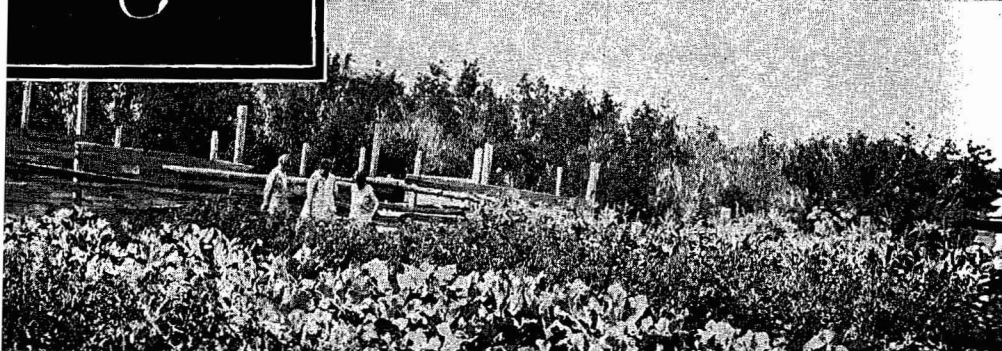




The
MONTANA
FARM
GARDEN
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INTRODUCTION

Few people think about gardening when the snow lies deepest, but that is when there is the most leisure for deciding the kind and amount of each vegetable to be grown and for ordering seed. Buying seed early is important. Such a practice will usually insure a better selection of varieties, if not a better grade of seed, and late buying may mean a delay in planting. If a well arranged, systematic plan is worked out before hand, time, space, and labor will be saved when seeding time arrives. A systematic planting plan involves the grouping of vegetables according to season of planting, and also grouping together those crops which require about the same length of time to mature.

There are many different kinds of vegetables which can be grown in Montana, thus affording a wide range of healthful, nutritious foods. In addition to supplying fresh vegetables in season, many crops can be canned, dried, pickled, or stored and kept in fresh condition, thus providing an ample supply through the winter months. The necessity of an abundance of fruit and vegetables in the diet for the maintenance of good health is widely recognized. With a well selected variety of fruits and vegetables produced on the farm, the family will use more than if they have to be purchased and better balanced meals are possible. Investigations show that such vegetables as spinach, cabbage, carrots, lettuce, tomatoes, asparagus and chard are especially high in the vitamins which it is believed are essential for growth and well being. Vegetables are also a good source of such minerals as calcium, phosphorus, and iron which are essential elements in the human body.

The Montana Farm Garden

By

E. E. ISAAC, Horticultural Specialist

A certain quantity of bulk food is necessary for good health, and vegetables are the main source of "roughage." Because of their succulence and relatively large bulk the leafy vegetables and most of the root crops probably aid in the digestion of the more concentrated foods.

The slogan "Eat vegetables for vitamins" is a sound one. The name "vitamin" has been given to a group of food substances that have been found necessary for growth and health. These vitamins have been classified as A, B, C, D, and E. The farm garden can supply all of these except vitamin D. Table 1 gives the relative distribution of vitamins A, B and C in many vegetables as reported by Smith in U. S. Department of Agriculture Circular 11 (1929). In this table "x" indicates that the food contains a small amount of the vitamin; "xx" indicates that the vegetable is a good source; "xxx" indicates the vegetable is an excellent source; "—" indicates that the vegetable contains no appreciable quantity; "*" indicates lacking in vitamins, or appearing insufficient.

TABLE 1—VITAMIN CONTENT OF DIFFERENT VEGETABLES

Vegetable	Vitamin		
	A	B	C
Asparagus	xx	*	*
Beans, string (cooked)	*	x to xx	*
Beets, leaves	xx	xx	*
Beets, roots	— to x	x	x
Cabbage (cooked)	x	xx	x
Cabbage (raw)	x	xx	xxx
Carrot (raw) young	xxx	xx	xx
Carrot (cooked) young	*	xx	x
Celery	— to x	xx	*
Chard	xx	*	*
Lettuce, head	x to xx	xx	xxx
Lettuce, leaves, green	xxx	xx	xxx
Onion (cooked)	— to x	x	x
Onion (raw)	— to x	x	xx
Peas	xx	x to xx	xx
Potato, baked	x	xx	x to xx
Potato, boiled	x	xx	x
Spinach	xxx	x	x to xx
Tomato	xx	xx	xxx
Turnip	— to x	xx	xx

Location of the garden. Any piece of land having soil suitable to raise good grain crops may be selected for the production of vegetables. The garden, however, should have a permanent location in order to permit building up the soil to the point where maximum production can be secured. To be of greatest value to the housewife, it must be near the house. The nearer the dwelling the greater the convenience in cultivating and harvesting. A level piece of land or one having a very slight slope to the north or northeast is most desirable. Steep grades are subject to washing. A slight slope to the northeast is not likely to be affected to as great an extent by drying hot winds as is a southwest slope. Protection from high winds, especially from the south and west, is desirable. A few rows of trees on the south and west will check the drying winds of summer, while a garden located with a shelter belt on the north will be likely to be covered deeply by drifting snows which upon melting will be stored in the subsoil and serve as a reserve supply of moisture throughout the growing season.

Size of the garden. On most farms the possibilities of the home garden are not fully realized. A garden of sufficient size is omitted in many cases for fear that too much labor will be involved. The way to reduce labor in a farm garden is to increase its size and introduce field methods of tillage. Planting the crop in long straight rows will facilitate horse cultivation.

