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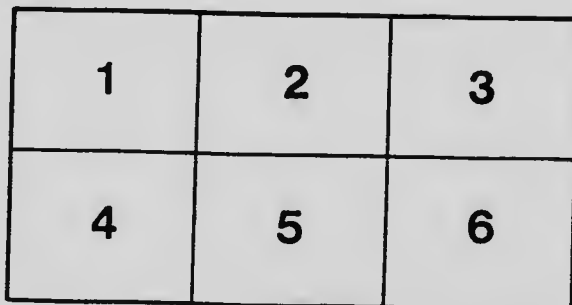
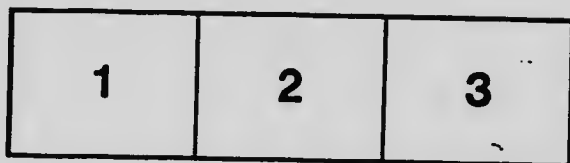
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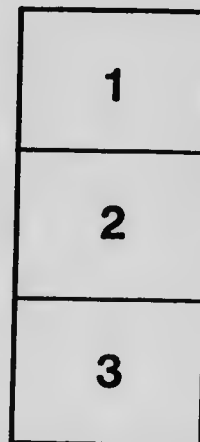
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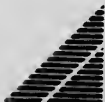
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Ontario Department of Agriculture

Reprinted from Annual Report of the
Ontario Vegetable Growers' Association for 1909

CABBAGE AND CAULIFLOWER GROWING IN CANADA AND THE UNITED STATES

By A. McMEANS, O.A.C., GUELPH.

Late in the month of July, 1909, the Executive of the Ontario Vegetable Growers' Association requested the Department of Agriculture to have an investigation made of the cabbage and cauliflower industry.

I was entrusted to do this work and was authorized to visit some of the principal cabbage-producing States to gather information and enquire into the methods used by the leading growers. During the month of August, the States of Michigan, Wisconsin, Illinois and Ohio were visited, and early in the month of November some of the cabbage-storing sections of New York State and the cauliflower district of Long Island.

CABBAGE.

ORIGIN AND HISTORY.

On the sea coasts of England and other countries of Western Europe, from Norway down to the northern shores of the Mediterranean, may be found the wild cabbage, *Brassica oleracea*. The cabbage in its wild state is entirely destitute of a head but has a rather succulent stem and leaves. Botanists tell us that from this wild plant originated not only all our varieties of cultivated cabbage, but also all forms of Kale, Kohl-rabi, Brussels sprouts, Brocoli and Cauliflower. No more wonderful example than this exists of the changes in a plant by cultivation. The improvement of the wild cabbage began, probably, some three or four thousand years ago. The Jews and Egyptians cultivated it and it is interwoven with the mythology of the Greeks. There seems to be no doubt, however, that the greater part of the development of the cabbage as we at present know it, took place within the past two hundred years. The origin of it is, however, of minor importance compared with the knowledge of its cultivation.

STATUS OF THE INDUSTRY IN ONTARIO.

There is no information available regarding the extent of the cabbage industry of this Province. In a Departmental Report for 1908, the statement is made that 4,900 crates or bushel baskets of cabbage were shipped from the Leamington district that season; of this amount fully one-half were express shipments.

In conversation with several leading commission merchants regarding shipments of storage cabbage into this Province, it was estimated that they ranged from forty to fifty cars yearly. In the past, storage cabbage have been brought in from New York State and the Province of New Brunswick, and, the present season, cabbage is being shipped in from the Province of Quebec, which cost laid down in Toronto a trifle less than \$20.00 per ton.



A Standard Cabbage Crate.

MARKETS AND HOW SUPPLIED.

Our early markets are supplied with cabbage grown in the Southern States; these are chiefly of the Wakefield type and are usually shipped in crates. The standard crate is of the following dimensions: Heads and centre piece 11 x 20 inches, the side slats and top and bottom pieces are 40 inches long. The crate holds from two to four dozen cabbage, depending upon the size of the same.

This southern-grown stock supplies the markets of this Province with new cabbage from February until about July the first, when shipments of domestic cabbage from the Leamington district make their appearance

in the market. The cabbage from this section is usually shipped in ventilated bushel baskets and small slatted crates holding not over one and one-half bushels. The industry in this section is not yet of sufficient extent to warrant the shipment of car lots.

