig them up and plant some other crop. Thus there will not be any nonproductive open spaces, and chances are you will do a much better job of controlling weeds.

Crops suitable for succession planting are given in table 1, part A.

**Fall Garden**

A fall garden is one that is planted in summer, but the vegetables are harvested in late summer or early fall. Succession planting is a means of extending the harvest season. Also, many crops must mature during cooler weather. Vegetables that will



succeed in a fall garden are listed in table 1, part B.

Vegetables for the fall garden can be planted in the area vacated by early maturing crops. They can be planted between rows of crops to be harvested shortly.

In South Dakota the fall garden is planted from June to August, depending upon the days to maturity of the crop and when heavy frost occurs in the fall. With the exception of snap beans, the crops listed in table 1, part A will withstand light frost. Because fall garden vegetables must make part of their growth during hot, dry weather, don't attempt a fall garden unless water is available for irrigation at that time.

**Table 1. Vegetables that can be Planted Successively or for Fall Harvest**

A. Succession Plantings—Plant from one to two weeks apart		
Turnips	Carrots	Beets
Radishes	Leaf lettuce	Kohlrabi
Onions	Snap beans	Sweet corn
B. Fall Crops—Plant from June to August. All except snap beans will stand frost.		
Cabbage*	Broccoli*	Carrots
Cauliflower*	Brussels sprouts*	Leaf lettuce
Kale	Rutabagas	Kohlrabi
Turnips	Parsnips	Onions
Beets	Snap beans (will not tolerate frost)	Spinach

\*Generally transplanted

## EQUIPMENT

Well made tools and equipment, selected to perform a particular task in good condition and repair, make work in the garden more enjoyable. Many time and labor-saving pieces of equipment are available which will promote better garden care and reduce labor.

Indispensable hand tools include a trowel, hoe, steel rake, spade, spading fork, bucket or watering can and liquid measurer, stout garden line, hand duster or a sprayer, and two pointed iron stakes.

For larger gardens, equipment such as a wheel hoe cultivator or a small 1 to 3 horsepower garden tractor with attachments is highly desirable. A power garden tractor may even pay for itself in rental to neighbors.

Other miscellaneous items which may be useful, especially on larger gardens, are: wheel-type fertilizer and insecticide distributor; wheelbarrow type compressed air sprayer or hose-attached sprayer, or a crank type duster; a hand or drill seeder; and a row marker.

## SOIL PREPARATION

### Tillage

Good soil preparation and care are essential for growing vegetable crops. The garden area can be plowed or spaded, depending on the availability and accessibility of equipment and garden size.

Plowing or spading can be done in the fall or in the spring, about 8 inches deep, when the soil is not wet. Before planting, work the soil to a reasonably fine condition with a disc or harrow and a drag, or with a wheel cultivator and rake.

### Organic Matter

Any soil will produce better crops if organic matter is added. It supports valuable soil organisms, improves soil texture, increases water holding capacity, provides aeration and better drainage, and makes fertilizer more effective. Sources of organic matter are animal manure, green manure, and compost.

Animal manure provides organic matter and nutrient elements. Apply animal manure in the fall and turn under either then or in spring.

Green manure refers to cover crops such as rye grass and alfalfa that are turned under to decompose. With a nonleguminous crop such as rye or oats, nitrogen must be added at plowing time to help decompose the material and prevent nitrogen starvation in the succeeding crop. Cover crops are generally planted near the final harvest. If enough growth takes place, the cover crop can be plowed down in the fall; however, this is generally done in the spring. One advantage of waiting until spring is that additional snow will be held during the winter months.

Compost consists of plant refuse placed in a pile with soil and fertilizer to decompose. Compost makes a good substitute for animal manure.

## FERTILIZING

Organic matter, such as well-rotted animal manure or decomposed straw, leaves, or grass clippings, improves the physical condition of the soil. It does not provide a balanced source of plant food. Organic materials are low in phosphorus and often temporarily deplete the soil of available nitrogen. It is often necessary to rely on chemical fertilizer to provide at least a portion of the nutrient requirements of garden plants.

Vegetables need a well balanced diet. Nitrogen, phosphorus, and potash, along with numerous other ingredients, must be available for plants to grow best. Applying fertilizer to vegetable crops will return more money for less cost than any other expenditure. With proper use of fertilizer, high production of high quality vegetables will result. Certain fertilizers are needed in all vegetable plantings, but should be used according to the need of each planting.

For further information refer to FS 537, "Fertilizer Guide for Vegetable Crops in South Dakota."





Figure 6. Row application method of fertilizer is economical where rows are further apart. (See FS 537)



Figure 7. Side dressing of nitrogen fertilizer is beneficial to long season crops about six weeks after transplanting. Be sure to stay six or eight inches away from the main stem in the case of tomatoes (above) and three to four inches with onions (below). (See FS 537)



## PLANTING

### Time of Planting and Crop Classification

The kinds of vegetables grown and the length of growing season in a particular area determine when to plant. Check current fact sheets for suggested varieties.