Estimating family needs. The home garden should be planned for the particular home it is to serve. Family needs and preferences should guide its making. Every family has varying tastes, as well as individual members of a family. With the wide range of vegetables from which to choose it is possible to supply the wants and needs of every individual. A carefully planned garden will include a list of varieties so that there will be a succession of crops maturing, beginning with the very earliest kinds and extending throughout the entire growing season. A study of Table 1 will help in selecting the varieties that provide the necessary vitamins throughout the season. Should the members of the family be especially fond of some particular vegetable, a larger amount of that crop should be planted. From Table 2 can be determined the length of row required to produce the amount required of each crop and the amount of seed necessary for planting. Yields in this table are based on normal production. Allowance should be made for possible drought with such crops as are used for preservation and storage.

TABLE 2—PLANTING TABLE AND YIELDS

Crop	Variety	Number of plants or amount of seed per 100-ft. row	Planting distance (in.)				Depth of planting (in.)	Approximate yield per 100-ft. row	
			Between rows			Dry land garden		Irrigated garden	
			Horse cultivation	Hand cultivation	Between plants in row				
ASPARAGUS	Mary Washington	65 plants	48	48	18	6-8	15 lbs	25 lbs.	
BEANS, SNAP	Stringless Greenpod, Bountiful	$\frac{1}{2}$ lb.	30-36	24	3-4	1-1 $\frac{1}{2}$	1 bu.	2 $\frac{1}{2}$ bu.	
	Roundpod Wax								
BEANS, DRY SHELL	Great Northern	$\frac{1}{2}$ lb.	30-36	24	3-4	1-1 $\frac{1}{2}$	4-6 lbs.	8 lbs.	
BEETS	Crosby's Egyptian, early								
	Detroit Dark Red, late	1 oz.	30-36	15-18	2-3	$\frac{1}{2}$ -1	50 lbs.	100 lbs.	
	Long Season, for storage								
CABBAGE	Copenhagen Market	1 pkt.	36	24-30	18-24	$\frac{1}{2}$	150 lbs.	250 lbs.	
	Danish Roundhead								
CABBAGE, CHINESE	Wong Bok, Pe Tsai	1 pkt.	30-36	18-24	15-18	$\frac{1}{2}$	50 heads	75-90 heads	
CARROT	Chantenay, Coreless	$\frac{1}{2}$ oz.	30-36	15-18	2-3	$\frac{1}{2}$	50-100 lbs.	200 lbs.	
CAULIFLOWER	Snowball, Weather	1 pkt.	30-36	24	18	$\frac{1}{2}$	Uncertain crop	40-50 heads	
CELERY	Golden Plume, Utah Golden Crisp	1 pkt.	36-48	36-48	6-9	$\frac{1}{4}$	100-150 heads	150 heads	
CHARD, SWISS	Lucullus, Fordhook Giant	1 oz.	30-36	24	8-12	$\frac{1}{2}$ -1	125 lbs.	300 lbs.	
CORN, SWEET	Sunshine, Golden Bantam, Golden Gem	$\frac{1}{4}$ lb.	36	30-36	18-24	1-2	65-75 ears	150 ears	
CUCUMBER	Davis Perfect, Chicago Pickling	$\frac{1}{2}$ oz.	48	48	48	$\frac{1}{2}$ -1	1-2 pecks	2-3 pecks	
EGG PLANT	Black Beauty	1 pkt.	30-36	24	18-24	$\frac{1}{2}$	75 fruits	125 fruits	
KOHLRABI	White Vienna	$\frac{1}{2}$ oz.	30-36	24	18-24	$\frac{1}{2}$	$\frac{1}{2}$ bu.	2 bu.	
LETTUCE, LEAF	Grand Rapids	$\frac{1}{4}$ oz.	30	12-18	3-5	$\frac{1}{2}$	25-40 ft. row	12-25 ft. row	
							sufficient	sufficient	
LETTUCE, HEAD	New York Wonderful, No. 12	$\frac{1}{4}$ oz.	30	18	10-12	$\frac{1}{2}$	25-30 heads	50-70 heads	
MUSKMELON	Emerald Gem, Hale's Best	$\frac{1}{2}$ oz.	48	48	48	$\frac{1}{2}$ -1	50-75 melons	100-150 melons	
	Osage, Golden Champion								
ONION, SETS	Yellow Globe	2 qts.	30	15-18	2-3	1-1 $\frac{1}{2}$	1-2 pecks	1 bu.	
ONION, SEED	Ebenezer, Yellow Globe	1 oz.	30	15-18	2-3	$\frac{3}{4}$	1-2 pecks	1-1 $\frac{1}{2}$ bu.	
PARSNIP	Hollow Crown	$\frac{1}{2}$ oz.	30-36	15-18	3-4	$\frac{3}{4}$	56-60 lbs.	150-200 lbs.	
PEAS	Alaska, Laxton's Progress	1 lb.	30-36	18	1-2	1-2	20 qts.	35-40 qts.	
PEPPER	California Wonder	1 pkt.	30-36	18	18	$\frac{1}{2}$	100 fruits	200 fruits	
PUMPKIN	Small Sugar, Winter Luxury	$\frac{1}{2}$ oz.	96	96	96	1	150 lbs.	350 lbs.	
RADISH	Scarlet Globe, White Icicle	1 oz.	30	12-18	$\frac{1}{2}$ -1	$\frac{1}{2}$	1 doz. per 1 ft. of row	2 doz. per 1 ft. of row	
RHUBARB	MacDonald, Mammoth Red	25 plants	48	48	48	2-3	50-100 lbs.	100-200 lbs.	
RUTABAGA	Purple Top, Yellow	$\frac{1}{2}$ oz.	30-36	18	6	$\frac{3}{4}$	100 lbs.	200 lbs.	
SALSIFY	Mammoth Sandwich Island	1 oz.	30	15-18	2-3	$\frac{3}{4}$	50 lbs.	100 lbs.	
SPINACH	Long Season, King Denmark	1 oz.	30	12-18	2	$\frac{3}{4}$	1-1 $\frac{1}{2}$ bu.	3 bu.	
SQUASH	Green Hubbard, Buttercup	$\frac{1}{2}$ oz.	96	96	96	1	150-200 lbs.	300-500 lbs.	
TOMATO	Earliana, Marglobe	1 pkt.	48	36-48	18-48	$\frac{1}{2}$	2 bu.	3-4 bu.	
TURNIP	Purple Top, White Globe	$\frac{1}{2}$ oz.	30	15-18	2-3	$\frac{3}{4}$	50-60 lbs.	100 lbs.	
WATERMELON	Cole's Early, Will's Sugar, Kleckly Sweet	1 oz.	72	72	72	1	20-50 melons	40-75 melons	