From July on, the home markets are supplied by the growers living in the vicinity of towns and cities, and this source can generally be depended upon to meet the demand until March or April. Should the price of storage stock in the United States be low, then can be seen the strange spectacle of American-grown cabbage of the Danish type competing against fresh Southern stock on the Ontario markets.

As yet in this Province the cabbage industry has not passed the stage when each grower either stores or pits his own crop.



Basket used in Leamington District.

TYPES.

There are three distinct types of cabbage with reference to the shape of the head, oval or pointed, round and flat. There are also three distinct classes, white or domestic, savoy and red. Some varieties are distinct in type while others partake of two or more shapes due to crossing. There is variation also in the shape, character and texture of the leaf, from regular straight edges, to irregular almost fringed edges, and from smooth and tender to coarse and tough. There is also some variation in hardiness. Usually the purplish-green varieties with crinkled leaves are hardier than the whitish-green sorts with smooth leaves.

ONTARIO METHODS.

Growing Early Cabbage.

The seed is sown either in hot beds or greenhouses during the month of February or very early in March, using Early Jersey Wakefield or a variety of that type. Shortly after the true leaf makes its appearance they are transplanted into flats; as soon as they begin to crown they are again transplanted into other flats, this time about three inches apart. Shortly after the second transplanting the flats are removed to cold frames or hot-beds. Where hot-beds are used, they are either "spent" beds, that is hot-beds which have exhausted most of the heat which was in the manure (by having had a previous crop), or else hot-beds in which manure to the depth of six to nine inches is used. By using this small amount of manure as heating material, the bed is kept much cooler and, as a consequence, the plant becomes gradually hardened and thus stands the check of transplanting to the field. This is also helped greatly by leaving the sash off the beds during the day, covering them only on cold nights. While there is no doubt that the above is one of the best methods, the one practised by most growers is as follows: The seed is sown in the hot-bed rather thinly and the plants left to grow along, gradually hardening them by removing the sash, or transplanting them directly from the seed bed to the cold frame. The varieties grown which are started in this manner are Early Jersey Wakefield as the earliest, followed by one of the Early Summer type as second early.

SOIL.

Any good garden or farm soil that will grow a good crop of corn will produce a good crop of cabbage. For early cabbage a warm or well-drained sand or sandy loam is preferable, and as the cabbage plant is a gross feeder it is almost impossible to have too much plant food in the soil. Barnyard manure, from twenty to fifty tons per acre, is generally applied and quite often this is supplemented with commercial fertilizers. In growing early cabbage, it is necessary to bring the plant along to marketable condition quickly, so as to catch the high market price, and one of the chief aids in doing this is by having more plant food in an available condition in the soil than the plant can use. It is preferable to have the soil fall plowed, plowing again early in the spring and working it up to a nice tilth.

PLANTING.

The plants are transplanted to the field as early as possible, and at the same time it is desirable to secure as favourable weather conditions as possible, which is a soft, moist air from the south or east.

Wakefield varieties are usually planted in rows twenty-eight or thirty inches apart and the plants sixteen to eighteen inches apart in the row; Early Summer and All Head varieties in rows thirty to thirty-two inches

apart and plants twenty to twenty-two inches apart. This admits of horse cultivation one way and at the same time gives the plant plenty of room to develop.

In planting, it is necessary that the work be done well, and for this purpose a "dibber" is used. The planter makes a hole in the soil with the dibber held in his right hand. With the left hand holding a cabbage plant, he thrusts the roots of the plant in the hole previously made. The soil is then firmly pressed against the roots of the plant by means of the "dibber." This work can be done very quickly by anyone who is experienced in the use of this tool.



Fig. 1. — Use of "Dibbers."

A good test as to whether the plant is properly set or not is to take hold of the edge of one of the leaves and if the leaf tears away the plant is properly set. If, however, the plant pulls out of the soil, it will be necessary for the planter to see that the soil is pressed more firmly against the root of the plant than he has been doing.

CULTIVATION.

This should start in almost at once, it being necessary to the life of the plant as it is to kill weeds. The general practice is to cultivate at least once a week and rather deeply at the start gradually working shallower

each time of cultivation. The hand hoe is generally used at least twice between the plants in the row, and cultivation is kept up until it is impossible to get either the horse or cultivator between the plants without damage to them.

In cutting early cabbage for market, a few more of the outside leaves are left on than is the case with later varieties.

LATE CABBAGE.

