VEGETABLE GROWING

IN THE

COAST AREA OF BRITISH COLUMBIA

By
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DOMINION EXPERIMENTAL FARMS
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INTRODUCTION

The cultivation of vegetables is one of the major branches in the field of horticulture. The scale of production runs from the large acreages which specialize in crops for canning purposes where only one or a few kinds are grown, to the market gardens which grow varying amounts of many kinds to meet the requirements of certain districts and markets, and to the producer of vegetables on a small scale for home purposes. It is the object of this bulletin to cover in general the field of vegetable production, particularly for those who have not had a great amount of experience along this line. At the Agassiz Experimental Farm there have been carried on many variety and cultural tests with vegetables and much of the data contained herein is based on these results.

Where experimental results are given and remarks made they hold for the particular conditions to which they have reference. Conditions change from one district to another and it is therefore possible that all recommendations made will not hold good in all districts where they are applied. It would not be practical to cover the whole field of such variability; it remains consequently for growers in established districts to ascertain what have been successful practices and in new districts to follow practices generally advocated and vary them according to the requirements of the particular locality.

There are many details of gardening to which no reference has been made. In the majority of cases it will be found that seed catalogues and directions on seed packages give much of the necessary detailed information as regards many cultural operations and other practices. Catalogues of such a nature are found to be of valuable assistance.

MARKETING

There are essentially five main channels for the distribution of vegetable crops, to canners, jobbers, retailers, consumers, and for the home.

In the first case the usual method of procedure is by contract with a canning company. In such cases it is first advisable to make the necessary arrangements for selling the crop and then to proceed with planting the stipulated area with the kinds and varieties of vegetables specified. The kinds grown should be of proven merit for the district. The chief advantages in this source of distribution are an assured market at an assured price, less packaging and usually a larger area to one kind of produce.

In disposing of vegetable crops to wholesalers or jobbers there are often a larger number of individuals with whom to deal; the market may be a fairly close or a distant one; the produce requires more packaging and grading; there is less certainty of a market; and prices fluctuate according to the market supply and demand.

Vegetable produce can often be sold direct to retail stores, particularly in smaller towns. In such cases the market is usually fairly close to the centre of production. The price received is usually higher than in either of the above mentioned cases but the total quantity sold through such sources is limited. Selling direct to hotels and restaurants is often practical. Where such a market is the chief source of outlet it is advisable to grow most of those kinds for which there is a popular demand.

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In small centres there is also the possibility of selling direct to consumers, either permanent residents or tourists in camp. Such a method of distribution as well as the preceding one mentioned requires a more definite system of delivery than do the first two methods enumerated. A wide selection of kinds should be planted and dates of seeding should be so arranged that there is a succession of the same kind of vegetable over an extended period.

The fifth method of distribution is evident, where vegetables are grown for consumption in the home of the producer.

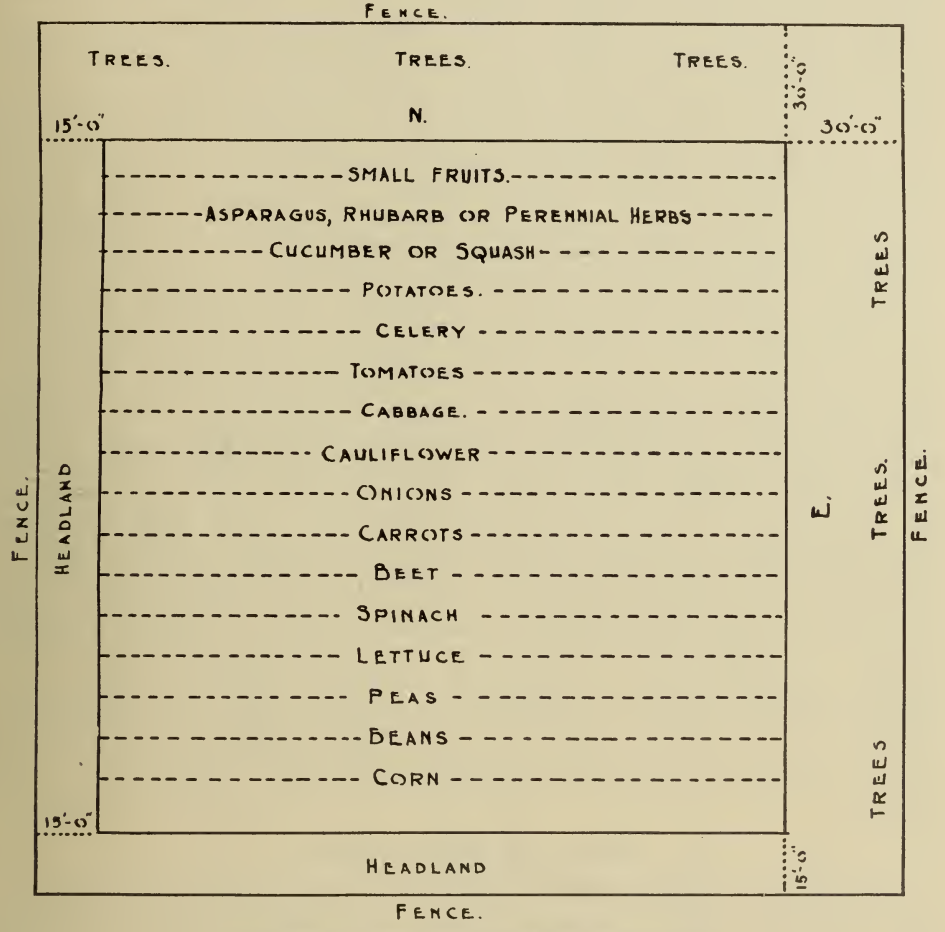
PLANNING A VEGETABLE GARDEN

Under farm and home conditions the vegetable garden requires a more definite system of planning than where produce is grown for the market, in which case a rotation of crops is the essential feature. On home lots the area is restricted and usually the maximum of available land is essential. Under farm conditions the area of land is not so limited and provision should be made for horse cultivation. A given area convenient to the house should be set aside and preferably fenced so as to be safe from live stock. No suggestions can be made as to the area cultivated as this is dependent on the size of the family and other

Hedges surrounding a garden make a desirable windbreak and protect young plants from cold winds in the early spring.

factors. From a mathematical point of view a square contains more square feet than a rectangle when the sum total of the sides is equal. A rectangle measuring on two sides 90 feet by 110 feet contains 9,900 square feet and a square measuring on two sides 100 feet by 100 feet contains 10,000 square feet. On the north and east side of such an area fruit trees could well be planted, either a double or a single row allowing for seven or fourteen trees or more if desirable, consisting of apples, pears, plums, and cherries. When planted on the north and east sides they will cause little shading to the garden area. The whole space under farm conditions should be surrounded by headland 15 feet wide and 30 feet wide on the tree side. This permits of space for horse cultivation and the trees will have little effect on the garden. On one side should be planted the perennial crops such as small fruits, asparagus, rhubarb, and herbs, the remaining space being devoted

to annual crops. All rows should be planted approximately 30 inches apart to permit horse cultivation. Annual crops are best rotated from year to year and a system of succession planting is advisable for most kinds of vegetables so that the crops mature over an extended period. Ten-day to two-week intervals of planting for this purpose are satisfactory. The following diagram illustrates an arrangement of planting. The number of rows of each kind of vegetable are arbitrary; it is not intended to show that a row of potatoes is equal to a row of carrots or beet. The list of vegetables is also incomplete, only the more common kinds are shown:—



ROTATION AND SUCCESSION CROPPING

In almost any system of gardening consideration should be given to one or both of the above conditions. Rotation is practised and advisable for chiefly two reasons. When an area of land is continuously cropped from one kind of vegetable there is a constant usage from the soil of one or more particular kinds of plant food. This is not a desirable condition and it is advisable, therefore, to arrange the planting system so that particular crops will not be planted more than once every four years on the same area. Another reason for rotation is to partially control diseases. Some kinds of vegetables are subject to certain diseases and these may live in the soil for several years. In order to avoid such soil infested areas, plantings should be arranged in rotation, for by so doing the soil fertility and soil disease problems are partially overcome.

Succession cropping or planting should be practised in all gardening systems with the possible exception of canning crops. Here too if the cannery will accept the crop over a fairly extended period it is of benefit. In the first place an element of risk in seed germination due to unsatisfactory weather conditions is overcome if an entire field is not planted on the same day. When a given area does not all mature at the same time a smaller force is able to handle the cropping which may mean a lesser expenditure for this item. Some crops on the other hand do not permit of this system, especially in cases where the crop must be planted as early as possible in order that it should mature before unseasonable weather conditions prevail.

For market and home gardens it is usually desirable that the crop should not all mature at the same time. Essentially the highest price for vegetables is obtained for the earliest crop and it is advisable that a good portion of the ground should be used with this object in view. An early production of vegetables is however attended with some risk on account of spring frosts and inclement weather. Furthermore, too great an area devoted to the production of a given kind to mature at one time tends to an unbalanced labour demand for brief intervals with possible slack periods between times. Diversity of crops tends to overcome this condition, in general an extended period of maturity assures a greater uniformity of labour, demand, and better prospects for disposal of the crop. Where carload shipping or shipping in large quantities is desirable or more economical there is merit in the production of crops for peak periods.

A few general methods lend themselves to succession cropping. With some kinds of vegetables use can be made of hotbeds for starting the earliest crops and later seedings can be made in the open. In general it can be said that in the early part of the season equal intervals between planting dates and the resultant dates of maturity are not as marked as the same length of time between later seedings. This is due to the fact that rapid growth does not take place until the warm spring weather approaches. Some crops lend themselves to seeding in the open at almost any time during the winter. There is little difference in the date of maturity of such a crop when seeded on the first of January or the first of February but there is a marked difference in maturity when seeded on the first of April as compared to the first of May. The same conditions are applicable to hotbed sown seed which is transplanted early to the field. Seedings made on January 20 and January 30 and transplanted to the open on March 1 and 10 will mature at more nearly equal dates than seedings made on February 20 and March 2 and transplanted to the open on April 1 and 10. Seedings made in the open from April 1 give a satisfactory range of maturity when dates of planting succeed one another at two-week intervals.

SEEDS AND SEED GROWING

It is advisable at all times to sow seed of the best quality as from this better germination and stronger growing crops are obtained. Poor seed will give a low percentage of germination which may entail reseeding and loss of time and weak seedlings do not have the same possibility of producing as strong and vigorous a stand. Germination tests can be run before the date of planting by placing 100 seeds on damp blotting paper and keeping in a warm room. The number of seeds which grow will give the percentage of germination and thus be an indication as to how much should be planted. If results are poor it would be advisable to obtain a new lot from a different source.

Generally speaking, seed growing is a specialized work requiring careful observation, patience, and special seed cleaning machines. It may however be carried on in a small way by others, in some cases profitably and in particular it adds interest for the average grower. A system of selection should be practised and the best method for this purpose is to choose an individual plant

and multiply from this. The plant selected should be typical of the variety and excel so far as possible in giving a uniformly shaped product, early maturity, vigorous growth, and high yield. In general the fruits from a single plant have all the same possibilities in self-pollinized plants. Thus it makes no difference if the first mature or last mature fruit is selected from a tomato plant, or the first or last pod from a bean plant. Self-pollinized plants in general require less selection work than cross-pollinized plants such as squash, cucumbers, corn, etc. Self-fertilization is briefly explained when it is the normal condition of the pollen of a single bloom to fertilize the stigma of the same flower (the female part of the same blossom). This condition is found in peas, lettuce, tomatoes, and other kinds. In other plants it is a matter of chance whether they are crossed or selfed as in carrots and in others crossing is largely essential as in cabbage and corn. Seeding habits are again divided into two classes, those which produce seed the first year, annuals and those which produce seed the second year, biennials such as carrots, beets and cabbage.