Table 3, showing the approximate yield of canned vegetables from various amounts of raw vegetables, also will aid in determining the amount to plant.

The suggestions given are not made with the idea that they are to be followed to the letter, but rather that they may be helpful in planning the individual garden. The amount to be produced for seasonal consumption, canning, drying, and storage may be varied to meet the requirements of the particular family the garden is planned for. Yields will vary greatly in different sections of the state. The above estimates of length of row-feet will be too low for some localities and too high for others. Variation in yield is more noticeable with dry land gardens. The influence of wind barriers enters in when it comes to estimating probable yield. A garden well protected by a belt of trees or by a natural barrier can be expected to produce considerably more than a garden exposed to the full blast of drying winds, other factors being equal. The amounts suggested for storage may be excessive for some families and inadequate for others. Allowance should be made for storage losses when planning for certain amounts to be stored. Losses in storage will vary with the type of storage and management. Seed requirements are included in the quantity of potatoes suggested for storage. Where certain vegetables are omitted from the garden it may be necessary to increase production of others in order to supply the family needs.

GROWING PLANTS UNDER GLASS

The growing season can be lengthened by starting plants under glass. This makes it possible to grow some crops that are not profitable when seeded in the field. The structure most commonly used for this purpose on the farm is the manure heated hotbed.

Location. The main points to consider in locating hot beds are: (1), nearness to the farm buildings so that they can be cared for with least trouble; (2), convenience to a good water supply; (3), protection from cold winds, particularly from the north; the southern side of a building, board fence, or hedge is generally suitable; (4), good drainage is necessary; avoid locations where water will collect in the pit, as water-soaked manure will not heat.

The hotbed pit. The depth of the pit will vary with the length of time heat will be required. Pits $2\frac{1}{2}$ feet deep will generally supply sufficient heat for six to eight weeks' growth. The width and length of the pit depend upon the size and number of sash used. Where only one or two sash are used it is well to have the pit extend a foot from each side of the frame, especially if hotbeds are started early.

Framework. The frame as a rule is constructed out of lumber. One-inch or two-inch material may be used. When constructed out of two-inch material more rigidity is secured. In order to admit more direct sunlight

TABLE 3—APPROXIMATE YIELD IN CANNING*

Asparagus	12 pounds	makes	6 pints with stalk
Asparagus	12 pounds		2 pints with tips only
Beans, string	1½ pounds		1 quart
Beets	12-15 baby beets		1 pint
Corn, sweet	1 dozen small ears		3 pints
Peas	1 bushel		7 quarts
Spinach and greens	1 bushel		7 pints
Tomato	1 bushel		13 quarts

*Data provided by the Home Economics Division of the Montana Extension Service.

TABLE 4—SUGGESTIONS FOR A FAMILY GARDEN FOR FIVE PERSONS

Crop	Amount that should be produced	Amount to be stored fresh or canned	Length of Row (feet)	
			Dry Land	Irrigated
Asparagus	25 to 50 lbs.	10 pts.	200	100
Beans, snap	3 bu.	45 qts.	300	150
Beets	70 lbs.	50 lbs.	150	75
Cabbage	350 lbs.	250 lbs.	200	150
Carrots	200 lbs.	150 lbs.	300	100
Celery	150 bunches	75 bunches	100	100
Chard, Swiss	75 to 100 lbs.	20 to 30 qts.	50	25
Corn, sweet	30 doz. ears	20 qts.	500 to 600	200
Cucumbers	¾ bu.	5 to 10 qts.	100	50
Kohlrabi	50 lbs.	25 lbs.	100	50
Lettuce, leaf	25 lbs.		50	25
Lettuce, head	50 to 100 plants		50 to 100	50 to 100
Onions	100 lbs.	75 lbs.	500	200
Parsnips	100 lbs.	75 lbs.	200	50 to 75
Peas	4 bu.	20 qts.	400 to 600	250
Peppers	25 lbs.	15 lbs.	50	25
Pumpkin & Squash	150 lbs.	100 lbs.	100	50
Radish	120 bunches		100	50
Rhubarb	50 lbs.	5 to 10 qts.	10 to 15 plants	5 to 10 plants
Rutabaga	150 lbs.	100 lbs.	200	100
Spinach	3 bu.	15 pts.	300	150
Tomato	8 bu.	75 qts.	400	200
Turnips	100 lbs.	75 lbs.	100	50
Potatoes	30 bu.	25 bu.	¼ to ½ acre	⅓ acre