Vegetables can be grouped into two general classes—cool season crops and warm season crops. The former grow best at cool temperatures in spring and fall and will tolerate frost; the latter grow best at warm temperatures in summer and will not tolerate frost.

Approximate time for planting each cool and warm season crop is given in table 2. More specific information on dates of planting specific crops for your area is given in the Extension fact sheet, "Vegetable Varieties for South Dakota." Your own experience and the advice of experienced gardeners should be helpful, particularly in the Black Hills area because of variations in elevation and climate.

### Seeds

Good seed or healthy transplants are essential for a successful garden. The cost of the seed or transplant is a very small item when compared with the value of the vegetables harvested. Good seed is clean, germinates readily, is free from disease, and is true to name. To be certain of pure seed, purchase only from a reliable seed firm. In general, it is not the best practice to save seed from home garden plantings. Left over seed can be used with fairly satisfactory results the second year. Never save seed from hybrids for replanting. They do not come true.

It is a good plan to treat all seeds with a fungicide such as thiram, captan, or chloranil (unless already treated) to prevent decay of the seeds or death of young seedlings due to soil-borne diseases. Place a small pinch of the fungicide in the seed packet and shake vigorously to coat all seeds thoroughly.

For quantity of seed to sow for a given length of row and kind of vegetable, and for depth of sowing, consult table 4. If the seeds are planted too thick, the resulting seedlings will be crowded and will grow spindly. In addition the job of thinning will be more tedious. Seeds can be sown somewhat deeper than recommended in table 4 if the soil is sandy or if sown in summer when the surface soil may be dry.

After covering the seed, firm the soil (do not pack) with the back of the hoe. This insures better contact of seed with soil and gives faster, more even germination. If the soil is heavy and a crust forms after a rain, scatter lawn clippings lightly over the newly seeded row.

The distances to allow between rows and between plants in the row (after thinning) are also given in table 4. Use the narrower spacings if (1) you cultivate with a hand hoe or wheel hoe or (2) water is available for irrigation.



**Table 2. Temperature Requirements and Time of Planting of Annual Vegetable Crops**

**Cool Season Crops**

**Group A. Will not grow well in hot weather. Should be planted in April or early May.**

Spinach	Peas
Head lettuce*	Cauliflower*
Radishes	

**Group B. Tolerate some hot weather. Can be planted as early as crops in Group A or shortly afterwards.**

Broccoli*	Onions
Cabbage*	Chard
Leaf lettuce	Irish potatoes
Carrots	Turnips
Beets	Celery (plant in May)
Kohlrabi	

**Warm Season Crops**

**Group C. Damaged by frost and will not grow well in cool weather. Should be planted after the danger of frost.**

Tomatoes*	Lima beans
Sweet corn	Pepper*
Squash	Muskmelons
Pumpkins	Watermelons
Cucumbers	Eggplant*
Snap beans	

\*Generally transplanted

**Transplants**

To get earlier and larger yields and to lengthen the harvest season, use transplants (6-8 week old seedlings) for many crops. Such crops as early cabbage and tomatoes require too long to reach the productive stage if seed is sown directly outdoors. Vegetables commonly transplanted are marked with an asterisk in table 2. Vegetables other than these are not commonly transplanted or do not transplant well. However, if grown in individual containers, and if roots are not disturbed when the plants are set in the garden, cucumbers, squash, muskmelons, and watermelons can be transplanted successfully.

Transplants can be started indoors in a home, in coldframes or hotbeds, or they can be purchased. In many cases it is easier and cheaper to buy transplants. Be sure to get stocky, well grown plants not tall spindly ones. Two advantages of growing transplants yourself are (1) you can grow the variety you want and (2) they will be on hand when you want them, generally in better condition than purchased plants.

Plant growing requires some skill and care. Factors such as light, temperature, moisture, and space must be considered. Seedlings should have at least 6 hours of sunlight for best growth. Almost any container can be used—clay pots or wooden flats are good. Vermiculite, or mixtures of soil with vermiculite, sand, or peat can be used. It is a good idea to fumigate both the container and the media. Small quantities can be treated in the oven for 1 hour at 225° F. With larger quantities use chemical fumigants such as Mylone or

Vapam. Use with caution. Treat soil 10 to 14 days before use. Treat the seed with a fungicide such as thiram, captan, or chloranil.

After the seedlings have developed one pair of true leaves, transplant them to containers filled with good garden soil. About 10 days before you expect to plant outdoors, "harden off" the young transplants by reducing the water supply and by gradually exposing them to cooler temperatures. This enables the plant to withstand the shock of transplanting and the less favorable growing conditions outdoors.

When transplants are set outdoors, the mass of roots and soil should be disturbed as little as possible. Dig a hole wider and deeper than the root ball, setting the plant somewhat deeper than it was originally growing. Fill around with soil and press down firmly to insure contact with the roots so that no air pockets remain. Water the plants, or better, use a "starter solution."

**Starter Solution**

A starter solution is a water solution of fertilizer applied to transplants immediately after planting. It provides the plant with readily available nutrients which stimulate growth and generally results in earlier, larger yields.