Having isolated the best plant or individuals, the seed should the following year be planted and all off type plants if such appear should be rogued out. The possibilities of uniform strains are much better if the progeny of a single plant is selected. In essentially cross-pollinized plants several individuals should be selected of as uniform a type as possible; in such cases it will be found that there is greater variation in the type of the progeny. For home purposes such variation is of little importance provided yield, quality, and other desirable characteristics are present.

Of the more common vegetables the following kinds are open or cross-fertilized: carrot, beet, parsnip, radish, turnip, corn, cabbage, kale, kohl rabi, Brussels sprouts, cauliflower, onion, celery, cucumber, squash, melon, pumpkin, and spinach, and those chiefly self-pollinized are peas, beans, lettuce, tomato, pepper and egg plant. Cabbage, kohl rabi, Brussels sprouts, and radish cross with one another.

The following table gives the approximate amounts of different kinds of seed for small areas, for an acreage basis, distance apart of rows and distance apart of plants:—

Vegetable	Number of feet in row for average family	Seed or plants required for 100 feet	Seed or plants required per acre	Distance apart of rows	Distance apart of plants	Depth to plant
						in.
Asparagus	100 feet	60 plants	5,445 plants	4 ft.	2 ft.	8 to 10
Beans, bush	100 "	1 lb.	60 to 80 lb.	3 ft.	4 in.	2
Beet	80 "	2 oz.	6 lb.	15 in.	3 in.	1
Brussels sprouts	50 "	$\frac{1}{8}$ oz.	1 oz. = 1,800 plants	30 in.	24 in.	$\frac{1}{2}$
Cabbage	75 "	$\frac{1}{8}$ oz.	1 oz. = 1,800 plants	30 in.	18–24 in.	$\frac{1}{2}$
Carrots	100 "	1 oz.	3 to 4 lb.	15 in.	2– 3 in.	$\frac{1}{2}$
Cauliflower	50 "	$\frac{1}{8}$ oz.	1 oz. = 2,000 plants	30 in.	18–24 in.	$\frac{1}{2}$
Celery	50 "	$\frac{1}{8}$ oz.	1 oz. = 3,000 plants	36 in.	6 in.	$\frac{1}{4}$
Corn	100 "	6 oz.	12 lb.	42 in.	hills 3 ft.	1 to 2
Cucumber	10 "	$\frac{1}{2}$ oz.	2–3 lb.	6 ft.	12 in.	1
Lettuce	50 "	$\frac{1}{2}$ oz.	2 lb.	15 in.	8 in.	$\frac{1}{2}$
Muskmelon	20 "	$\frac{1}{2}$ oz.	3 lb.	6 ft.	12 in.	1
Onion, seed	100 "	1 oz.	5 lb.	15 in.	3 in.	$\frac{1}{2}$
Parsnip	30 "	$\frac{1}{2}$ oz.	5 lb.	15 in.	3 in.	1
Peas	100 "	1 lb.	175 lb.	3–4 ft.	1 in.	2
Pepper	20 "	$\frac{1}{4}$ oz.	1 oz. = 1,500 plants	30 in.	18 in.	$\frac{1}{2}$
Pumpkin	2 hills	$\frac{1}{2}$ oz.	1 oz. = 20 hills	8 ft.	hills 8 ft.	1
Radish	15 ft.	1 oz.	10 lb.	15 in.	$\frac{1}{2}$ in.	1
Rhubarb	6 hills	.....	.....	4 ft.	4 ft.	
Spinach	50 ft.	1 oz.	10 lb.	15 in.	4 in.	1
Squash, bush	5 hills	$\frac{1}{8}$ oz.	6 lb.	6 ft.	hills 6 ft.	1
Squash, trailing	5 "	$\frac{1}{8}$ oz.	3 lb.	10 ft.	hills 10 ft.	1
Tomato	35 ft.	$\frac{1}{8}$ oz.	1 oz. = 1,500 plants	3–4 ft.	3–4 ft.	$\frac{1}{2}$
Turnip	40 "	$\frac{1}{2}$ oz.	2 lb.	15 in.	3 in.	1

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The distance apart of the rows will vary with hand and horse cultivation.

To estimate the number of plants required per acre multiply the distance of plants in the row by the distance apart of rows and divide this figure into 43,560 (the number of square feet in an acre). If the distance apart of plants and rows is in inches 43,560 must be multiplied by 144.

LONGEVITY OF SEED

Different seeds vary in the length of time they are viable or will give satisfactory germination. Seed should always be kept in a cool dry place.

Kind of seed	Number of years viable	Kind of seed	Number of years viable
Beans	3 to 8	Lettuce	5 to 9
Beet	6 to 10	Onion	2 to 7
Cabbage	5 to 10	Parsnip	2 to 4
Carrot	4 to 5	Pea	3 to 8
Cauliflower	5 to 10	Pepper	4 to 7
Celery	8	Radish	5 to 9
Corn	2	Spinach	5 to 7
Cucumber	10	Squash	6 to 10
		Tomato	4 to 7
		Turnip	5 to 10

PRODUCING EARLY VEGETABLES

There is usually a considerable amount of interest manifested in the production of early vegetables. This phase of work is discussed to some extent under the individual vegetables which lend themselves to this kind of treatment, the remarks made here are of a more general nature.

Usually several factors are involved in producing early vegetables or vegetables out of season, the most important of which are weather conditions. It is due to the demand for and the higher price received that there is a desire to produce certain kinds of vegetables out of season and it is for this reason to a very great extent that the greenhouse business has attained the important place that it holds to-day. There is, however, a possibility of having crops grown in the open to mature at an earlier date than is the average for the kind. This is attained chiefly by selecting the quickest maturing varieties, planting early either in the open as would be done with peas or beans and other crops or starting the plants under glass as is done for tomatoes, lettuce, celery, etc. Another method followed is to sow seed of such plants as cabbage and broccoli in August, transplant to field positions in September and harvest an early spring crop. The chief advantage in the production of such crops is an increased price and the chief disadvantage is the possible loss due to winter-killing, killing by spring frosts, poor germination of seed due to cold wet weather after seeding, and lower yields. It not infrequently happens that seed germination will be better in a mild bright February than it will be in the following month if the weather turns cold and wet as it often does.

The type of soil on which early crops are produced is an important factor. It should preferably be one that is protected on the sides from which the prevailing cold winds come. It will tend to be warmer and earlier if it has a southern slope and also if the soil is well drained and of a somewhat sandy texture. Such soils are naturally warmer and are more easily worked shortly after heavy rains. Where manure is applied to the land, ploughing and as much soil preparation as possible should be done in the fall. Following fall cultivation deep spring cultivation will be necessary. After spring planting has been done the ground should be worked whenever possible as frequent heavy rains tend to pack the earth and retard plant growth.

Certain kinds of vegetables lend themselves to early production more than others, particularly as regards seeding in the open. While there is an element of risk and uncertainty in this phase of work, the reward, when results are satisfactory, is usually worth the trouble and possibility of loss, so it can be recommended that a certain portion of land on each holding can be devoted to this kind of work.

Tests have been made with numerous kinds of vegetables to determine their response to early seeding in the open as compared to early seeding under glass. In general it may be said that seeding under glass is the more dependable method as weather conditions are not as important a factor. It may be added, however, that seeding in the open in January or February, when weather conditions will permit, is frequently satisfactory and will produce as early a crop as any other method. Experience has also shown that plants seeded in the open and not transplanted will give an earlier crop than those which have been moved. When growing conditions are poor in the early part of the season plants such as cabbage, cauliflower, spinach, and lettuce which are attacked by flea beetles, root maggots, and slugs suffer more from insect injury than do those plants which have not been set back by transplanting.

Under "succession cropping" remarks have been made on dates of seeding which are applicable to early production.

HOTBEDS AND COLD FRAMES

Hotbeds are desirable where vegetables are grown. They may be used on an extensive scale in which to mature plants from seeding, or used to start tender plants which would not ordinarily mature if sown in the open. They serve the purpose therefore of giving an earlier crop or of permitting a crop to be grown which under outside conditions would not be possible.

A hotbed consists essentially of a frame covered with glass under which is a certain depth of fresh horse manure. The frames should be strongly made of 2-inch lumber of such a size that it can be fitted with standard size sash three feet wide and six feet long. Each individual frame can be made to have as many sash as convenient, one, two or more. Frames should be so constructed that the back is higher than the front, 18 inches and 12 inches being satisfactory heights.

Fresh horse manure should be used mixed with straw. It should be allowed to heat before being put in the frame. This is best done by putting it in a pile and allowing it to stand until heating has commenced. The outside part can then be thrown into the frame first. It should be spread evenly and be well tramped to a depth of approximately 18 inches, and then covered over to a depth of 4 inches with well composted earth. The depth of manure for each bed is determined by the outside temperature and the length of time it will be in use. If manure is not allowed to heat to its maximum before being put in the hotbed, the temperature will continue to rise for two or three days and no seed should be planted until it is assured that the temperature will not go above 90 degrees Fahrenheit.

Hotbeds are best placed in a protected position with a southern exposure They may be built above ground or excavations can be made to a depth of 18 inches and this filled with manure to the ground level. When built above ground the manure pile should measure two feet each way greater than the frame. In order to conserve heat as much as possible the outside of the frame should be banked up with manure or earth. When nights are cold the glass should be covered over with sacks, burlap, or other suitable material. Seed may be either sown in flats or in the soil that is placed on top of the manure. Where different kinds of vegetables are being grown some consideration has

to be given to the kinds that are placed in the same frame on account of rapidity of growth. Generally speaking cabbage, cauliflower, Brussels sprouts, and lettuce should not be planted in the same frame with peppers, tomatoes, celery, and egg plant. The former grow more rapidly and usually it is necessary to allow more ventilation so that the plants do not grow too spindly. Such ventilation retards the growth of the second group of plants mentioned. Where such conditions are encountered it is advisable to have several small frames rather than one or two large ones.

A considerable amount of attention must be given to the young growing plants, regulating the temperature, and the amount of moisture. Ventilation chiefly controls the above factors. The young plants must be watched that they do not become too spindly from too rapid growth. Too much moisture is likely to cause " damping off " resulting in the death of many plants. The sash raised at the back slightly above the frame will control these factors.

When young seedlings have formed their true leaves or when they become crowded they should either be planted to another hotbed if considerably more growth is desired or they may be transplanted to cold frames which consist of wooden frames covered over with either glass or cloth. The cold frame serves to harden off the plants. The same operation is performed with hotbeds by gradually allowing more air over a period of a week or ten days and for the last few days leaving the plants exposed day and night.

The essential operation of hotbeds is to supply sufficient heat to induce rapid growth, to apply sufficient water for moisture purposes, and at the same time to allow sufficient ventilation so that there will be no occurrence of damping off fungus, and to ensure that the plants will not become too spindly.

It is ordinarily advisable to withhold water from seedlings a few days before transplanting and to give them a thorough soaking a few hours before moving them. Withholding the water assists in the hardening off process.

CULTIVATION

Little need be said on the cultivation of soil and the different methods of doing it. The work is essential and the different methods of doing it all have some merit. Essentially there must be either fall or spring ploughing or both. Fall ploughing undoubtedly has merits, as the weather action of winter, particularly when freezing conditions prevail, does much to break down the soil, release plant food and put the ground into a finer form for working. Under many conditions fall ploughed land will require a spring ploughing.