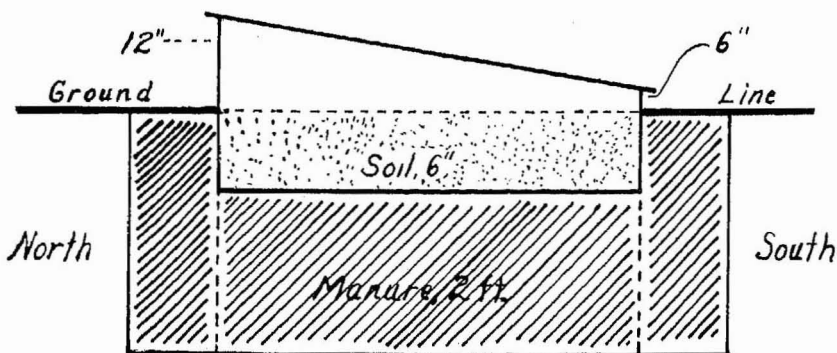


Fig. 1—Illustrates a cross section of a hotbed with pit 80 inches deep, manure two feet deep, with six inches of soil on top. The lower end of the sash is six inches high, the upper end is 12 inches high. The large pit, indicated by the outside solid lines, should be dug for small hotbeds started early.

the frame is constructed 18 inches in the rear and only 12 inches high in front, as indicated in Fig. 1. It is then placed so as to face the south. The width of the frame is built to accommodate the length of sash to be used, and as long as desired.

Hotbed sash. The sash can be secured through dealers, or they may be made by a carpenter. Only the most durable wood should be used. Cypress and cedar are popular for this purpose. The most common size of sash is 3x6 feet. A larger sash is too heavy to handle and is more subject to breakage. A good sash does not need more than one bar crosswise in the center for reinforcement. More would tend to shut out sunlight. A good grade of glass is always desirable. Some gardeners are using glass substitutes and are satisfied with results; others do not like the substitutes. Most gardeners are using glass sash. Glass cloth and other substitute forms of glass either do not admit enough light or lack durability. They may be suitable for temporary protection, but not for continuous use. Sash should be constructed to guard against leakage from snow and rain.

Preparation of manure. The preparation of the manure should start about three weeks before the hotbed is to be used. Fresh horse manure, preferably from grain fed animals, should be placed in a pile so as to start fermentation. As soon as heating is well under way the manure should be forked over, the lumps broken, and the inner portions of the pile turned to the outside.

When the manure has started to heat uniformly it is then ready to be placed in the pit. Packing of the manure firmly when filling the pit is necessary to avoid settling of the seed bed after the seed has been sown. If the manure is dry, heating can be hastened by adding enough hot water to moisten it. The pit should be filled to within five or six inches of the top, and five to six inches of good plant bed soil placed on top of the manure. The sash should be put in place at once to protect against cold, rain, and snow.

It is usually best to let the bed stand a few days before planting as the temperature may run high enough to injure the seed. When the temperature has receded to 80° or 85° F. the seed can be planted with safety. The seed can either be broadcast or sown in drill rows two to four inches apart, and covered with soil or just pressed into the soil. Larger seeds, such as cabbage and tomato may be covered to a depth of $\frac{1}{4}$ inch. Drying of the surface is checked to some extent by covering the seed bed with cheesecloth or burlap. Such coverings also tend to guard against washing out seed when watering. The covering must be removed when the plants start breaking through the soil.

Time of seeding hotbeds. Conditions vary so much over the state that no definite date can be set for starting hotbeds that will be suitable for all sections. Hotbeds are prepared the last of March and are ready for seeding the first of April at Bozeman. They can usually be started earlier in the lower altitudes.

The length of time required for seedlings to reach a size for transplanting to the field will range from 4 to 12 weeks for the various vegetables.

Ventilation. Ventilation is a means of drying the air and controlling temperature. Poor ventilation favors development of the damping-off disease. Ventilation is accomplished by raising or lowering the sash.

Watering. Plants should be watered preferably in the morning and on clear days. This gives the foliage and the surface of the ground opportunity to dry off rapidly and allows the soil to warm up again during the day. Withholding water so as to hold the plants on the dry side for a few days prior to transplanting serves to help harden them. They should be thoroughly soaked a few hours before removal from the seed bed. Another method of hardening plants is by gradually exposing them to lower temperatures by means of ventilation.

THE SEED BED

Thorough soil preparation is very necessary for growing garden crops. Plowing to a depth of 8 to 10 inches is advisable if it is possible to do so without turning up subsoil. Bringing too much subsoil to the surface is injurious to plant growth.

Time of plowing. Fall plowing is desirable on all soils where it can be practiced, more especially so on the heavier soils where water is not available for irrigation. Land turned over in the fall and left rough will be in better physical condition the following spring. Advantages of fall plowing are: (1), improves the physical condition of heavy soils by exposing them to frost action; (2), aids in control of certain insect pests by exposing them to the weather; (3), makes possible the earlier preparation of the soil for planting; (4), hastens decay of coarse vegetable matter turned under. Too much coarse material turned under may be actually injurious to plant growth. Raking and burning the remains of vegetable plants before plowing may be helpful in the control of garden pests. Very heavy soils may pack too much after fall plowing, but in such cases turning in the fall and again in the spring is better than spring preparation alone.

Summerfallow. Since moisture is a limiting factor in plant growth it is advisable to summerfallow for dry land gardens. Moisture conditions will be better on summerfallow than on land that has been cropped. It also is a means of controlling weeds. The extra labor involved will to a large extent be offset by saving of hand work the following year. When summerfallowing, plow as early as possible in the spring and then work shallowly the balance of the season as often as necessary to control weeds. Such a piece of land need not be plowed again in the fall unless it is a very heavy soil and has packed too hard to make a good seed bed.