A starter solution can be made by dissolving 2 ounces of 5-10-5 or 1 ounce of 12-12-12 fertilizer to a gallon of water. One cup per plant of this solution will generally give a vigorous start to such plants as tomato, pepper, and cabbage. Some gardeners apply a material such as 8-32-16 in a trench around the transplant at the rate of a handful per plant. Overfertilization with nitrogen early in the season can reduce fruit production. Commercial preparations of completely soluble fertilizers are also available, but at higher cost. Follow directions on the label if these materials are used.

**Plant Protection Devices**

Many crops can be transplanted outdoors earlier and will give earlier yields if they are protected during the first 2 or 3 weeks of growth. Examples of plant protectors are hotcaps, hotents, polyethylene "in-the-row" greenhouses, glass, sheets of treated paper, and shingles. All but the latter can be purchased from seed firms, seed stores, or some hardware stores. These give some protection against cold temperatures and winds, and some will protect from light frost. On sunny days ventilation must be provided or temperatures will become too high under the protectors. Whatever type is used, it should be anchored securely in the soil to prevent its being blown off and injuring the plant.

**IRRIGATING**

**Vegetable Needs**

Moisture is a limiting factor in growing vegetables in South Dakota. For best growth most vegetables re-



quire 1½ to 2 inches of water per week during the warm part of the growing season. There are several benefits from irrigation: yields are increased, quality is improved, earlier harvest may result, succession plantings of quick growing crops are possible, and drought sensitive crops such as celery, head lettuce, and cauliflower may be grown successfully.

Not all water in South Dakota is suitable for irrigation. If you are doubtful about the suitability of the water, check with your county extension agent for information on how to have your water tested.

#### Methods

Methods of irrigation feasible for the garden include:

**Furrow.** Water is applied by allowing it to run down furrows between the plant rows. An area with a gentle slope is necessary. Short rows are more uniformly wetted than long rows. Advantages of furrow irrigation are that water under pressure is not needed and less equipment is used.

**Perforated plastic hose.** Water is distributed by a plastic hose containing many small holes on the top-side. The area wetted is usually 10-20 feet on either side of the hose. Plastic hose is relatively cheap and lasts several years. It can also be used on lawns, flowers, and woody plants.

**Lawn sprinklers.** Many lawn sprinklers apply water too rapidly for some soils. If so, start and stop the sprinkler at 30 minute or hour intervals until enough water has been applied.

**Rotary irrigation sprinkler.** This type sprinkler is excellent for larger gardens. Water can be applied more slowly, more uniformly, and over a larger area than with the lawn sprinkler. These sprinklers can be attached to a garden hose or to portable aluminum pipe.

When irrigating with sprinklers be sure the areas irrigated overlap for complete coverage.

#### When and How Much to Irrigate

This depends largely on the moisture content of the soil. In South Dakota as much as ¼ inch of soil moisture may be lost on a hot summer day through evaporation and transpiration. The dry appearance of the crop should never be used as a guide, because by that time it is too late to irrigate. A rough measure is when a handful of soil obtained at a depth of 6 to 9 inches barely forms a ball when squeezed firmly in the hand. A better measure is to irrigate at least once a week unless the rainfall during the week totaled at least 1½ to 2 inches and fell in amounts greater than ⅓ inch each time.

As a general rule, water should be applied at a rate so that puddles do not form—in other words not any faster than the soil can absorb it. This will vary with different soils. It is important to soak the soil to a depth of at least 12 inches. With furrow irrigation this

can be checked by digging to that depth a few hours after irrigating. With sprinkler irrigation place three or four coffee cans at random within the sprinkler pattern. When the average depth of water in the cans is 2 inches, stop irrigating. The gardener will soon learn by experience how much water to apply.

It is advisable to water the garden before noon so that free water from the leaves may have a chance to evaporate in the afternoon. This will reduce the possibility of foliage disease infection in the garden.

#### WEED CONTROL

Weeds rob garden plants of water, nutrients, and even space and light. The most effective methods of weed control in the home garden are hand weeding and cultivation.

##### Cultivation

This can be accomplished by using a hand hoe, a wheel hoe, or by attaching cultivating blades to a garden tractor. Do not cultivate deeper than 1 inch to avoid injuring plant roots near the soil surface. The best time to cultivate is as soon after each rain or irrigation application as the soil is dry enough to be worked.

The object is to uproot and expose weed seedlings and germinating weed seeds so they will be killed. A conscientious cultivation program will prevent most weeds from growing and producing seed. This makes the job easier the following year. Except for special problems such as with heavy soils, cultivation is done only to control weeds.

##### Herbicides

Many chemicals are available for weed control. The majority of these are used rather specifically with certain crops. There is no chemical weed killer at present which can be used safely in the home garden to control all weeds in all vegetables. Because of this and other problems, it is **not recommended that the home gardener concern himself with chemical weed control.**

On larger plots with fewer kinds of vegetables, chemical weed control may be practical. For more information check with your local County Extension Agent and SDSU specialists.