Cultivating implements are of several kinds, horse drawn, garden tractors and wheel and hand implements. The tools and methods used will determine to a very great extent the planting distance. Cultivation by hand with the use of a hoe is the slowest method possible but the most economical of space. Wheel cultivators are a considerable improvement on the hoe method and many useful attachments are available, such as seeders and fertilizer spreaders. Small garden tractors are becoming more popular and they permit one man to work a considerably larger area than either of the other methods. There is practically no operation that cannot be performed with these machines. There are various types made of different power. Possibly the ploughing of sod land is an operation for which a different method is advisable, as it is difficult to get the turf turned over at a sufficient depth. Attachments are available for seeding, fertilizing, disking, harrowing and cultivating.

Horse cultivating has its merits. One of the chief disadvantages is that it requires more space between rows and at the end of rows than any of the other methods mentioned. Horse labour is usable for a greater variety of purposes than most machinery.

After crops are planted cultivating serves two general purposes; to keep down weeds, and to keep the surface soil loose, which aids soil aeration and on some ground prevents baking. In performing such operations due regard must be paid to the rooting system of the different plants. In the early part of the season cultivation can usually be deep but as the season progresses care should be taken that few of the young rootlets are broken off.

PAPER MULCH

During recent years a considerable amount of publicity has been given to the merits of covering the soil adjacent to rows with different types of prepared paper. Experiments have been carried out under varying conditions to determine what benefit is derived and also the most advantageous method of handling the material. Results under different conditions have been variable as to the particular benefit for different kinds of crops. The advantages sought are increased earliness and yield. More experimental evidence is required as to the possible effect of using the material at different seasons of the year. The results given below are those obtained at this institution during the past three years.

The system of handling the paper for seeded and transplanted crops is different. In the first place it is essential to have the ground as level as possible and free from lumps of earth and stones. When the rows are seeded they should be made straight, and soil in good friable condition helps in this respect. The paper is best laid as soon as the seed has germinated, when the rows are clearly defined. The paper is unrolled along the rows and is held in place with strips of wood such as laths or lattice strips by fastening these down along the edges with wire staples, approximately a foot long made from heavy galvanized wire.

With transplanted crops such as cabbage and tomatoes the paper is best laid on the ground and the outer edges covered with dirt. At the required distance of spacing holes should be cut and the young seedlings set through them.

Melons—paper mulch on left, normal conditions on right. Comparative yields 211 pounds and 84 pounds from 30 feet of row.

Taken on the whole the average kind of vegetable has not responded to an appreciable extent when the seeding or transplanting has been done on the average spring date of seeding for the particular kind of vegetable. The following kinds have been tested in duplicate plots, consequently only large differences can be interpreted as the response to the treatment: beet, carrots, spinach, lettuce, onions, cabbage, cauliflower, beans, peppers, celery, tomatoes, potatoes, egg plants, cucumbers, melons, and corn. These, with the exception of peppers, have all shown a slightly increased earliness and yield but with all other than egg plant, cucumbers, and melons the advantages obtained have not been sufficiently great to offset the cost of the material and the extra expense involved in handling charges.

The following table gives the results that have been obtained with melons. Cucumbers and egg plants have given comparable figures though the increase has not been so great.

MUSKMELON—HEARTS OF GOLD

Year	Plot No.	Mulched rows						Check rows					
		Number of marketable fruit	Weight of marketable fruit		Weight of unmarketable fruit			Number of marketable fruit	Weight of marketable fruit		Weight of unmarketable fruit		
			lb.	oz.	lb.	oz.			lb.	oz.	lb.	oz.	
1929	1	81	106	10	10	4		47	56	4	7	0	
	2	112	152	3	15	6		52	60	3	17	4	
1930	1	78	137	2	12	8		60	90	4	18	3	
	2	128	211	8	25	3		54	84	8	8	5	
1931	1	66	87	8	21	2		11	10	12	37	9	
	2	127	150	12	29	6		27	26	6	38	8	
Totals		592	845	11	113	13		251	328	5	126	13	

Based on the three years' totals the mulched plots have yielded 158 per cent more than the check. Considering the cash value of the crop it is reasonable to assume that with this crop the increase obtained with paper would be a profitable investment.

SOILS AND FERTILIZERS

The diversity of types of soil is so great that no one recommendation is the most suitable for all conditions. The light sandy soils are in general less fertile than the loams and muck soils and consequently require greater amounts of manures. Experience has shown that barnyard manure is the best all round material to use. To a very great extent it can be said that all other material applied is a substitute for manure. The garden at the Agassiz Experimental Farm has been cropped with various kinds of vegetables during the past thirty-five years and as far as the writer's knowledge is concerned it has received no fertilizer other than heavy annual applications of barnyard manure. Muck soils are in general fertile and well supplied with humus and consequently are more retentive of moisture than lighter soils, and therefore are less likely to respond to heavy applications of manure. A substitute for manure is green covercropping with different kinds of plants, depending on what will give the largest amount of green growth in the shortest possible time. Legumes such as crimson clover and vetch, fall rye and buckwheat are very commonly used.

Plants themselves vary in their response to different chemical elements, the three most important of these being nitrogen, phosphates, and potash. In gen-

eral it can be said that leafy vegetables such as cabbage, kale and lettuce require more particularly nitrogen, seed producing plants such as corn require chiefly phosphates, and roots such as carrots, beet, and turnips require chiefly potash. Crop yields are usually a good indication of soil fertility. It is also an easier matter to maintain good soil conditions than to allow them to become depleted and then have to rebuild. Under proper systems of rotation there is a fairly uniform demand of chemical elements; it frequently happens also that one chemical added to the soil will not affect crop growth materially although this element is lacking. The amount to be applied and the percentage of ingredients may depend on local conditions. Usually a fertilizer formula approximating 5-10-5 and applied at the rate of 750 to 1,500 pounds per acre will cover most vegetable garden requirements. The amount of barnyard manure applied and natural fertility will be the governing factors as to the amount of commercial fertilizer to use.

As it is not practical to make specific recommendations for the amounts and kinds of fertilizer to use for different crops under varying conditions except in a general way, exact determination can best be made by the grower on his own property. Reliable experimental results require a considerable amount of detail and work. Many growers are, however, interested in such work and as a guide for such efforts the following procedure is outlined. If a complete fertilizer of the above recommended formula is used the grower may desire to know the most profitable amount to apply, 500, 1,000, or 1,500 pounds to the acre. A 5-10-5 fertilizer, using nitrate of soda, superphate of lime, and muriate of potash, consists of 650 pounds, 1,250 pounds, and 200 pounds respectively of the different ingredients on a ton basis. If used at the rate of one ton per acre full weights of each of the chemicals would be used or a total of 2,100 pounds. If used at the rate of 500 pounds per acre one quarter of each of the weights would be used, namely 162½ pounds, 312½ pounds, and 50 pounds. If an application of 500 pounds per acre is required for areas of less than one acre the acre fraction is the fraction of the weight of each chemical that should be used when the original figures are divided by four to reduce to 500 pounds or one-quarter of a ton. If the area is one-half of an acre then there should be applied 81¼ pounds, 156¼ pounds and 25 pounds at the rate of 500 pounds per acre. If the area to be fertilized is not so readily estimated as one-half the fraction can best be obtained by finding the number of square feet and dividing this number by 43,560 or the number of square feet in an acre. An area of 175 feet by 100 feet contains 17,500 square feet, therefore 17,500 square feet divided by 43,560 square feet will equal 0·402 of an acre. This figure multiplied by each of the original amounts of chemical, 650, 1,250, and 200 will equal approximately 251 pounds, 503 pounds, and 80 pounds which is the amount of fertilizer for 17,500 square feet applied at the rate of one ton per acre; applied at the rate of 1,000 pounds per acre each figure would be divided in half; applied at the rate of 1,500 pounds three-quarters of each of the above figures would be taken.

If it is now desired to test different weights of a 5-10-5 fertilizer for carrots as an example, the procedure could be as below mentioned. No great area need be set aside for a fertilizer test but the greater the number of tests made for each application up to eight replications the better. It is also advisable to have such fertilizer test plots removed or marked off from the main cropping fields so that they can be harvested as separate units. All test plots should receive uniform treatment except for fertilizer applications, the soil conditions should be as uniform as possible, the dates of seeding, the dates and rates of thinning, and the date of harvesting, etc., should be the same, the variety tested should be the same for each plot. The area, as previously mentioned, need not

be great. Rows thirty feet long and spaced approximately thirty inches apart are adequate; this distance is to overcome any effects of fertilizer from row to row. If the 5-10-5 fertilizer is applied at the rates of 500, 1,000, and 1,500 pounds per acre the method of procedure would be to plant 24 rows or more in units of six. There should be in addition an outside row on each side, the first and last row. The second and third rows should receive an application at the rate of 500 pounds per acre, the fourth and fifth rows an application at the rate of 1,000 pounds per acre, and the sixth and seventh rows an application of 1,500 pounds per acre. This method should be repeated as many times as possible up to eight to obtain as accurate results as possible. Taking the number of replications as six, each plot consists of two rows two feet apart and thirty feet long, which equals an area of four times thirty, or one hundred and twenty square feet. There are six plots for each treatment so the number of square feet for six plots is 120 times 6 equalling 720 square feet. At one ton per acre the amount of fertilizer required for a plot is obtained as follows: 720 divided by 43,560 equalling 0·0165. The total weight of the 5-10-5 fertilizer is 2,100 pounds, therefore, 2,100 times 0·0165 equals 33 pounds for an application at the rate of 2,100 pounds per acre, applied at 500 pounds per acre one-quarter of 33 equals $8\frac{1}{4}$ pounds, at 1,000 pounds per acre equals $16\frac{1}{2}$ pounds and at 1,500 pounds equals $24\frac{3}{4}$ pounds. Each row should receive one-twelfth of these amounts.

If a test of a single element is required or if the value of one element as compared to another is desirable the procedure is essentially the same.

Comparing nitrate to superphosphate in the above formula, taking the area for application the same as above, the amounts required for each treatment are obtained in the same manner, namely 650 pounds of nitrate is multiplied by 0·0165 and 1,250 pounds of superphosphate is multiplied by 0·0165. Dominion Department of Agriculture bulletin No. 145 on "Manures and Fertilizers" contains valuable information on this subject.

There is frequently an element of doubt as to the most suitable time to apply fertilizers and whether the whole application should be made at one time. The quickest method is to broadcast all the fertilizer over the field before the crop is sown. An essential feature in plant growth is to have the plants well established by the time hot dry weather is prevalent so that they can withstand these somewhat adverse conditions. If this has been accomplished and the resultant crop should prove satisfactory the plants will have developed a sufficient root system to enable them to gather the necessary food. In order to give the plants a quick start abundant fertility should be available at the time of seeding or root development and consequently an application of fertilizer immediately before or at the time of seeding or transplanting is desirable. Another factor to be considered is the kind of fertilizer used. Nitrogen generally speaking is the most readily available form. Phosphates and potash are less readily available and consequently can be applied previous to planting with beneficial results. Usually a single application of these is sufficient. Nitrogen can be applied all at one time or in two applications. It should be borne in mind that a quick growth early in the season is one of the primary objects and that the plant root system spreads out over a considerable area of ground so that fertilizer applications need not be concentrated around a small area about the stems of the individual plants.