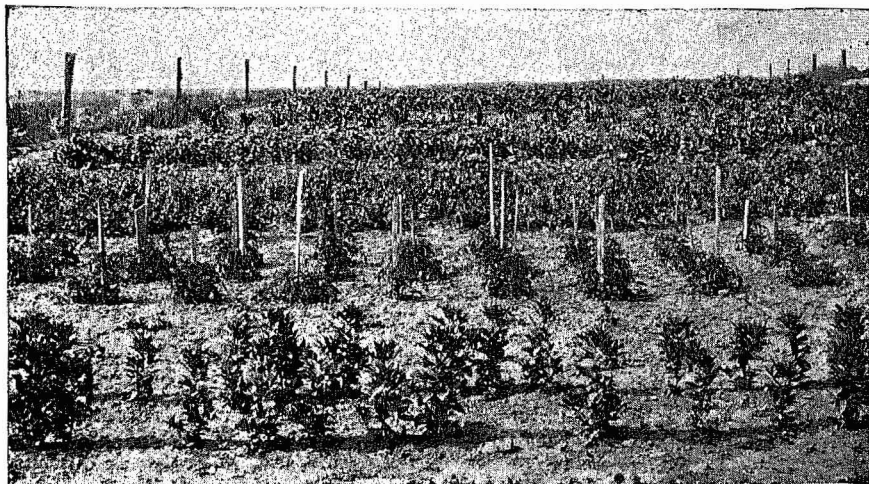


Fig. 2—The reward of a well prepared seed bed.

A firm seed bed. Pulverizing and firming the seed bed should follow immediately after spring plowing before the surface has had time to become dry and cloddy. Plants do not root and grow well in a soil that is loose, hence a firm seed bed is required. The disk harrow is a valuable tool for pulverizing and firming the seed bed beneath the surface. The spike-tooth harrow will aid in leveling and pulverizing the surface and it is hard to beat the home-made plank drag for smoothing the surface.

The thoroughness with which the seed bed is prepared before planting determines to a large extent the ease and efficiency of cultivation, but no amount of cultivation will overcome poor preparation. Prompt firming of the seed bed will reduce the loss of moisture through evaporation.

CULTIVATION

Cultivation is one of the essential operations in gardening to secure maximum yield. Hence we can say that cultivation increases the yields of crop plants. This is due mainly to weed control and the formation and maintenance of a soil mulch. Perhaps the value of a soil mulch as a means of conserving moisture has been over-emphasized by some writers, but nevertheless, plants will do better in a good soil mulch than in a soil that is allowed to form a deep hard crust. The real conservation of moisture for the growing crop is dependent upon thorough destruction of weeds.

When to Cultivate. Since weed control is the most important function of cultivation, it follows that the work should be done at the most favorable

time for killing weeds. Weeds are most easily destroyed just as they are breaking through the soil. Their roots are small at that stage of growth and they do not have much of a hold on the soil. Shallow working of the soil is effective while the weeds are small, but if they are allowed to grow large, deep cultivation becomes necessary. It is well to remember that weeds rob the growing crop of both moisture and plant food. Early cultivation checks this loss.

Cultivation should be given as often as is necessary to keep down weed growth. There is no justification, however, in working the ground when there are no weeds and when there is a good soil mulch established. Cultivating dry land gardens when unnecessary may do more harm than good by cutting roots and bringing moist soil to the surface. Under irrigation, and especially with heavy soils, it is necessary to cultivate frequently to maintain a soil mulch.

Cultivation immediately after a rain that soaks down only a few inches is likely to do more harm than good, due to hastening the drying of the surface soil. The destruction of roots in the wetted soil would also prevent the plants from getting the full benefit of such light rains. In such cases one should determine whether to cultivate or not by the condition of weed growth.

Depth to cultivate. Shallow cultivation is preferable to deep cultivation for all vegetables. Deep cultivation will destroy many of the roots of the crop plants, especially after the plants have reached considerable size. Vegetables prefer a deep, mellow soil, but deep working of the soil should be done at the time of preparing the seed bed.

Hoeing and weeding. These operations are expensive but no matter how carefully the cultivating is done some hoeing between plants is necessary. Removal of weeds between plants in the rows is just as essential as the removal of weeds between rows.

Keeping up soil fertility. A soil to be productive must contain a good supply of humus or decaying organic matter. The soil can be kept mellow and fertile by liberal applications of manure each year. In addition to keeping the soil mellow, manure adds plant food elements, such as nitrogen, phosphate, and potash. Manure should be rotted for spring applications to irrigated gardens. In the case of dry land gardens it is better to apply manure just before plowing the season the land is to be in fallow. Manures containing a considerable amount of straw or coarse material are likely to have a depressing effect on plant growth until they become decayed.

Another means of keeping up the humus content of the soil is through plowing under growing crops of legumes, such as red clover, sweet clover, and field peas. They decompose quickly when plowed under green and are satisfactory in supplying humus for the soil. Rye can be similarly used, but wherever possible one of the legumes should be grown instead of rye as they add nitrogen to the soil as well as humus.

COMMERCIAL FERTILIZERS

There is a phosphate deficiency existing in the soil in many sections of the state. Direct application of treble superphosphate to the soil will help correct this deficiency and increase yield and quality of some garden crops, particularly potatoes.

The addition of $2\frac{1}{2}$ ounces of superphosphate to a bushel of soil for production of plants such as tomatoes, cabbage, onions, and cauliflower in the hotbed has improved the handling quality of plants and yield and quality of crops.

IRRIGATION

Irrigation is an insurance against loss of crops due to drought. An ample supply of moisture in the soil not only increases the yield but also improves the quality of most garden crops.

Practically every dry land farmer can improve his prospect of having a good garden by any of the following methods: (1), by utilizing well water for either surface or sub-irrigation; (2), construction of private reservoirs; (3), locating the garden in a coulee and dyking to hold the spring run-off; (4), putting up snow fences and planting trees to stop drifting snow. A good belt of trees will reduce loss of moisture by checking evaporation during the growing season.