#### MULCHING

Mulching is the practice of covering the soil around your vegetables with protective material. It is particularly important in South Dakota because low rainfall makes it necessary to conserve moisture whenever possible. In areas where water is not suitable for irrigation, the use of a mulch should help considerably in growing vegetables.

Most vegetables benefit from mulching. Tomatoes, cucumbers, melons, and beans are some of the crops most practical to mulch. Besides controlling weeds, the mulch will conserve moisture, regulate the soil



temperature, keep the fruit clean, eliminate injury to crops by cultivation, and prevent erosion. Mulching makes gardening easier and may increase yield. After the mulch is put down, cultivation is unnecessary for the rest of the season.

Leaves, grass cuttings, sawdust, crushed corncobs, straw, hay, and black plastic can be used for mulch.

Organic mulch should be weed free. Place organic mulch such as sawdust, leaves, straw, or hay on the soil after the plants are well established, usually just after the first cultivation. Spread the material evenly over the soil between rows and around plants. The thickness of the mulch depends on the material and its cost. Mulch such as leaves and straw or hay is applied about 3 inches deep.

Some organic mulches may cause a nitrogen deficiency to develop in the garden because organisms that decompose the organic matter compete with the vegetables for the nitrogen. To prevent a lack of this nutrient, add extra nitrogen with the mulching material. One advantage of organic mulch is that when turned under (at end of the growing season), it will add organic matter to the soil. Turning under a mulch should also be accompanied by an application of nitrogenous fertilizer.

Black plastic, specifically for mulching, is now on the market. The material comes in rolls of various widths (usually 36-48 inches) and is unrolled over the prepared, well fertilized seedbed before planting. The edges of the material are anchored in small furrows about 2 inches deep, with soil on top of the edges. Make the furrows before the plastic is rolled out. After the material is rolled out over the soil, plant vegetable transplants through holes cut in the mulch at the desired spacing.

## INSECT AND DISEASE CONTROL

Many problems that occur in vegetable gardens can be controlled if proper preventative steps are taken. Insects and diseases can quickly ruin a promising crop. Even if the plants survive, yield is reduced, quality is lowered, money and time are wasted, and keeping quality and storage life of many vegetables is decreased. Some insects and diseases may carry over to the following year and make control more of a problem in the future.

There are several ways in which the insect and disease problem can be reduced and possibly eliminated. Use as many of these practices as possible for effective pest control.

**Disease resistant varieties.** Although there are few if any vegetable varieties resistant to insects, there are many good varieties that are resistant to certain diseases. These should be planted wherever possible.

**Seed treatment** is an inexpensive means of controlling diseases of young seedlings. Some seed com-

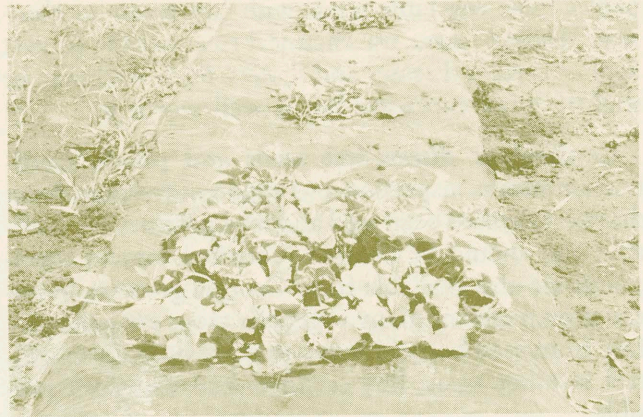


Figure 8. Black polyethylene plastic mulch will control weeds, conserve moisture, and absorb heat for warm season crops.



Figure 9. Red Pontiac potatoes planted at the same time. On the right: rows were planted with certified seed. On the left: rows were planted with non-certified seed. Compare stand and vigor of the plants.



Figure 10. Cover the plant thoroughly with spray or dust for best results.



panies treat vegetable seeds with hot water to eliminate diseases; some use chemical treatment to protect against certain diseases and insects. Such seed may be slightly more expensive but is well worth it.

**Certified or disease-free seeds and plants.** Certification means inspection and apparent freedom from disease. Certified bean seed and seed potatoes are available and should be planted. Certified tomato transplants are also available from Georgia growers. Western grown seed of many vegetable crops are generally free from seed borne diseases that are difficult to control in other areas. Buy certified seed whenever possible.

**Rotation.** Rotating the garden from one area to another each year or rotating crops in a single area helps reduce the insect and disease problem.

**Sanitation.** Plant remains including roots should be burned or destroyed. Many diseases and some insects overwinter in dead plants. They can then become the source of an outbreak the following year. Do not put diseased plants in the compost heap.

**Controlling weeds.** Many weeds around the garden harbor insects and diseases. Keeping such weeds under control will aid in the pest control program.

**Spraying and dusting.** This is probably the most widely used insect and disease control measure. Insecticides and fungicides (chemicals used to control insects and diseases, respectively) may be applied either as a dust or spray. Dusts are easier to apply but sprays adhere better and give better coverage.

Whether you spray or dust, it is important to start prior to the first sign of the disease or insect damage. This will prevent a buildup and make control easier.