The following table gives useful information on fertilizer mixtures, taken from Dominion Department of Agriculture bulletin No. 145:—

HOME MIXING TABLE

Percentage of plant food required—as expressed by the formula	Nitrogen supplied by			Phosphoric acid supplied by superphosphate (16% P_2O_5)	Potash supplied by muriate of potash or sulphate of potash (50% K_2O)
	Nitrate of soda 15½% N	Sulphate of ammonia 21% N	Dried blood 12% N		
	lb.	lb.	lb.	lb.	lb.
1	130	95	167	125	40
2	260	190	334	250	80
3	390	285	501	375	120
4	520	380	668	500	160
5	650	475	835	625	200
6	780	570	1,002	750	240
7	910	665	1,169	875	280
8	1,040	760	1,336	1,000	320
9	1,170	855	1,503	1,125	360
10	1,300	950	1,670	1,250	400

"To find the weights of the material required to furnish the same amount of plant food as is contained in one ton of 4-8-6, using nitrate of soda, superphosphate and muriate of potash:

There is required 4 per cent of nitrogen. Opposite the number 4 (in first column) the amount of nitrate of soda to furnish 4 per cent of nitrogen is found to be 520 pounds.

Similarly, opposite 8 (in first column) the amount of superphosphate to furnish 8 per cent of phosphoric acid is 1,000 pounds.

Opposite 6 (in first column) the amount of muriate of potash necessary to furnish 6 per cent of potash is 240 pounds."

ASPARAGUS

Asparagus is one of the most prized early spring vegetables and deserves a place in every garden. It is easily grown and being perennial a single planting given good care will last for ten or twelve years.

Plants may either be bought or grown from seed. One-year-old roots are the best to set out in the permanent bed. Seed should be sown in drills one and one-half inches deep with drills at least fifteen inches apart. The seed is slow to germinate and in ground where weeds are likely to be troublesome it is often advisable to plant a few seeds of some quick germinating kind such as radish so that the rows will be clearly defined which facilitates weeding. The plants should be thinned to six inches apart in order to allow maximum root development the first season.

The following spring the permanent bed should be prepared. Asparagus rows are best planted four feet apart. Each row should be trenched eight to twelve inches deep depending on the soil type, the lighter the soil, the greater should be the depth. When the bed is prepared the young plants should be dug and all weak and small roots discarded.

In the row, plants should be spaced eighteen to twenty-four inches apart and covered to a depth of two inches. The better soil should be placed closest to the roots and where the bottom of the trench is in the less fertile subsoil well rotted barnyard manure or rich earth should first be spread along the row. During the season as growth develops the trenches should gradually be filled up.

Asparagus demands a fertile soil and heavy annual applications of well-rotted manure should be dug in early each spring. When the amount of manure that is available is not sufficient additional plant food should be added in the form of commercial fertilizer, using approximately 300 pounds of nitrate of soda, 450 pounds of superphosphate of lime, and 150 pounds of muriate of potash per acre. Under garden conditions for one hundred feet of row 4, 6, and 2 pounds of the above mentioned ingredients should prove beneficial.

No crop should be harvested the first year after planting and comparatively little the second year. During the third year harvesting should be limited to five or six weeks, thereafter from eight to ten weeks.

Cultivation should at all times be carried out to control weeds and grasses and in the early spring to have the surface soil loose and open as an aid to growth. In weeding, it should also be the aim to destroy any young plants which have voluntarily seeded. Tops can be removed any time after growth has ceased. So long as the bed continues to yield satisfactorily there is no need to change. As soon, however, as growth appears to be weakening a new planting should be prepared as it requires three years for this to come into bearing. Under many conditions a patch will last for twelve years. One of the limiting factors for continual bearing is that each year the plant forms a new crown on top of the old one, consequently in time the root system is forced to near the surface. Blanched asparagus is obtained by hilling over the rows in the early spring and cutting the stalks when the tip reaches the surface. Under some conditions blanched stalks have a tendency to be bitter. When the cutting season is over the beds should be levelled off. The most popular present day variety is Mary Washington, others of merit are Palmetto and Argenteuil.

BEET

Experiments run with beet have consisted of dates of seeding for earliness, dates of seeding for storage roots, distance apart of thinning and variety tests. Comparatively little success has attended seedings prior to April 1. As a general rule, seed planted early gives a very low percentage of germination and roots which develop have a tendency to run to seed. When such plants come to this stage the roots are usually tough and stringy. Seed sown from April 1 on will give satisfactory results and will mature in the order of sowing, and when it is sown at intervals of ten days to two weeks will give a satisfactory cropping system. For the production of fall roots a satisfactory time for planting is approximately May 15 to June 15. Earlier seedings have a tendency to be overgrown and woody.

Beet can be thinned as the roots come to an edible size and such young roots are of excellent quality when approximately one inch in diameter. Thinning the plants to three inches apart allows sufficient room for normal development.

There are many varieties of beet but as frequently happens the highest yielding varieties are not of the best quality. Detroit Dark Red has proved to be one of the most satisfactory kinds. Early Flat Egyptian is as the name indicates a flat variety and matures a few days earlier than Detroit Dark Red and most other varieties. The best quality beet that has been tested is the Dark Red Ball. This is a late maturing kind, has a long tapering root and is of lower yield than others mentioned.

CARROTS

Carrots respond to treatment in a manner somewhat similar to beet. Early seedings will, however, give more satisfactory results. Weather conditions, however, affect the rate and percentage of germination. Roots from such early

seedings do not have as great a tendency to run to seed but no specific recommendations can be made along these lines as much depends on soil and weather conditions. During April satisfactory results are obtained and succession sowing is advisable. For fall storage roots, seed should be planted from May 15 to June 15 as early seedings tend to become overgrown and coarse.

Thinning can be done as with beet, namely, to pull the most developed roots when they reach marketable size. When full development is required thinning distances should be from one and one-half to two and one-half inches apart.

Carrots are of several different types, of which the most important are: the short stump rooted varieties which are early, such as the French Forcing Horn and the intermediate varieties as Chantenay, Danvers Half Long, Scarlet Horn, and Early Nantes. The Chantenay has given very satisfactory results for yield and quality. The Early Nantes and Scarlet Horn are slightly earlier varieties and are of excellent quality but not quite as heavy yielders.

PARSNIP

Parsnips are not so popular as many other root crops and they are grown essentially for winter production, so different dates of seeding are not as important a factor as with the last two mentioned crops. A long growing season is required and most satisfactory results have been obtained from seed sown in the middle of April and plants thinned to three inches apart. Parsnips are hardy and will stand alternate freezing and thawing so they can be left in the ground all winter provided roots are not required when the ground is frozen. A disadvantage with some varieties is the extremely long root system which increases the difficulty of harvesting. The variety Hollow Crown gives satisfactory results but has the above mentioned characteristic. Guernsey develops to a less extent the long tap root but of the strains tested the shape of roots is not as uniform.

RADISH

Radish is an easy crop to grow except for attacks of root maggots and flea beetles. The crop matures quickly and has responded very well to early seeding in January and February, giving marketable roots before attacks from insect pests. As a large number of roots can be grown in a comparatively small area one of the most satisfactory methods of preventing insect injury is to plant seed in frames and cover these over with cheese cloth or to apply corrosive sublimate as mentioned under cabbage.

Radish are of different seasons of which the spring varieties are the most important, of these French Breakfast and Scarlet Turnip White Tipped have given satisfactory results. White Vienna is a good summer and China Rose a good winter variety. For production of the last two varieties seedings run from May until the end of June.

TURNIP

Turnips are severely attacked by root maggots and flea beetles and as it is usually a low priced crop it is not profitable to grow where these pests are prevalent. The plants are also not adapted to as wide a range of conditions as many other vegetables. It is essentially a cool season crop for spring or winter use.

Cultural treatment is similar to that for other root crops. There is at times confusion as to the classification of turnips, which come under two distinct types; the smaller growing varieties such as Purple Top Milan, White Milan,

and Snowball are most suitable for spring or early summer crops; and the second type is best represented by Canadian Gem, a larger, later maturing, yellow fleshed variety, which should be seeded early in June.

Dates of seeding have been tried out and when planted previous to March little satisfaction has been obtained as roots run to seed as they approach marketable size. Seedings in March have given satisfactory results. For winter crops the larger yellow coloured varieties are most suitable and should be seeded in June. Rutabagas are sold as winter turnips and are frequently referred to as Swedes; they require a little longer growing season than turnips, in other respects they are very similar.

KOHL RABI

This is a vegetable which does not appear to be grown as extensively as it deserves. It is of very good quality and is cooked in the same way as turnips and resembles them much in taste. Seed should be sown early and as rapid growth as possible gives a better quality product. Plants should be thinned to approximately four inches apart and thinning in part can be accomplished by harvesting the first roots which attain a marketable size. The edible portion becomes tough and stringy with age and should consequently not be allowed to grow for too long a period. The marketable portion of kohl rabi is the swollen stem and so it differs from the true root crops. It is possibly due to this reason that plants are less severely attacked by root maggots, and flea beetles will not cause as much harm as they do to some other crops. For this reason it can be grown where turnips, to a great extent, will fail. White Vienna has proved a satisfactory variety.

LETTUCE

Certain parts of the province are well adapted to the growing of head lettuce and it has been proved that excellent plants can be grown and that a high average of good marketable heads can be obtained. Lettuce is consumed in rather large quantities and much of the produce on the market is imported, which shows that there is no over-production of locally grown stock, which should prove beneficial from a marketing point of view.

There are in general two methods of handling this crop. Seed sown in hotbeds in February and later transplanted to the open or seed sown in the open at the same or at a later date. Information applicable to this crop is given under the heading "Producing Early Vegetables". The first method is generally used to produce the earliest crops. For the later maturing crops the seed can be sown in the fields in drills. It is advisable to have plants maturing over an extended time. The earliest crop, however, brings the highest price. Young seedling plants should be set out on the square about 15 inches apart so that cultivating can be done two ways with wheel hoes. The entire root system to the first green leaves should be set in the ground. Lettuce when seeded in drills in the field is planted in rows approximately 15 inches apart. When the plants require thinning the wheel hoe is again used and run across the rows, cutting out the rows in blocks so as to leave plants every twelve or fifteen inches. In many cases more than one plant will be left to a hill, so hand thinning to individual plants is necessary. It is advisable at all times to have rows as straight as possible as this makes cultivation easier.

When the plants commence to head it is necessary to make pickings every one or two days. Nothing but firm heads should be taken; plants can either be pulled or cut off. When packing in crates the roots should be cut off and the large outer leaves removed.

Under many conditions head lettuce cannot be satisfactorily seeded after May 1, and in some seasons not later than April 15, as late plantings do not

head out satisfactorily. In some seasons good results can be obtained from seedings made in early July, particularly if there is sufficient soil moisture to start germination. Crops from late plantings are ready for the market in September and October.

In gardening there is no fertilizer as generally satisfactory as barnyard manure. This should be applied whenever available but failing this under the majority of conditions an application of nitrate of soda at the rate of 250 pounds per acre should prove beneficial or a complete fertilizer consisting of 250 pounds nitrate of soda, 250 pounds of superphosphate of lime and 50 pounds of potash.

New York and Iceberg have proved to be the most satisfactory varieties.

The most troublesome pest is slugs. The Entomological Branch at Agassiz in some preliminary tests (work unpublished) has found that copper sulphate dust mixed in the proportion of one pound to ten pounds of finely hydrated lime dusted on and around the plants in the evening is the most satisfactory method of controlling this pest. Applications should be made as soon as slugs are noticed. It is necessary to give several treatments.