No hard and fast rule can be given as to how often to irrigate. A good rule to follow is to watch the condition of the soil and the plants. So long as the soil is kept in a good workable condition plants will not suffer because of lack of moisture. When applying water a sufficient amount should be put on to soak well down into the subsoil. A light cultivation as soon as the ground is dry enough to work after each irrigation will check baking of the surface soil.



Fig. 3—Trees make excellent snow catchers. They pile it up for gardens and keep it away from buildings. Here is an ideal spot for a garden.



Fig. 4—Well water used for irrigating a garden. The only equipment needed was a windmill and a large tank. When the tank was filled a 3-inch plug was removed and the water distributed over the garden where needed.

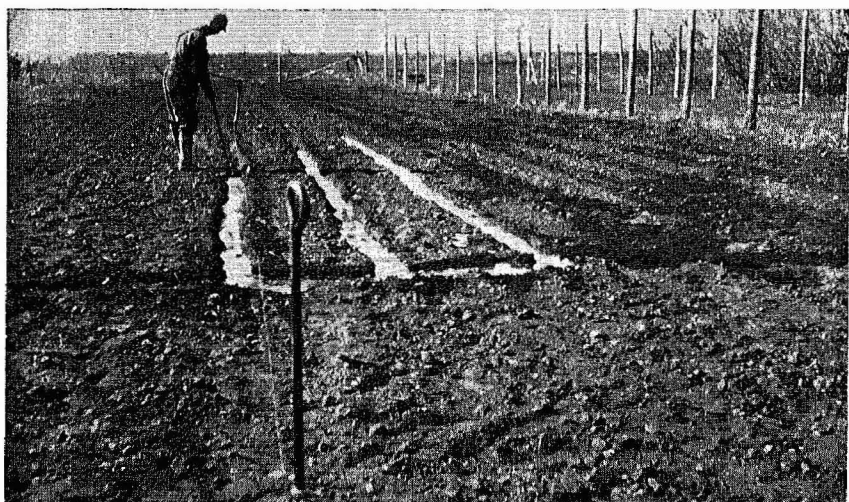


Fig. 5—Shallow rills are plowed out between rows to conduct the water. Avoid flooding garden crops.

Insect Control

By

D. J. PLETSCH, Assistant Entomologist

Of the half million different kinds of insects which are known, only a few dozen bother garden crops. Where good garden practices such as fall plowing, clean cultivation, and burning or removal of trash in the autumn are followed, losses from insects can be avoided or kept at a minimum. When insect attacks continue in spite of these measures, more direct methods of control must be used.

Two Types of Insects: From the control standpoint there are two principal types of insects: (1), insects with biting and chewing mouthparts, and (2) those with piercing and sucking mouthparts.

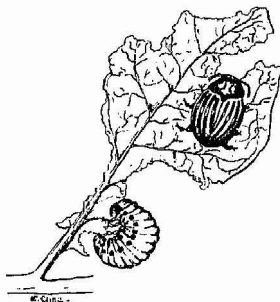


Fig. 6—Colorado potato beetle and larva (Actual size).

The chewing insects such as cabbage worms and Colorado potato beetles (fig. 6) usually feed on the foliage of the plants. They may be controlled by hand picking (if few in number) or by the application of poison sprays or dusts such as arsenate of lead, Paris green, calcium arsenate, etc. These poison materials, unless blown off or washed away, will protect the plants for some time. We call such materials "stomach poison insecticides." At times a stomach poison is used by pouring it around the crown and roots of the plant; or a "bait" may be made by mixing the poison with bran or other ingredients.

The other type of insects, such as plant lice or aphids, pierce the plant tissue with their mouthparts and suck the sap from within the plants. Thus

they are not killed by poisonous coatings on the outside of the plant. Instead, these insects must be killed by "contact insecticides" which destroy them when sprayed or dusted on their bodies. Usually only those specimens will be killed which are present when the insecticide is applied.

Below are discussed the more common insect trouble-makers in Montana gardens. Insecticides referred to are more fully discussed under that heading on page 17. Insects which cannot be identified from the discussion given here may be forwarded to the office of the State Entomologist, Montana State College, Bozeman, for identification and detailed control methods.

Aphids: Plant lice, or aphids, are soft-bodied insects with or without wings. The more common wingless forms (Fig. 7) may be green, yellow, black, or other colors. They are often troublesome on cabbages, tomatoes, and other vegetables, as well as many kinds of flowers. Application of nicotine sulphate (Blackleaf 40 is one form), nicotine dust, or oil emulsion will control these insects.

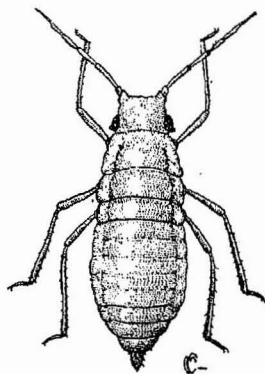


Fig. 7—Aphid or plant louse
(Enlarged 25 times)

Blister beetles: These spotted gray, black, or purple beetles about $\frac{5}{8}$ inch in length (Fig. 8) often riddle the foliage of beets, Swiss chard, and many other garden crops. Good control has been obtained by dusting with calcium arsenate, using one part of the poison to 10 parts of hydrated lime. Sodium fluosilicate or magnesium arsenate dust have also been recommended against these pests.

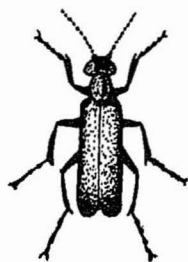


Fig. 8—Blister beetle
(Enlarged about two times)

Grasshoppers: As soon as the partly grown grasshoppers are noticed along the edge of the garden, grasshopper bait should be spread. The proportions of bait ingredients for small quantities are given under "insecticides." Broadcast the bait thinly and evenly, and poultry will not be endangered.