For further information see your local County Extension Agent and SDSU specialists and refer to USDA Home and Garden Bulletin No. 46—"Insects and Diseases of Vegetables in the Home Garden." (May 1971)

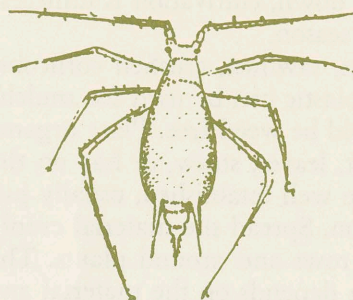
#### Identification of Insects and Diseases

If you cannot identify a disease or insect and thus do not know how to treat it, take a specimen (roots and all) of the affected plant or the insect to your county Extension agent or send in a specimen to the Extension Entomologist, or Horticulturist at South Dakota State University, Brookings. Mail so as to avoid week-end layovers in the post office.

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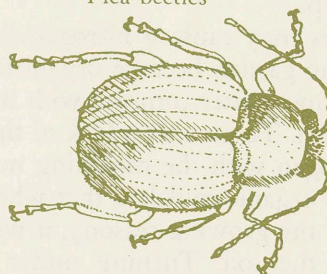
### Common Garden Insects

Aphids or plant lice



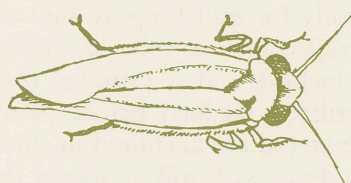
Small, soft-bodies, green to black. Generally clustered on stems and undersides of leaves.

Flea beetles



Small rounded beetles, grey to black, have flea-like pumping habit. Cause characteristic "shot-hole" damage in leaves.

Leafhoppers



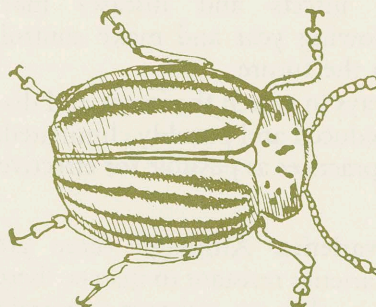
Small wedge-shaped bodies, greenish color, have a characteristic jumping habit.

Cabbage caterpillars



Velvety green, chewing caterpillars; chew large holes in leaves and heads. Adults are white butterflies.

Colorado potato beetle

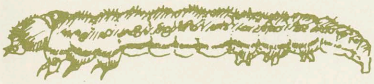


A yellow and black striped beetle about  $\frac{3}{8}$ " long. Larvae are soft bodied, red, spotted with black. Will defoliate plants if allowed to become numerous.



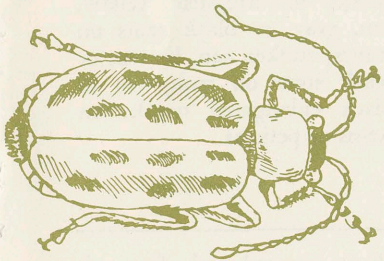
## Common Garden Insects

Corn earworms

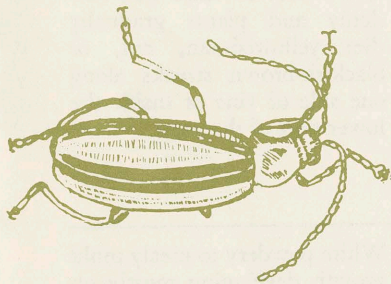


Caterpillar with brown or green stripes. Enter the ear through the silk channel in the husks and feed on the tip of the ear.

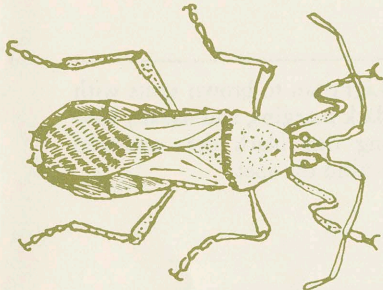
Cucumber beetles



About  $\frac{1}{5}$ " long, spotted beetle, yellow to dark green wing covers. Striped beetle about  $\frac{1}{5}$ " long, yellow with 3 black stripes on the wing covers. Both species eat holes in the leaves of young plants.

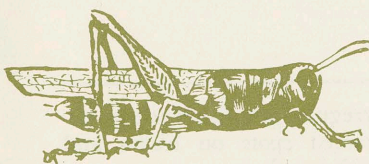


Squash bug



Brown to black, flattened bugs. Will emit an unpleasant odor when disturbed.

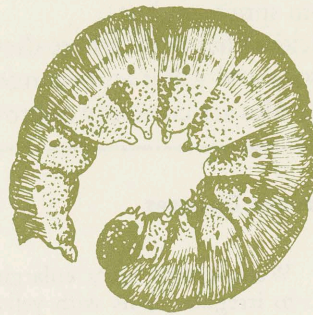
Grasshoppers



Vari-colored. Insects, running to browns, greys, blacks or yellows. May vary from  $\frac{1}{4}$ " in length as nymphs to 2" ad. adults. Strong hind legs adapted for jumping; many hoppers are also strong flyers.