SPINACH

Spinach is a cool season crop and therefore requires early planting. There are two essentially different kinds though similar in type and growth habits. The Winter or Prickly variety is more suitable for early crops and King of Denmark or Noble Gaudry for later crops. Spinach is adaptable for seeding at different seasons of the year from December until late in April and from late July until the middle of August. For early crops seeded in December and January the Prickly variety has given best results. Seedings between May and July ordinarily run to seed before reaching a marketable size. Plants should be thinned to stand four to six inches apart.

Spinach is a crop which does best in soils of nearly neutral action between acidity and alkalinity. Where growth is not satisfactory and the soil is considered to have an acid reaction applications of lime at the rate of one or two tons per acre may prove beneficial.

SWISS CHARD

This is a desirable pot-herb easily grown and yielding good sized crops. One of its chief advantages is that it withstands summer heat so when sown in early spring crops can be harvested throughout the summer and fall until hard frosts occur. The plants grow larger than spinach and consequently require up to twelve inches spacing in the rows. The method of harvesting is to cut off the outer leaves as they reach marketable size. Care should be taken not to injure the remaining part of the plant as this continues to develop.

Two of the best varieties are Lucullus, which has dark green leaves and Perpetual similar to the former but having lighter coloured foliage.

PEAS

Peas are one of the most popular kinds of garden vegetables and are represented by many different varieties and by several different types. Three of the main essentials between varieties are earliness, quality, and habit of growth. Included in the latter character there are the true dwarf varieties growing up to two and one-half feet tall, the half dwarf varieties up to four feet and the tall varieties up to seven feet tall. Within these groups are found varying degrees of earliness, yield, and quality. The earliest maturing varieties are found in the dwarf kinds and the highest yielding ones are found among the tall varieties.

Among many varieties tested Alaska has proved to be the earliest. It is a round seeded variety and therefore responds well to early seeding, grows approximately three feet high, yields well but is of inferior quality.

Little Marvel has proved to be a very satisfactory dwarf kind. It grows about two feet high, matures a week later than Alaska, yields approximately the same and is of superior quality.

Two half dwarf varieties which yield considerably more than either of the above kinds are Bruce and Director. They mature approximately ten days later than Little Marvel.

Two tall growing varieties that have outyielded any other variety are Duke of Albany and Golden. These kinds mature at the same date as Bruce and Director. The Duke of Albany excels in quality and the Golden in yield.

The most satisfactory late dwarf variety tested is Supreme. It outyields Stratagem, due largely to the fact that it gives a considerably higher percentage of seed germination.

Apart from the variety characters mentioned above there is to be considered the work involved in staking tall varieties as compared to non-staking of the dwarf kinds. Where mildew is prevalent and in intensity, it varies from year to year, some staking aids in overcoming this trouble.

Depth of planting seed should be approximately two inches. For dwarf varieties rows should be two and one-half to three feet apart and for tall varieties four and one-half feet apart.

The following table gives the result of an experiment testing different distances apart of planting seed and indicates that close planting gives the best results.

PEAS—DISTANCE APART OF PLANTING SEED

Variety	Distance apart of planting	Yield in pounds					Total yield
		1923	1924	1925	1926	1927	
English Wonder	1 inch	7	19	20½	19	18	83½
	2 inches	4½	17½	23¼	14⅓	9¾	69½
	3 "	3	16¼	19¾	10¾	7¾	57½
Stratagem	1 inch	4¼	.....	.....	15	14¾	34
	2 inches	4⅛	.....	.....	10½	17¾	32⅜
	3 "	5⅜	.....	.....	10	14¼	29⅜
Thomas Laxton	1 inch	11¼	19¾	18¾	.....	16½	66¼
	2 inches	10½	9	14⅕	.....	23	57⅝
	3 "	4¾	10½	10¼	.....	12¾	38¼

The plot area each year consisted of a single 30-foot row for each distance apart of planting, with rows spaced three feet apart.

BEANS

The greater amount of work done with beans has consisted of variety tests with dwarf kinds. The object in view has been to determine earliness, yield, and freedom from disease. The kinds tested have been divided into two classes, green and wax podded. Of the green podded varieties Masterpiece is probably the best all round variety with a very desirable type of pod, it being long and straight, particularly desirable for slicing. Other good kinds are Early Bountiful, Stringless Green Pod, and for a late crop Refugee. Amongst the wax podded varieties Jones White, Davis White Wax, and for a late crop Hodson Long Pod, have proved best.

Beans are essentially a warm season crop and are usually not planted until May. They will, however, under favourable conditions respond to earlier planting. Crows are frequently a troublesome pest when the young seedlings are first showing through the ground as they pull out many of the young plants. In order to obtain the maximum yield from plants, harvesting should be regularly performed as any drying of pods tends to shorten the period of production as the accompanying illustration shows.

Affect of continual cropping on beans. The row in the foreground was not harvested. Growth is complete. The rows in the background were harvested regularly, growth and production continuing over a longer period.

The following table gives the result of an experiment on distances apart of planting seed and indicates the beneficial results of close planting.

BEANS—DISTANCE APART OF PLANTING SEED

Variety	Distance apart of planting	Yield in pounds					Total yield
		1923	1924	1925	1926	1927	
Round Pot Kidney	2 inches	30¾	16	17¾	14	22½	101
	4 "	15½	10	19	13	12¼	69¾
	6 "	14½	7½	12¼	12	10½	56¾
Stringless Green pod	2 "	23¼	19	18½	12½	15½	88¾
	4 "	22½	14	11	10½	9¾	67¾
	6 "	7½	8	9¼	12¾	5½	43

The plot area each year consisted of a single 30-foot row for each distance apart of planting, with rows spaced three feet apart.

ONIONS

Onions are considered essentially a crop for the drier, warmer, parts of the province and an important factor which enters into this consideration is the curing of the crop in late summer. In the coast district good crops can be grown and in the majority of cases greater success can be had by sowing seed in hot-

beds and transplanting seedlings to the open three inches apart early in April. Early seeding in the open in February and March has given little success due largely to the fact that seed gives a very low percentage of germination. Seed can be sown quite thickly in hotbeds and no transplanting until setting out in the open is necessary. Young seedlings should be planted only at a shallow depth and for this purpose a spade or piece of metal can be used to open up a narrow trench in the soil by pressing downwards and then either backwards or forwards. Furrows opened in this manner need not be more than one inch wide. The following table gives the result of an experiment run during the years 1927 to 1930.

ONIONS TRANSPLANTED FROM HOTBED VERSUS SEEDED IN OPEN—FOUR YEARS' RESULTS

Variety	Year	Date seeded in hotbed	Date trans-planted	Date seeded in open	Yield trans-planted row	Yield seeded in open	Total yield	
							Trans-planted	Seeded in open
					lb.	lb.	lb.	lb.
Ailsa Craig	1927	Feb. 28	April 16	April 12	51¾	25	.....	.....
Ailsa Craig	1928	Feb. 27	April 21	April 21	31½	23	.....	.....
Ailsa Craig	1929	Mar. 16	May 2	May 2	104¼	49¼	.....	.....
Ailsa Craig	1930	Mar. 10	April 19	April 19	121	65	308½	162¼
Southport Yellow Globe	1927	Feb. 28	April 16	April 12	36¾	30	.....	.....
Giant Yellow Prizetaker	1928	Feb. 27	April 21	April 21	45	21	.....	.....
Giant Yellow Prizetaker	1929	Mar. 16	May 2	May 2	107½	51¾	.....	.....
Giant Yellow Prizetaker	1930	Mar. 10	April 19	April 19	134	93	323¼	195¾
Southport Red Globe	1927	Feb. 28	April 16	April 12	23½	24¾	.....	.....
Large Red Weathersfield	1928	Feb. 27	April 21	April 21	40½	19	.....	.....
Large Red Weathersfield	1929	Mar. 16	May 2	May 2	60½	39¼	.....	.....
Large Red Weathersfield	1930	Mar. 10	April 19	April 19	112	86	236½	169

The plot area in the first year compared single 30-foot rows of each variety for each treatment, in the second year duplicate rows, in the third and fourth years triplicate rows of each variety treatments alternating with one another.

Under experimental farm conditions liming the soil for onions has proved beneficial.

Onions—transplanted seedlings from hotbed on the left, seed sown in the open on the right. Crop from a 30-foot row.

When seeding in the open this operation should be performed early in April. It is frequently advisable to delay thinning until fairly late in order to determine what damage has been done by root maggots. This is the worst pest of onions and control may be had by applications of corrosive sublimate, or the Bordeaux oil emulsion spray that of recent years has been found very effective in the control of this pest, or by planting very early in the spring some old bulbs. These will be showing green before the main crop and the flies which produce the maggots will largely lay eggs on these old plants; they should be destroyed early in June so that all larvae will be killed. Misses caused by maggot injury can be filled up with plants thinned out.

The onion crop should be allowed to mature as much as possible in the open. Maturity is at first indicated by a withering and falling over of the tops. When this stage is reached the bulbs should be pulled and allowed to dry in the field. If weather is dull and cloudy or if heavy dews prevail it may be necessary to turn the onions a few times. Where drying is not satisfactory on the ground racks can be set up in the field and the onions in bunches tied to these. Where an attic, hay mow, or some such space is available the crop can finally be cured indoors. The tops should not be pulled off until the neck is thoroughly dry. This is one of the conditions that determines keeping quality. Ailsa Craig and Prize-taker have given very satisfactory yields and large bulbs. Other good varieties are Red Wethersfield and Yellow Globe Danvers.

Onion sets are produced from most of the better known varieties of onions. To produce a crop such as this growth of bulbs must be curtailed and this can best be accomplished by sowing the seed thickly and refraining from thinning. Poor soil is often a suitable location and where watering is practised this should be withheld. Sets must like the main crop onions be properly cured. They may be planted in January or February the following year to obtain early green onions. Multipliers or shallots are also very satisfactory for this purpose and are hardy, often remaining in good condition in the open throughout the winter. A single small bulb divides itself into several parts and in this manner gives a considerable increase. They are used in a manner similar to green onions and are of milder flavour.

LEEK

This vegetable does not receive any extensive attention though in certain districts it is in quite popular demand. Seed should be started under glass early in March and the seedlings transplanted to the open in April, whenever ready. The crop has similar requirements to onions. The seedlings should be planted four to six inches apart in the rows with the rows eighteen inches apart. Plants should gradually be hilled up in order to obtain a well blanched stalk. Musselburgh and Giant Carentan have proved the most satisfactory varieties.

CABBAGE

In some districts cabbage is one of the most difficult crops to grow due mostly to the attacks of insects, chiefly root maggots, flea beetles and the green cabbage worm. Root maggots are best controlled with applications of mercuric chloride (corrosive sublimate) mixed in the proportion of one ounce to ten gallons of water and applied to the young seedlings three days after planting in the open and at weekly intervals thereafter giving three, four, or more treatments depending on the vigour of plants and the degree of infestation.

Flea beetles are best controlled by a nicotine dust made up by mixing one ounce of forty per cent nicotine sulphate with one pound of finely hydrated lime. This mixture should be dusted on the plants with a dusting machine when the beetles are prevalent, when the air is still and when the temperature is 65 degrees Fahrenheit or above.

The green cabbage worm is the larval form of the white cabbage butterfly. Owing to the waxy surface of the cabbage leaves sprays do not adhere well to the foliage. Arsenate of lead dusted on the plants at frequent intervals at the rate of one pound of lead to sixteen pounds of hydrated lime helps to control this pest. Where control measures are necessary for both flea beetles and green cabbage worms the arsenate of lead can be mixed with the nicotine dust and applied at the same time. Care should be taken that the dust penetrates well into the developing head. If a dusting machine is not used the material can be shaken onto the plants through a cheesecloth bag.