Sugar beet webworms: During the latter part of May, or during June, the tiny caterpillars of this species may hatch on Russian thistle, lamb's-quarters, or other weeds adjacent to garden plots. When plants bearing these larvae are disturbed, the tiny worms drop from the foliage, each hanging by a fine thread. This characteristic distinguishes them from other small caterpillars similar in appearance. If detected at this stage, the larvae can be readily controlled by a thorough application of a Paris green, nicotine sulphate, or pyrethrum spray. If early spraying is neglected or improperly carried out, the caterpillars develop rapidly to a stage where insecticides are much less effective. When the worms are large (Fig. 9) they migrate into, and seriously injure, cultivated crops. When such migrations start, ditches with running water are often used as a barrier.

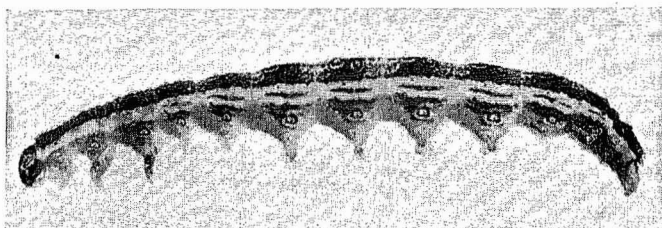


Fig. 9—Beet webworm (Enlarged two times).

Colorado Potato beetle: Potato plantings may be seriously damaged by the orange-red larvae or the striped adults of this species (Fig. 6). Dusting or spraying with Paris green or lead arsenate gives excellent control.

Maggots affecting onions, radishes, and cabbage: These plants are attacked just below the soil surface by white maggots which cause disfiguration and rotting of the tissue. Use of corrosive sublimate (poisonous to man) early in the season may prevent losses from these pests. The corrosive sublimate (bichloride of mercury) is made up in a wooden or other non-metal container, at the rate of one ounce to ten gallons of water.

For cabbage, pour $\frac{1}{2}$ cupful around the stem of each plant as soon as the transplants are set out in the field. Repeat after one week.

For onions, use a sprinkling can to pour the solution along the row as soon as the plants appear. Soak the soil in the row to a depth of $\frac{3}{4}$ inch. Repeat twice at weekly intervals.

For radishes, apply early as for onions. Never apply later when the radishes are almost ready for table use.

Cabbage worms: Heads of cabbage are commonly riddled by velvet green caterpillars. Control measures for this pest (the imported cabbage worm) should be started when the first holes are found in the leaves. Lead arsenate dust may be used for the early season treatment. If control measures are necessary the last two weeks before the cabbage is to be used as food, a pyrethrum spray (such as "Evergreen") may be safely used.

INSECTICIDES

Arsenate of lead. A violent poison, may be used as a liquid spray or as a dust.

Liquid formula.....Arsenate of lead.....1½ to 2 pounds
Water 50 gallons

Dust formula Arsenate of lead.....1 pound
Hydrated lime.....3 to 5 pounds

Paris green. This is also a violent poison and should be handled with care.

Liquid formula.....Paris green.....1 pound
Hydrated lime.....1 pound
Water 50 gallons

Dust formula Paris green.....1 pound
Hydrated lime.....6 pounds

Pyrethrum. This is non-poisonous to man or animals and should be used where it is dangerous to use the arsenical sprays. Instructions for mixing are supplied by the manufacturer with each container.

Nicotine sulphate. A violent poison used as a contact insecticide.

Liquid formula Blackleaf 40.....1 fluid ounce
Laundry soap.....½ ounce
Water 6 gallons

For larger quantities 1 pint of Blackleaf 40 is sufficient for 100 gallons of water.

Dust formula.....Blackleaf 40.....1 pound
Hydrated lime.....20 pounds

This formula makes a 2 per cent nicotine dust. An outfit such as is used for treating wheat with copper carbonate can be used for mixing nicotine dust.

Poisoned bran, garden quantity:

Bran 1 quart
Molasses 1 tablespoonful
Paris green.....1 teaspoonful
Water Sufficient to moisten

CULTURAL NOTES

Asparagus. This crop is well worth growing in every home garden. Its early appearance in the spring, together with the fact that a bed once established will produce for several years, makes it of special importance. Strong one-year old plants are preferable for starting new beds. These may be purchased from nurseries, or plants can be grown from seeds sown a year in advance of starting the bed. Plants should be set to a depth of 6 to 8 inches, and spaced about 18 inches in the row with rows approximately 4 feet apart. No cutting should be done until the third season, as the plants need the first two years to develop strong crowns.

Rhubarb. This hardy perennial deserves a place in every home garden. It does well on a wide range of soil but prefers a rich loam. Growth is improved by applications of partly decayed barnyard manure worked into the soil in early spring. An abundance of moisture is needed for best growth but this crop succeeds well in good dry land gardens.

The usual method of propagation is by division of old plants. The sections made by division of the old crown should be planted to a depth so that the crown part is about 3 inches deep. Plants are generally spaced about 3 feet in rows 4 feet apart. No harvesting should be attempted the first season and only for a short period the second year. The first, and to some extent, the second season, is needed to develop strong crowns.

Celery. It requires about 60 days to grow celery plants large enough to set in the garden. Hence a hotbed or greenhouse is needed for starting plants. One of the problems in celery production is premature seeding. It has been found that plants grown for the first 60 days from seed under controlled temperatures ranging from 65° to 75° F. are not as likely to form seed stalks as those grown at lower temperatures during the seedling stage.

Celery may be blanched by standing 12-inch boards on edge on both sides of the row close against the plants so that only the tops project above the boards. Another method is to bank the plants high with earth. The earth method is not desirable in warm weather as it has a tendency to cause rotting of plants.