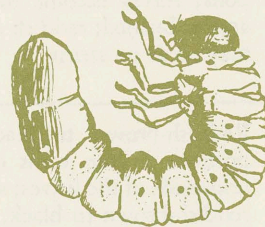
## Common Garden Insects

Cutworm



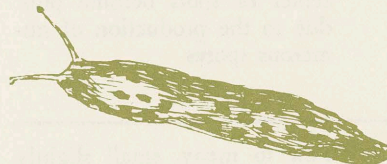
Dull grey-brown, striped or spotted, stout, soft-bodied caterpillars. Will curl up tightly when disturbed. Adult is a grey-brown "miller" or moth.

White Grub



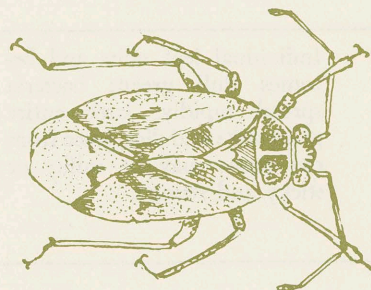
White or cream-yellow larvae with a brown head. Bodies are curved, from  $\frac{1}{2}$  to  $1\frac{1}{2}$  inch long. Adult is a large brown to black beetle. Larvae cause damage to plant roots.

Slugs



Greyish, legless, slimy wormlike creatures. Will be found in dark, damp places. Leave to feed at night. They are not insects but close relatives of snails.

Plant Bugs



They are true bugs that feed on the foliage of certain vegetables. Feeding leaves plants with a burned appearance. The plant bugs come in a variety of shapes, sizes, and colors.



## SPECIAL PRECAUTIONS

1. Use pesticides only on garden crops for which they are specifically recommended.
2. Apply chemicals when they are specified on the label. Be especially careful to observe the proper intervals between treatment and harvest.
3. Guard against drift from sprays or dusts.
4. Be careful to store pesticidal chemicals where they may be kept under lock and key.
5. **Always** wash up with soap and water and change your clothing after finishing each spray job.
6. Check to see which pesticides are currently approved for use.

### Common Garden Diseases

Bean blights (bacterial)      Water-soaked spots enlarging to irregular spots with yellow or reddish-brown margins; spots occur on leaves, stems, or pods; leaves become dry and appear burned; reddish streaks may occur on stems

Bean anthracnose (fungus)      Reddish-brown to blackened portions in the veins on the underside of the leaves; sunken reddish-brown to black, somewhat circular spots on the stems and pods; when wet, center of spots become pink due to the production of numerous spores

Bean rust (fungus)      Few to many, small slightly raised and distinct reddish-brown circular pustules, mostly on the undersides of the leaves but may occur on pods and stems; on certain varieties the rust pustules may have a yellow halo

Bacterial wilt on cucurbits (cucumber, squash muskmelon, pumpkin)      Individual leaf wilts and becomes dull green; bacteria spread rapidly, later entire plant wilts and dies; juice from cut stems may be milky or sticky and stringy.

Potato scab (fungus)      Rough, scabby, raised or pitted areas on tubers

Blossom-end rot on tomatoes (not a true disease)      Large, sunken leathery spots at blossom end of fruit. Usually associated with a sudden lack of water

### Common Garden Diseases

Leaf and fruit spots on cucurbits (caused by several different organisms)      Small pale green to water-soaked spots enlarging to round to irregular yellow, tan, gray, or black spots on leaves; sunken tan, brown, or black spots on fruit; tan to black elongated streaks on stems or petioles

Fusarium (fungus) wilt of cucurbits, peas, and tomatoes      Plants stunted and often yellow; leaves or vines wilt suddenly and plants gradually die; yellowish-tan, red, or blackish-brown streaks along one side of vine or inside the lower part of the stem

Mildew (fungus) peas, cucumbers, and occasionally on other vegetables      White powdery to mealy mold growth developing mostly on the upper side of the leaves

Septoria leaf blight on tomatoes (fungus)      Light tan to brown spots with dark margins, and usually having tiny black dots scattered within the spot

Early blight (fungus) on potatoes and tomatoes      Dark brown to black spots on leaves, most spots are irregular and have concentric rings (target spots)

Late blight (fungus) on potatoes and to tomatoes      Irregular greenish-black water-soaked spots on leaves and fruit or tubers



## PRESERVATION AND STORAGE

By planting larger amounts of many crops than can be used fresh, a family will have a surplus for freezing, canning, or storing. This makes a garden more economical, and it is possible to have high quality vegetables the year around.

Most vegetables can be frozen or canned. In many cases the frozen product closely approaches the fresh product in quality. With some vegetable canning is the only satisfactory method. Not all vegetable varieties can be canned or frozen with good results. Consult Extension Leaflet 203 for varieties suitable for processing.