Cabbage is grown to mature at three different seasons: the spring, the summer and the winter crops. The spring crop is seeded in July or August and transplanted to field conditions in September. As the young plants are in the open all winter this crop can only be grown in the milder and more sheltered parts. One of the most suitable varieties for this purpose is Flower of Spring. Under local conditions this variety, when planted for a fall or winter crop will not give firm heads.

For the early summer crop seeds are best started under glass in February and planted to the open when good sized plants are available. If seed is sown thickly in hotbeds the plants should either be thinned out or transplanted once. Cabbage seed sown in the open in January will usually give good germination, and satisfactory growth for the production of early crops, and where hotbeds are not available this method is quite satisfactory. Golden Acre and Copenhagen Market are both good varieties for this purpose. The Golden Acre produces very firm regular heads which measure from six to eight inches in diameter.

For the main crop varieties seed can satisfactorily be sown in frames covered over with cloth for insect protection. For fall cabbage seed should be sown about the first week in April. For winter storage purposes experiments have shown that this date is too early as heads mature in September and October and have a tendency to split open. For storage purposes seeding of the Danish Ballhead varieties and Brunswick is best made the first week in May. For Copenhagen Market the date of seeding can be delayed for two to three weeks. Satisfactory distances apart for plants in the field are eighteen inches apart in the row and rows two and one-half feet apart.

CHINESE CABBAGE

This vegetable is quite variable in type and differs much from ordinary cabbage in appearance and habit and in being an annual. It is subject to attacks of flea beetles and root maggots. It is essentially a fall crop and requires a cool season for maturing. Mature plants withstand about ten degrees of frost. Of several varieties tested only two have given satisfactory results, New Joy and Wong Box (Pasting). The former resembles celery in type and the latter is somewhat similar to chard in appearance and forms a firm compact head, heads averaging four pounds in weight. Seed is best sown in the open from June 15 to July 15 for heads to mature in October and November. Seed sown in April has not proved satisfactory either when sown in the open or transplanted as the young plants run to seed without forming heads. New Joy is best cooked in a manner similar to celery and Wong Box can be eaten as a salad or cooked in a manner similar to cabbage.

CAULIFLOWER

In general cauliflower requires similar treatment to cabbage and is subject to the same pests, though it is not as severely attacked by the green cabbage worn. It is less hardy to freezing and is somewhat more difficult to raise. Cabbage will mature heads satisfactorily during the heat of summer

while cauliflower under most conditions will not. In the milder more protected parts spring crops can be raised by sowing seed in July and treating like cabbage. The early summer crops are best produced by starting the seed under glass in February and transplanting the seedlings to the open when danger of frost is over. Cauliflower heads should be as white as possible and to produce this effect they must be covered over when reaching maturity. This can satisfactorily be done by tying together the large outer leaves. Heads must be watched carefully as too long blanching either causes moulds to set in or else flower stalks commence to appear. In some cases the large outer leaves need only be snapped over the head. If tying is resorted to suggestions have been made to use different coloured strings on different days to indicate without examination the length of time that blanching has been under way.

For the production of fall crops seeding can be done as for cabbage. Cauliflower can be divided into two main groups best represented by the varieties Snowball and Autumn Giant. The first mentioned is a satisfactory kind for both early summer and fall crops, the latter for fall crops only, it is a larger growing variety and requires a longer growing season and should therefore be planted a little earlier than Snowball.

BRUSSELS SPROUTS

Comparatively little success has attended the production of this vegetable under the Agassiz Experimental Farm conditions. Cultural operations are similar to those given cabbage for fall crops. Seed should be sown in frames in April and transplanted before hot weather commences or sown in the open in January or February. Plants attain a greater size than most cabbage and should, therefore, be given more space. Brussels sprouts are comparatively hardy and will stand quite a few degrees of frost in the fall and early winter. The " buttons " mature from the ground upwards and should be harvested when firm, frequent harvesting permitting a greater development of the upper buds. Plants are attacked chiefly by root maggots, flea beetles and aphids. Barr Little Gem, Matchless and Dwarf Improved have proved to be the best varieties.

Brussels sprouts like cabbage and cauliflower, when seeded in the open in January or February will frequently give more satisfactory results than when seeded in hotbeds and later transplanted.

Better results are also obtained with seedings made in the open when no transplanting is done. As mentioned in an earlier section, transplanting gives the plants a set back at a time of year when growth is not very rapid, consequently seedlings are more subject to serious injury from root maggots and flea beetles. This method of planting is, however, more adaptable to small than large areas.

CUCUMBERS

The two outstanding varieties of cucumbers are Perfection and White Spine. Both of these varieties have proved to be of good quality and are high yielders. Cucumbers may either be planted in hills or rows. When planted in hills approximately three plants to a hill and hills spaced six feet on the square. Another convenient method of planting is to sow in rows and plants spaced a foot apart. The highest yield obtained from this method of planting using paper mulch was 729 fruits weighing 502 pounds from a thirty-foot row. When the hill system of planting is used extra fertilizing can well be obtained by removing some earth and filling up the hole with well rotted manure or compost earth. For larger areas the row system is the most satisfactory, the hill system, however, allows for cultivation both ways during the early part of the season.

Cucumbers—Comparative crops at one harvesting from 30 feet of row. Paper mulch on the left, normal cultivation on the right.

Cucumbers—Paper mulch on the left, unmulched row on the right.

Cucumbers are a warm season crop and usually do not respond to early planting as the seed has a tendency to decay in the ground when the weather is dull and wet. If early plants are desired this can be accomplished by starting seed under glass preferably each plant in a separate container so that it can be transplanted without causing any injury to the root system. If seed is planted on small squares of inverted sod at transplanting time the sod with the seedlings attached can be set out in the open. Rows treated with paper mulch have given very satisfactory results, yields being greatly increased when this method of cultivation is followed.

Pickling cucumbers are treated in a manner similar to slicing cucumbers. Fordhook and Snow Pickling have proved satisfactory varieties but the larger growing kinds such as Davis Perfect and White Spine when harvested small are equally good.

Slicing cucumbers are very palatable when cooked as vegetable marrow.

MUSKMELON

The coast area is not particularly suitable for growing this crop but under some conditions good results can be obtained. Seed can be started under glass in individual containers such as small sized flower pots and when suitable weather conditions prevail the seedlings shaken from the pots and transplanted to the open with as little root disturbance as possible. Seed can also be started satisfactorily in the open when warm weather has set in approximately the middle of May. Cool wet weather at seeding time prevents to a large extent good germination. Plots can be laid out on the hill system as with cucumbers or seeding may be done in rows six feet apart and plants one foot apart in the rows. As with cucumbers paper mulch has considerably increased the yield and earliness of this crop.

The most satisfactory variety has been Emerald Gem.

PUMPKIN AND SQUASH

The term squash is somewhat vague when particular types are considered. Quite frequently when reference is made to squash the Hubbard varieties are the kind in mind and the term vegetable marrow or summer squash designates the larger more oblong kinds. Apart from these two kinds there are the Patty Pans, Summer Crookneck and other less known types of comparatively little importance. Commercially the Hubbard squash, either the smooth green and golden or the warted types and the summer squash, trailing or bush form in green or white are the most important kinds. The Summer Crookneck is of excellent quality and a type with the variety name of Cream or Perfect Gem is very desirable, trailing in habit, fruits somewhat globular, average weight of fruits two to three pounds and quality similar to the Hubbard varieties. The size of these fruits is particularly desirable for domestic use.

Including pumpkins cultural requirements for the above types are similar. Seeding, if a high percentage of germination is required, should be delayed until the weather is bright and warm, approximately May 15. Seed may be sown in drills or hills. For the bush types, hills should be spaced approximately six feet apart on the square leaving two or three plants to a hill. In drills plants should be thinned to stand three or four feet apart and drills six feet apart. With trailing varieties of summer squash and the Hubbard varieties hills should be eight to ten feet apart or drills at the same distance and plants thinned to three or four feet. It is always advisable to sow more seed than a full stand of plants will demand.

In the hill system of planting there is no need to elevate the soil. When the ground is poor it can be enriched with well rotted barnyard manure or com-

post earth. Squash roots spread out to a very considerable distance, for this reason it is advisable to enrich the soil for a considerable area beyond the actual points where the seed is placed.

The floral parts of squash are of some interest and frequently the condition that prevails leads growers to believe that a very poor set of fruit is being obtained. On the same plant there are two types of bloom, namely, the male and female flower. The function of the male flower is to produce the pollen which is carried to the female blossom by bees and other insects after which it dies; the female blossom develops the fruit. The majority of the pollen producing flowers are nearest the root end of the plant and they are borne chiefly on long stems and usually are the first to appear. The female blossoms are borne throughout the length of growth and are closely attached to the vine.

Amongst pumpkins the variety Sweet or Pie is desirable in quality and size. Hubbard squash are better keepers for winter use than most other kinds. For storage the stem should be attached to the fruit and room temperature should be between 40 and 50 degrees F. It is necessary to harvest before frost injury occurs.

EGG PLANT

This vegetable receives only limited attention in the coast area of the province as it does not thrive particularly well. At the Experimental Farm during recent years the varieties New York Purple and Early Dwarf have given satisfactory results, particularly when the plants have been treated with paper mulch. Seed should be started under glass the latter end of March and seedlings transplanted to the open approximately May 15, setting the plants two feet apart in rows with rows three feet apart.

Flea beetles have been the only troublesome pest.

PEPPERS

Peppers are of some commercial importance in the coast area of the province and satisfactory crops can be obtained with little trouble. Seed for this crop should be given the same treatment as with egg plants and seedlings transplanted to rows thirty inches apart with plants eighteen inches apart in the rows.

There are numerous types of peppers, the large green kinds are however of most importance; these will turn red if allowed to fully ripen. Earliest, Neapolitan, Ruby King, and Hamilton Market have all done well.

Long Red Cayenne is a much more pungent kind and requires a longer period in which to mature.

CELERY

Celery is a crop somewhat particular in its soil requirements demanding particularly one that is rich in plant foods and well supplied with moisture. Muck soils generally fulfil these conditions. On light somewhat dry soils results are not as a general rule satisfactory, growth being small and the stalks hollow and pithy.

Seed should be sown in hotbeds about the middle of March and when the young plants have attained sufficient size they should be transplanted to other hotbeds and spaced three inches apart in rows four inches apart. Early in May they should be planted in the open six inches apart in drills every three to four feet.

Experiments have been run to determine the comparative value of planting in trenches six inches deep and planting on the level. There has been no practical difference in the results obtained and consequently the extra labour involved

in making a trench is not justified. It should be mentioned, however, that the surface soil on which the experiment has been conducted is shallow, consequently the young plants when set out have been set down to the less fertile subsoil. In transplanting and cultivating celery care should be taken that earth does not get into the growing centre of the plant.

In the fall when the plants have attained sufficient size and before severe frosts they should be blanched either with soil, boards, or paper collars made for the purpose. Experiments conducted on the respective merits of blanching with soil or boards has given no marked superiority of one method over the other. During warm weather soil has a tendency to cause a greater amount of russeting on the stalks, but for late crops during cool weather this condition does not make itself apparent. Blanching with earth is more rapid than with boards. Soil should be banked against the plants using a shovel on small areas and a mouldboard plough on larger plantings; wider spacings between rows are necessary when earth is used. The upper part of the foliage is left exposed. When boards are used one by twelve material of any convenient length is satisfactory. These should be laid on the ground close to the rows then raised vertically and drawn together at the top leaving a space approximately four inches wide. The upper edges may satisfactorily be held together with cleats of wood. When the bottom edges do not lie close to the ground some earth should be thrown against them. A greater tendency for slime rot to develop has manifested itself when blanching with boards has been adopted. This condition will however not as a rule be present if the boards are removed as soon as blanching is completed.