Celery may be harvested and stored in narrow beds in a root cellar for late fall and early winter use. The plants should be removed from the field before freezing with a considerable amount of soil adhering to the roots. It is a good plan to wet the soil thoroughly as the plants are being packed close together in the storage beds. Apply water only to the soil and roots. Water applied to the tops is likely to start decay. Storage temperatures of 32° F. are favorable for celery. Higher temperatures hasten maturity and shorten the storage period.

Endive. This delicious salad crop requires about the same culture as lettuce. Seed may be sown in early spring after danger of hard freezes is past. Blanching is practiced to make the leaves more tender and to reduce bitterness. The outer leaves are drawn up and tied at the top about two weeks before using. Green curled winter and white curled are good varieties.

Cabbage. Seeds should be sown in a hotbed or indoors, especially for an early crop, about 6 weeks before the plants are to be set in the garden. Late cabbage may be seeded in the open in the lower altitudes.

The season for fresh cabbage may be lengthened by planting early, second early and later varieties, or by making succession plantings of a variety such as Copenhagen Market. Danish Roundhead is a good late variety for winter storage.

Unless the soil dries out rapidly, late cabbage should not be irrigated after the heads are half-formed. An irrigation or a heavy rain after the heads are well developed and solid will often cause them to burst. Bursting of heads can be checked by pulling on the plants until the roots pop and then letting them settle back in place.

Root Crops. The cultural requirements are similar for the different kinds. A deep, rich, mellow soil is needed for good growth. These crops provide an excellent source of fresh vegetables for winter use. Successive plantings of beets, carrots, and turnips made about two weeks apart will insure a continuous supply of small tender roots for table use during the summer and early fall. Parsnips require a long, growing season and planting should be done fairly early in the spring. Rutabagas require a longer season for growth than turnips. Hence all seeding of rutabagas should be completed fairly early.

When root crops are to be grown for winter storage, it is advisable to do some thinning to encourage growth of larger individual roots. Medium to large-sized roots keep better in storage than the small ones. Beets should be thinned to stand about 2½ to 3 inches in the row. A 2-inch spacing in the row is sufficient for carrots and parsnips. Rutabagas require about a 6-inch spacing for best growth.

Onions. Onions may be grown both from seed and sets. Open field seeding is not satisfactory in all parts of the state. Where the season is too short to mature a crop from open field seeding, yield and quality can be improved by using green seedlings that have been grown in a hotbed. Green seedlings may be planted in the garden when danger of a hard freeze is over. It requires about 10 weeks from seeding in the hotbed to produce plants large enough to transplant to the garden.

It is better not to irrigate or cultivate onions after the middle of August in order to hasten maturity. When harvesting, the usual procedure is to pull and pile into windrows in such a manner that the tops give partial shade to the bulbs. In two or three days the bulbs may be topped and spread out in thin layers in a well ventilated shed to cure. Three or four weeks are required for thorough curing unless artificial heat is used. Onions keep best when stored in a cool dry atmosphere at a temperature ranging between 32° and 36° F.

Tomatoes. Seeding is done indoors or in the hotbed from the middle of March to the middle of April. To secure good strong plants the seedlings should be transplanted into shallow boxes or flats when the third leaf is showing, giving them about a 2-inch spacing, or they may be planted into

the hotbed soil. If planted in hotbed soil they can be spaced 4 inches apart and left until time to transplant to the field. Those transplanted to flats should be shifted to 4-inch pots or transplanted to the hotbed soil when they are beginning to crowd.

Spacing in the field will depend upon the method of training. When pruned to a single stem and staked they may be spaced 18 by 18 inches, but when allowed to grow without pruning they should be spaced 4 by 4 feet.

When kept well cultivated tomatoes will produce quite well without irrigation but frequent applications of water at the right time will improve the yield. Blossom end rot may be brought on by improper irrigation.

Pruning the plants is accomplished by pinching out the branches that start in the axil of the leaves when they are about 1 to 2 inches in length. Earlier maturity is favored by pruning, which is an advantage in those sections with less than a 125-day growing season.

Nearly mature sound fruits may be picked just before frost, packed in single layer crates and stored in a cellar where they will continue to ripen until late fall.

STORAGE OF VEGETABLES

If the greatest benefit is to be derived from the garden it is essential that proper storage space be provided. The crops from the home garden that are suitable for storage include, beets, cabbage, carrots, onions, parsnips, winter radish, rutabaga, pumpkin, squash, salsify, turnips, and potatoes. To this list might be added celery, for a short storage period, and likewise well developed green tomatoes that are picked just before the first killing frost.

Successful storage depends upon: (1), the quality of the product, (2), temperature control; (3), moisture control, and (4), ventilation.

The house cellar is commonly used for storage of vegetables but it is not as satisfactory as an outdoor cellar for root crops, potatoes, and cabbage unless there is a specially constructed room in the basement where the outdoor cellar conditions can be maintained. Root crops, cabbage, and potatoes keep best at a temperature ranging between 32° and 38° F. in a moderately moist storage. Squash and pumpkins should be well ripened and stored in a dry room with a temperature of 45° to 50° F. Onions require a dry room with a temperature of about 35° F. Celery may be stored in a moist basement room, outdoor cellar, or pit. The hotbed pit may be cleaned and used for this purpose. When lifting celery for storing, a considerable amount of dirt should be left adhering to the roots.

A good outdoor cellar can be made by excavating to a depth of 3½ to 4 feet and using poles, woven wire, straw, and dirt for a roof. Three to 5 feet of straw and 12 inches of dirt are generally considered sufficient to keep out frost from overhead. A well constructed vestibule over the entrance is the best means of keeping out rain and snow. Too much emphasis cannot be placed on construction of doors. If doors are not properly made or do not fit tightly, freezing is likely to occur. Doors should be constructed of double thickness with a good grade of building paper between.