### Storage

Storage makes it possible to hold vegetables in good condition for several weeks to several months. Storage places can be cellars of houses, barns, or other buildings, or they can be outdoor banks, pits, or mounds. Cellars, if they can be kept cold enough, are usually better for prolonged storage or during periods of very low temperatures. Temperature, humidity, and ventilation are the important factors in vegetable storage. Different kinds of vegetables require different storage conditions. Table 3 gives temperature and humidity requirements for some commonly stored vegetables.

## PERENNIAL CROPS

Asparagus and rhubarb are the two perennial vegetables commonly grown in South Dakota. In an area about 6 feet square, if the plants are set 1½ feet apart,

or a row about 25 feet long with plants 1½ feet apart, will supply more than enough fresh asparagus for an average family. Three hills (plants) of rhubarb spaced 3 feet apart should provide all the family can use.

**Asparagus.** The best way to start an asparagus planting is to purchase 1 year old roots. Set the plants 6 to 8 inches deep in a hole or furrow and cover with 2 inches of soil. The remaining soil can be filled in as the young shoots grow. No spears should be cut the first 2 years. Thereafter spears can be harvested annually up to July 1. Then allow the tops to grow until killed by frost. Remove old tops before spring growth begins.

**Rhubarb.** The usual method of starting rhubarb is to obtain pieces of the crown having at least one good bud. These pieces are planted 3 to 4 inches deep and covered with about 1 inch of soil or just enough to cover the bud. No stalks should be harvested until the second year. Remove flower stalks that form as soon as noticed. The harvest season will extend from 4 to 8 weeks, depending on the age of the plants.

Both of these crops are heavy feeders. To keep the plants growing and yielding well, apply fertilizer or manure. Mix a spadeful of well-rotted manure or 2 to 3 tablespoonsful of garden fertilizer in the soil before planting. After the plants have become established, manure can be applied in the spring while fertilizer can be added after the final harvest in early summer.

Table 3. Storage Requirements for Vegetables

Cool and moist 32° F-40° F) High humidity	Cool and dry (32° F-40° F) Low humidity	Warm and moist (55° F-65° F) High humidity	Warm and dry (55° F-60° F) Low humidity
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### Group I

Carrots	Onions	Green tomatoes	Squash
Beets	Dry beans	Sweet potatoes	Pumpkins
Parsnips			
Rutabagas			
Turnips			

### Group II

Potatoes
Cabbage
Cauliflower

Vegetables in Group I will store longer and remain in better condition if placed in perforated polyethylene bags. Cabbage will store better if the entire plant is harvested and the roots placed in moist sand. Harvest large green tomatoes before frost. Be sure all vegetables to be stored are free of disease. Handle carefully to avoid bruising.