The two experiments referred to above were run on the same plot area, which each year consisted of two thirty-foot rows spaced four feet apart, one on the level and the other trenched. Half of each row was blanched with boards and half with earth. Yield results were recorded annually on the weight of twelve average sticks trimmed. The following table gives the yield records that were obtained:—

CELERY—TRENCHING AND BLANCHING

Year	Planted in trench				Planted on level			
	Blanched with boards		Blanched with earth		Blanched with boards		Blanched with earth	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1927	16	8	25	0	15	8	20	8
1928	23	0	26	0	18	0	19	0
1929	22	0	14	2	27	2	25	8
1930	27	0	25	8	28	8	23	0
1931	27	0	30	0	30	0	22	0
Totals	115	8	120	10	119	2	110	0

The Self Blanching, Golden Self Blanching and White Plume varieties have proved the most satisfactory but not as large or as heavy yielders as Winter King, Giant Pascal and other late green varieties.

As the celery crop matures late a large portion must be stored. A satisfactory way of accomplishing this is to dig a trench twelve to fifteen inches deep and set the plants upright with roots attached, close to one another. The roots may be lightly covered with soil. The trench should be covered over with one by twelve inch boards joined together to make an inverted V. These boards should be covered with straw and earth, the extent of protection depending on the amount of frost. Some provision should be made for ventilation during mild weather.

CORN

Corn is a vegetable crop of considerable importance both from a canning and fresh market point of view. During recent years canneries have accepted British Columbia-grown corn which has considerably increased the acreage planted.

In general there are two main ways in which the crop is planted, either in hills or drills. The hill method offers certain advantages as it permits of cultivation in two directions. More seed should be sown for either method than it is intended to have plants, to allow for germination, three or four plants per hill and every eight or ten inches apart in drills. Hills are satisfactorily spaced at three feet apart each way and drills three to four feet apart.

Corn is tender to frosts and percentage of seed germination is lowered by cool moist weather or wet poorly drained land. As with most other crops there is an advantage for an early product for the produce market and on limited areas, especially where the soil has a tendency to be dry and warm some early seedings are justified. For main crops such as canning, seeding is usually best deferred until the third week in May. The season of maturity can be influenced

Corn—on the left no manure, on the right manure applied at the rate of 20 tons per acre.

as above mentioned and use can also be made of different varieties requiring varying lengths of time in which to mature. Golden Bantam has been an outstanding popular variety during recent times but results obtained at this institution in the past five years have shown the three varieties, Sixty Day Golden, Groff Golden and Golden Giant, to be of much promise.

The following table gives the results obtained with Sixty Day Golden and Golden Bantam.

RESULTS WITH SIXTY-DAY GOLDEN AND GOLDEN BANTAM

Variety	Average date of maturity 5 year average	Total plot yield 5 year average	Total number of cobs 2 year average	Average weight of cobs 2 year average	Computed yield per acre 5 year average
		lb.		lb.	lb.
Sixty-Day Golden	Aug. 18	146¼	142	9·05	8,848
Golden Bantam	Aug. 29	114¾	137	5·84	6,942

Pickaninny is an early maturing variety of excellent quality. The average yield is, however, low as compared to the above mentioned kinds and cobs are small.

Experiments have been carried out to determine the value if any of removing suckers from sweet corn. The results obtained during the past five years in the accompanying table shows that suckering tends to decrease the yield. There has been an indication of slightly increased earliness for total weight, particularly with Golden Bantam, the increase, however, under most circumstances would not compensate for the extra labour involved and the decreased yield.

RESULTS OF CORN SUCKERING EXPERIMENT

Variety	Year	Date ready for use suckered	Yield suckered	Date ready for use normal	Yield normal	Total yield suckered	Total yield normal
			lb. oz.		lb. oz.	lb. oz.	lb. oz.
Early Malcolm	1926	Aug. 5	17 8	Aug. 9	17 8	.....	.....
Early Malcolm	1927	Aug. 16	18 12	Aug. 16	23 12	.....	.....
Early Malcolm	1928	Aug. 27	57 18	Aug. 27	59 0	.....	.....
Early Malcolm	1929	Sept. 14	104 7	Sept. 14	106 14	.....	.....
Early Malcolm	1930	Aug. 23	100 10	Aug. 25	100 6	298 13	307 8
Golden Bantam	1926	Aug. 9	29 0	Aug. 13	27 8	.....	.....
Golden Bantam	1927	Aug. 21	22 8	Aug. 23	22 8	.....	.....
Golden Bantam	1928	Aug. 27	42 8	Aug. 27	48 4	.....	.....
Golden Bantam	1929	Sept. 10	42 1	Sept. 10	54 12	.....	.....
Golden Bantam	1930	Aug. 25	60 14	Aug. 25	71 12	196 15	224 12

The plot arrangement has been as follows:—

In 1926 and 1927 there were two thirty-foot rows of each variety adjacent to one another, one row was suckered and the other allowed to grow naturally. In 1928 there were four adjacent thirty-foot rows of each variety. The rows of each variety were alternately suckered and allowed to grow naturally. In 1929 and 1930 there were six adjacent thirty-foot rows of each variety. The rows of each variety were alternately suckered and allowed to grow naturally.

In the coast area the most troublesome pest with corn is slugs, control remedies for which are mentioned under lettuce.

Corn is an acknowledged heavy feeder and therefore requires rich soil well supplied with manure or other fertilizer. The photo illustrates the difference in growth between manured and untreated plots.

TOMATOES

Tomatoes are produced mainly for canning purposes or table use. The different methods of production lie mainly in the varieties used and to some extent in pruning and training. For canning purposes plants are not staked and from the Ashcroft, Kamloops and Okanagan Lake area much of the early ripe fruit from fields grown largely for canning purposes is shipped in crates to different markets as a fresh vegetable.

Tomato seed should be planted early in March in hotbeds or greenhouses. The young seedlings when the true leaves form should be transplanted to distances approximately four inches apart. Much will depend, however, on the expected size of plants when they are to be set in the open which should be when danger of frost is over and warm weather has commenced, usually about the third or fourth week in May. Distance apart for planting in the field is determined largely by the method of cultivation that is adopted. For unpruned plants which are not staked three to four feet on the square is an average distance, for pruned staked plants twenty-four to thirty inches apart in the rows, depending on the amount of pruning, and rows three feet apart are satisfactory distances.

Several different methods of pruning may be followed. The plants broadly speaking are allowed to trail on the ground with three or four main branches forming or they are trained to stakes by tying. Under either system the amount of vegetative growth allowed to develop is optional and dependent on local conditions. The average tomato plant when allowed to develop normally does a considerable amount of branching out, growing shoots arising from the axils of leaves and fruiting trusses arising from the stems between the axils of leaves. In any system of pruning where growth is curtailed, the young shoots arising from the axils of leaves should be cut out. It is necessary to repeat this operation several times during the growing season. The terminal growth is allowed to develop and by this means plants can be trained to one or more main branches which grow four to five feet high. In the table below two or three truss plants have been headed at that height after the fruiting spurs were pruned.

On the Experimental Farm plants are pruned and tied to stakes as this method has proved to give earlier maturity and less damage from fall rains. Under some conditions and particularly in some seasons unpruned plants will mature good crops of ripe fruit and the less plants are pruned the greater the total amount of fruit produced. Where plants are allowed to grow on the ground in districts where cutworms are present much of the crop will be spoiled by these insects eating the tomatoes. The following methods of pruning have been tested out. Plants headed back at one, two and three trusses and plants trained to one and two main branches with no curtailing of terminal growth. Pruning to one truss has not proved satisfactory due to very low yields and sunscalded fruit. Pruning to two and three trusses has proved satisfactory in so far that during the first three weeks after the first ripe tomatoes are obtained the total yield of ripe fruit is greater than where more growth is allowed to develop. After this period is passed the amount of fruit produced is in keeping with the size of plants and plants trained to two stems outyield those which have been pruned back harder. The top prices for tomatoes are obtained during the early part of the season and it is for this reason that a small yield offsets a large yield in the ratio of high price and low yield to low price and high yield.

The following table gives pruning results from 1927 to 1931 inclusive:—

TOMATOES—METHOD OF PRUNING FOR EARLINESS

Method of pruning	Total yield first week	Total yield second week	Total yield third week	Total yield fourth week	Total yield fifth week	Total yield for season	Total yield green fruit	Total yield unmarketable fruit
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Pruned to 2 stems.	51 3	102 6	234 11	433 12	741 1	1,475 15	176 0	206 12
Pruned to 1 stem..	67 7	132 15	255 6	399 11	599 4	1,019 5	126 4	128 4
Pruned to 3 trusses	59 8	132 1	237 13	375 1	484 14	570 11	3 7	40 9
Pruned to 2 trusses	68 15	125 14	201 15	248 0	276 15	279 7	0 8	19 12

The plot arrangement has been as follows: In 1927 and 1928 there were single thirty-foot rows for each system of pruning. In 1929 there were three and in 1930 and 1931 there were four thirty-foot rows for each system of pruning one row arranged respectively in each of three or four plots. There were, each year, ten plants to a row.

A convenient size of stake is approximately one and one-half inches square and six feet long, driven one foot in the ground immediately after transplanting. It is necessary to tie the vines three or four times and allowance must be made at the first and second tying for the increased thickness of stems, so that they are not eventually cut by the string.

Bonny Best and Best of All have proved to be two of the most satisfactory varieties.

EARLY POTATOES

In the production of early potatoes there are several economic factors to be borne in mind. The lower yield per acre as compared to main crop varieties, and the higher price per pound of early potatoes in the spring, as compared to the lower price for later maturing varieties; obtaining two crops from the same land in one season which is within reason when potatoes are planted early in the spring; the lower cost of digging and sacking the smaller quantity, and finally a lesser carriage charge to the market.

In growing early potatoes one of the essential features is choosing the proper variety for the soil, and having the best strain of that variety available. The grower has two good alternatives, either to carry on his own seed selection or to obtain seed from a source on which he knows he can depend. In choosing his own seed he should plant the seed plot as a main crop variety, and harvest when the crop is matured; by doing this his seed will be in better condition than if harvested early and stored through the summer.

The soil for early potatoes must necessarily be one that is well drained, easily worked, and preferably with a southern exposure, as this hastens warming up in the spring. Such requirements are found in a sandy loam with a porous subsoil. The time to plant is as early as possible in March and in this connection one gambles to a certain extent with spring frosts. Potatoes can, however, overcome to a reasonable extent spring freezing of the foliage as all the possible sprouts are not showing above the ground for a considerable time after the first foliage appears. If the first leaves are frozen others will soon take their place.

Experiments have been conducted on the Agassiz Experimental Farm to determine the number of eyes per set that should be used—one, two, three, or all the eyes. Results have shown that a two ounce set with three or more eyes gives better results than the same size set with one or two eyes. It has been proved, also that whole sprouted tubers are better than cut sets giving a larger yield and a higher percentage of germination. In the majority of varieties it will be found that the average two ounce or two and one-half ounce set has from three to four eyes. Experiments now under way (three years' results) indicate that four ounce sets give a greater return than two ounce sets. The tubers should be set out to sprout from six to eight weeks before planting, in order that they may produce strong sprouts. This should first be done by exposing the tubers to a moderate or subdued light for a week in a cool place, which permits the potatoes to take on their first green colour. When this " greening " stage has been attained, the temperature should be slightly increased to encourage growth. Tubers sprouted slowly in the light give more vigorous and stronger sprouts than those sprouted in the dark. Sprouts from one to one and one-half inches long are desirable, but care must be taken that they are not broken off in planting. Ordinary greenhouse flats are satisfactory for sprouting

purposes, if piled one on top of the other it is economical in space. When so arranged the ends of flats should be four inches high and the sides one and one-half inches high.

Early potatoes can be planted a little closer than the main crop varieties as they have smaller tops and are competing for moisture and plant food for a shorter period. A good distance is twelve inches in the row and rows approximately thirty inches apart. Closer planting makes cultivation more difficult. Average depth of planting should be about two inches with an additional covering of about two inches. Cultivation should be frequent and hilling up done at the time the tubers form.

No projects have been carried on to determine the best mixture or amount of chemical fertilizer to use. A project has been run, however, to determine whether increased yields are obtained from fertilizer applications plus the use of barnyard manure. A mixture that has given good results consists of an application of 750 pounds to an acre and consists of 228 pounds nitrate of soda, 438 pounds of superphosphate of lime and 84 pounds of muriate of potash. The following table gives the result of a three-year test for rows thirty feet long and carried out in triplicate.

FERTILIZER TEST—EARLY POTATOES

Variety	1926		1927		1928		Total yield	
	Yield, fertilized rows	Yield, unfertilized rows	Yield, fertilized rows	Yield, unfertilized rows	Yield, fertilized rows	Yield, unfertilized rows	Yield, fertilized rows	Yield, unfertilized rows
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Bermuda	58	37¾	67½	43	47	39¼	172	117¼
Early Ohio	54	43½	51¼	39¾	33	31½	175½	120
Vicks, Extra Early	60	36	56½	37¼	36¼	32¼	116¼	103
Price received per pound	8½ cents		2 cents		6 cents			

Total average yield per acre:—Fertilized rows, 9,970 lbs.; unfertilized rows, 7,319 lbs.
Fertilizer cost per acre, $13.65. Average value of increase—$145.80.

The best time to harvest the early crop may be a little difficult to determine as the longer it remains in the ground the greater the yield and usually the later on the market the smaller the price per pound. In most cases, however, it would seem advisable to dig one or two weeks after full bloom, as the increase in yield is not usually proportionate to the decreased price. This, however, is a matter for personal judgment, which will be influenced by market conditions. In 1925, sets were planted on March 19 and part of the crop was sold on May 28 at 5·84 cents a pound net. On June 13 the price was two cents a pound, a difference which would not be made up by increased yield during that time. On June 11, 1924 the price received was 8·45 cents a pound net, and in June, 1923, by local sale seven cents a pound. When suitable spring conditions prevail the crop should be ready for harvesting from eight to ten weeks after planting. In order to obtain top prices the crop should be marketed by June 1. Twenty cents a pound has been received, this price however cannot be considered an average one. The main factors which influence the price is the amount of imported stock on the market, the amount of previous year's crop still in storage, and the amount of the local crop available.

The variety to grow will depend on several factors, but there are only a few "best" varieties:—Early St. George, Early Rose, Early Ohio, and Vick Extra Early are four kinds which have done well under conditions here, and which should prove successful on the average farm, yielding a crop of approximately

three tons to the acre. The following table gives yield and price results obtained in the five-year period of 1926 to 1930. Owing to the size of plots the computed yield per acre would probably be less under average conditions.

POTATOES EARLY—RESULTS OF TEST OF VARIETIES

Year	Area planted	Date planted	Date harvested	Yield	Computed yield per acre	Wholesale price per lb. received	Value of crop per acre
	sq. ft.			lb.	tons lb.	cents	$
1926	2,700	Mar. 8	May 21	679	5 956	8½	931 26
1927	2,475	Mar. 16	June 24	556½	4 1,794	2	195 88
1928	3,525	Mar. 14	June 8	597¼	3 1,381	6	442 86
1929	2,775	Mar. 19	June 25	874½	6 1,727	4	549 08
1930	2,850	Mar. 27	June 16	658½	5 65	4¾	478 09

POTATOES, MAIN CROP

Three of the main problems in potatoes are the selection of the variety, the kind, amount and time of application of fertilizer and the control of diseases. The choice of the variety depends mainly on the local conditions as influenced chiefly by soil type and weather conditions. Different types of soil and weather conditions will affect to some extent the shape of tubers, particularly as regards second growth and quality. Apart from this some varieties will do well under some conditions and poorly under others. To a great extent the best kind must be determined by the grower and this can be done by ascertaining what variety has done best in the district by actual tests. In general it can be said that where soil is light and sandy with a tendency to become dry in the summer an early variety such as Early St. George, Early Ohio, or Early Rose should be grown. In districts where blight is likely to be prevalent Early St. George is one of the least desirable of early varieties as it is particularly susceptible to this disease. Potato growth is influenced very markedly by the amount of moisture in the soil and as soon as a deficiency is prevalent growth ceases. When the supply increases again new growth commences and this usually takes the form of nobby growth thus giving irregularly shaped tubers. Under growing conditions such as these, varieties which have made practically complete growth by the middle of summer are most desirable unless moisture conditions can be controlled by irrigation.

The Netted Gem is a variety of potato which obtains a premium on the market but under many conditions it will not succeed as well as other kinds, particularly on light dry soils. Burbank very closely resembles the Netted Gem and will succeed under a wider range of conditions, the shape of tubers is, however, not ordinarily as regular and uniform as the former variety. The better known kinds apart from those mentioned above come chiefly in the two groups, Green Mountain and Up-to-Date. In the former Wee McGregor and Gold Coin have proved very satisfactory under a wide range of conditions and in the latter group Jones White, Up-to-Date, Table Talk and Dalmeny Beauty have given good results. Comparing the three groups which includes the Burbank, the varieties in the Up-to-Date class have given as a whole the most satisfactory results. Other high yielding varieties have been Rawlings Kidney, Dreer Standard, Empire State, Ormandy, and U.B.C. It is of interest to point out that the varieties Empire State and Dreer Standard have been cultivated continuously on the Experimental Farm without change of stock since 1892 and 1895 respectively and that results at the present time are as satisfactory as at any stage in the past.

The amounts, kinds and time of application of fertilizer is a problem which has received many recommendations. To start with it may be said that there are very few crops which will respond as well and repay as many times for the trouble and cost of fertilizer applications as potatoes will do. Under the heading of fertilizers some generalized suggestions were offered and mention was made of the difficulty in prescribing exact formulae for different conditions. An experiment now under way aims to compare two formulæ applied at the rate of 750 and 1,500 pounds an acre applied along the drills after the sets were covered. The following table gives the results obtained during the first two years, the crop valued at 30 and 15 dollars respectively in 1930 and 1931.

POTATOES—FERTILIZER TEST

Formula and rate of application	Average yield per acre	Average value of crop per acre	Average cost of fertilizer per acre	Average value of crop above fertilizer cost
	tons lb.	$	$	$
4–10–10 at 750 lb.	9 776	234 30	17 13	217 17
4–10–6 " 750 "	9 1,834	245 84	15 22	230 62
4–10–10 " 1,500 "	11 97	277 69	34 27	243 42
4–10–6 " 1,500 "	11 1,522	294 89	30 44	264 45
No fertilizer	4 539	104 02		104 02

The plot area has been as follows:—In 1930 plots were replicated in series four times each consisting of five rows thirty feet long, spaced three feet apart, four receiving fertilizer, the fifth row acting as a check. In 1931 the same method was followed but plots were replicated eight times.

Potatoes—plot on the left fertilized with superphosphate of lime at the rate of 937 pounds per acre. Plot on the right no fertilizer.

Fertilizer ingredients at 1,500 pounds per acre. At 750 pounds each figure would be divided by two:—

	4-10-10	4-10-6
Nitrate of soda	97 pounds	97 pounds
Sulphate of ammonia	214 "	214 "
Superphosphate of lime	937 "	937 "
Sulphate of potash	300 "	180 "

The above table does not aim to give cost of production charges nor is it intended to intimate that the formulae and ingredients used are the most suitable. It does illustrate, however, what may be expected from fertilizer applications and that under some conditions at least a high potash content is not necessary. The most economical and one of the most satisfactory methods is to broadcast the fertilizer over the field following the last cultivation before drilling the land for the sets.

There is adequate information on the size of sets, distance of planting and other cultural operations which will not be detailed here. An additional experiment which has been under way for the past two seasons is of interest as it has indicated so far that seed which has been cut will give a higher yield if allowed to callous over for ten days or two weeks before planting. The results of the 1930 crop in particular indicate that this is due to the fact that such sets give a higher percentage of full stand and consequently a higher yield. Weather conditions at the time of planting and immediately after are of considerable importance in respect to freshly cut seed rotting in the ground.

In a publication of this nature the matter of potato diseases cannot be discussed at any length, it is therefore deemed more advisable that bulletins and pamphlets covering this phase of the problem be consulted separately.

FORCING RHUBARB

Rhubarb forcing is practised on quite an extensive scale in British Columbia. It is essentially an undertaking for districts in which good field crops are grown.

Forcing roots are obtained from two general sources. In some cases old patches have to be renewed and the plants taken out are suitable for forcing. When a supply of such roots is not adequate seed can be sown with the object to supply the necessary plants. Such stock is available in two or three years, depending on growth. Seed should be sown in the spring in rows 18 inches apart and plants thinned to approximately 12 inches apart. In the fall or following spring the young seedlings should be transplanted to approximately twenty-four inches apart. If growth has been satisfactory the roots are large enough at the second fall for forcing though three-year plants will ordinarily give better results.

Best growth is obtained if the roots are frozen before being put into sheds. Weather conditions determine the extent to which this can be done—the ideal method is to freeze roots for two weeks with ten to fifteen degrees of frost and then allow the roots to remain in a cool place for two weeks before going into the shed. Such conditions are not obtained except under controlled temperatures. Under British Columbia coast conditions the roots should be dug about the last week in November and placed in the forcing house early in December in order to obtain the first crop early in January.

On a commercial scale it is often necessary to build a special house but any darkened building which has sufficient space is suitable. The best temperature for the shed is sixty degrees and for this some system of heating is necessary; wood-burning stoves are satisfactory, one or more at each end of a

building, and stove pipes should be long and run through the greater length of the building so that as much heat as possible is thrown off. Roots can be placed on the ground or on shelves in the shed and covered over with earth, ashes, straw, or some such material that can be kept moist. The shed should be partly darkened to produce large well coloured stalks. It requires from five to six weeks to obtain a crop. Roots will yield from four to six weeks. It is advisable to have roots going into the shed at different times in order to insure a regular supply of stalks. Good plants should average from five to seven pounds of marketable crop.

HERBS

In this group are included those kinds of plants which are chiefly used for flavouring. The following kinds have been tested and all have given satisfactory growth results: parsley, horseradish, sweet marjorum, pennyroyal, lavender, balm, thyme, horehound, hyssop, rosemary, sage, coriander, caraway, fennel, dill, sweet basil, anise, savory, borage, and chives.

DOMINION DEPARTMENT OF AGRICULTURE PUBLICATIONS

The following publications of interest to vegetable growers may be obtained from the Publications Branch, Department of Agriculture, Ottawa:—

Bulletin 145 N.S.—Manures and Fertilizers.

Bulletin 161 N.S.—Vegetable Insects and Their Control.

Pamphlet 100 N.S.—Tomato Culture.

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