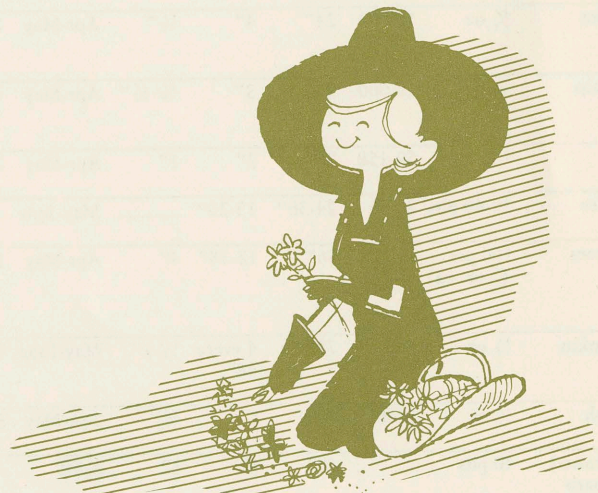




Table 4. Planting Details for Home Gardens in South Dakota

Vegetable	Seeds per 100' row	Approx. no. good plts. per oz. of seed	Distance between rows	Plts. apart in a row	Depth of pltg.	Time of pltg.	Approx. days to germin.	Ready for use from date of pltg.	Length of time a good specimen can be harvest.	Aprox. plt. per person per year		Nutrient Assets	Frost hardy	When to harvest
										Fresh	Process			
Asparagus	66 crowns	.....	36"	18"	8-10"	April	.....	2-3 yr	til July 1	10-15"	10-15'	Vit. A & C	Yes	When spears are 6-8" long
Pole Beans, Lima Bush	½ lb	20-70	30"	36"	1"	2 wks after frost	5-10	80-90	3-4 wks	5 hill	5 hill	Vit. A, B, C & B <sub>2</sub> , Ca, P, Fe	No	Just before pods reach full size and plumpness
Beans, Snap Bush	½ lb	80	30"	36"	1"	May to	5-10	60-65	3-4 wks	5 hill	5 hill	Vit. A, B, C & B <sub>2</sub> , Ca, P, Fe	No	Before pods are full size and white seeds are about ¼ developed
Beans, Snap Bush	1 lb		24"	3"	1"	July	4-8	50-60						
Beets	1 oz.	1,500	12-18"	2-3"	½"	Apr-July	7-12	50-65	1-2 wks	5-10'	20-30'	Vit. A, B, C, B <sub>2</sub> Semi		When 1-2" in diameter
Broccoli	66 plts.	7,000	24-36"	18-24"	.....	Apr-May	.....	65-75	1-2 wks	5	5	Vit. A, B <sub>2</sub> , C Ca, P, Fe	Yes	Before dark green blossom clusters begin to open
Cabbage	66 plts.	7,000	24"	18"	.....	Apr-May	.....	60-90	2-3 wks	3-5	1	Vit. C, Ca	Yes	When heads are of desirable size before they split
Carrots	½ oz.	16,000	12-18"	2"	¼"	Apr-June	7-14	55-80	2-4 wks	10'	5'	Vit. A, Ca	Semi	When root is 1-1½" diameter
Cauliflower	66 plts.	8,000	24"	18"	.....	Apr-June	.....	65-75	2-3 wks	3 heads	6 heads	Vit. A, B, B <sub>2</sub>	Semi	Before heads are blemished. Tie onto leaves above head when curd is about 2" diam.
Corn, Sweet	2 oz.	100-150	30-36"	8-10"	½-1"	May-July	5-12	65-95	1 wk	15'	15'	Vit. A, B starch, P	No	When kernels are fully filled out and in milk stage
Cucumbers	½ oz.	800	48-72"	12"	½-1"	May-June	7-10	50-70	several weeks	5'	3'	Vit. A, B, C, B <sub>2</sub>	No	When fruit is dark green and slender
Egg Plant	50 plts.	5,000	36"	24"	.....	May-June	.....	80-90	until frost	2'	.....	Vit. A, B, C, B <sub>2</sub>	No	When fruits are ¾ grown. Before color becomes dull
Kohlrabi	½ oz	7,000	24"	4"	¼-½"	Apr-May	6-9	50-70	2 wks	3-5'	.....	Vit. C, Ca	Yes	When crowns 2-3" in diameter
Leaf Lettuce Head	½ oz	22,000	14"	3"	¼"	Apr-May	5-10	35-50	2-3 wks	10'	.....	Vit. A, B, C & B <sub>2</sub> , Fe, Ca	Semi	When leaves reach desirable size and are still tender. When heads are firm
Muskmelon	1 pkt	1,000	48-72"	24"	½-1"	May-June	7-12	70-100	until hard frost	10'	.....	Vit. C	No	When stem easily slips from the fruit leaving clean scar
Seed Onions Sets	½ oz	9,000	12-18"	2-3"	¼"	Apr-May	7-12	85-100	.....	25-50'	.....	Vit. C, Ca	Yes	For storage—when tops fall over. For fresh table use, when ¼-¾" diameter
Parsley	½ oz	15,000	24"	4"	½"	Apr-May	14-21	75-90	until hard frost	8-10'	.....	Vit. A, C	Yes	Anytime after leaves are ready for use
Parsnip	½ oz	10,000	24"	3"	¼-½"	Apr-May	14-21	120-150	until hard frost	10'	.....	Vit. B & C, Ca, P	Yes	When the roots reach desirable size
Peas	1 lb	50-150	24"	2"	1"	Apr-May	7-10	50-80	1 wk.	10-15'	15'	Vit. B, P, Fe	Yes	When pods are well filled
Pepper	30-60 plts	3,500	24-30"	15-20"	.....	May-June	.....	60-100	2-3 wks	2-3 plt	.....	Vit. C	No	When fruit reaches desirable size
Potatoes	100 pcs (2 oz. ea)	.....	36"	12-18"	4"	Apr-May	14-21	100-120	until frost	50-75'	.....	Vit. B & C, starch	Semi	When tubers are large enough. Tubers grow till vines die
Pumpkin	½ oz	100	72"	4 every 48"	½-1"	May-June	7-14	100-120	2-3 wks	3 hill	.....	Vit. A	No	Skins should be hard and mature on the vine
Radish	½ oz	1,500	12"	1"	¼"	Apr-May	3-7	22-35	3-5 day	10'	.....	Vit. B & C	Yes	When desirable size
(crown) Rhubarb	40 plts	.....	48"	30"	8"	April	.....	1 yr.	1 wk	6'	6'	Vit. C	Yes	8-10 weeks in the spring



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									2-3 wks	2 hill	Fresh	Process			
Summer Squash	½ oz	250	36-48"	4 every 48"	1"	May-June	7-10	50-70	2-3 wks	2 hill	.....	Vit. A & B, B <sup>2</sup>	No	In early immature stage, when skin is soft	
Tomatoes	40 plts	10,000	48"	18-36"	.....	May-June	.....	55-90	until frost	3-5 plts	5 plts	Vit. C	No	When fruit is of uniform color, before they are soft	
Turnips	½ oz	11,000	18"	6"	¼-½"	Apr-June	5-10	40-50	1-2-wks	10'	.....	Vit. A & C, Ca	Yes	When 2-3" in diameter	
Watermelon	1 oz	200-250	72-96"	4 every 48"	1"	May-June	7-12	80-130	until frost	3 hills	.....	Vit. C	No	When underside of the fruit turns yellow	

**ACKNOWLEDGEMENT**

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