The late cabbage crop as grown by the vegetable grower of this Province is generally a second crop, spinach, peas or some other early crop having occupied the soil for a time previous to the plowing and fitting of the soil for the cabbage crop. The soil for late cabbage should be much the same as for early, but what is really preferred is a well-worked loam with a cool, retentive subsoil. Careful preparation of the soil for this or any other crop is generally well repaid by the resulting crop.

SEED AND GROWING THE PLANTS.

The production of plants for the late crop is quite different from that of the early one. For this purpose, a strip of land is chosen in the spring, is put into good shape with the aid of a plow and harrow, then floated or rolled, and seed sown in rows which are spaced about one foot apart. Although one ounce of cabbage seed will contain close to eight thousand seeds, the average grower is satisfied if he gets two thousand good plants per ounce of seed used, thus taking about four ounces of seed to produce plants for an acre of cabbage. The seed can be sown by any of the seed drills on the market and should be sown rather thinly, say one ounce to four or five hundred feet of row. It is the practice of some growers to select a rather poor piece of soil for the seed bed, the idea being that plants grown on a poorer soil are usually more tough and wiry than those grown on richer soil, and thus bear the shock of transplanting better than the green, soft, succulent plant. The date of sowing seed for the late crop will vary from the first to the twentieth of May for the different parts of the Province. After the plants break through the soil they should be hoed or wheel-hoed to keep down weeds, help growth and conserve soil moisture.

In five or six weeks after sowing the seed, the plants should be ready for setting out in the field.

PLANTING.

If the field has been kept well cultivated or thoroughly worked and plowed freshly, the chances are that the soil will be moist enough for planting without going to the extra trouble of watering. A good rule to go by is to insert the "dibber" in the soil, withdraw it, and if it leaves the hole clean and open, without filling it with dry dirt, the soil is or should be sufficiently moist for setting plants without the use of water

in weather that is favourable. The distance apart at which the plants are set will vary with the soil and condition of the same and land value. With most of our growers living close to towns and cities, where land values are high, the distance apart is generally rows thirty-two inches and plants twenty to twenty-two inches apart. This will vary up to rows three feet or more apart, and plants two feet and upwards apart.

It is the practice of a few growers in this Province to sow the seed where the plant is to mature. For this purpose a hill-dropping drill is used and three or four seeds dropped in a hill. After the seeds germinate and make nice-sized plants, the extra ones are thinned out. This method requires more seed per acre, and while it saves the labour incidental to transplanting, it also necessitates that the land on which the crop is to be grown by this method be what is known as clean land; otherwise, the extra labour required to keep the land clean would overbalance the cost of transplanting. As for the crop, when carefully tended to, in either case there is no marked difference.

Cultivation should be kept up the same as for early varieties.

VARIETIES GROWN.

These are largely All Head, All Seasons and Flat Dutch for fall use and a short period of storage, say up to Christmas; Danish Ball Head and Hollander for storage and supplying the markets from the last of October until the supply is exhausted in the spring.

STORAGE.

The methods of storage in this Province are as yet in the hands of the grower and vary very much even in the same district. Some growers have small storage houses for their vegetables and store their supply of cabbages on shelves, others store in narrow bins, in barn basements. These bins are about two feet in width, with narrow air spaces between them, and the cabbages are piled some five or six feet deep. In the past, sufficient care has not been taken to get a good circulation of air through and around these deep but narrow bins, with the result that the loss by rot was of undue proportion. I was in a large barn basement this fall where upwards of fifty tons of cabbage were stored in long A-shaped piles. These were about three and a half feet wide at the bottom, about four feet high and twenty feet in length. The cabbage in these piles had the rough outside leaves trimmed off, but some six or eight inches of the stump were left on, the grower thinking that the shrinkage was not so heavy and that the head would draw some sustenance from this extra portion of the stump, also that the A-shaped pile of cabbage would allow of better circulation of air, the extra portion of stump not allowing the cabbage to lie so close together. Other growers resort to pitting their supply of late cabbage for storage. This involves an extra lot of labour, both in storing and again in taking them out of the pits to prepare them

for market. At best it is but a makeshift and not to be recommended. In pitting cabbage two methods are chiefly used, so a brief description of each may be of use.

THE A-SHAPED PIT.

To pit cabbage by this method a piece of ground is chosen that is either well drained or slightly higher than the surrounding ground; this is for the purpose of getting dry location. It is levelled off some three or four feet in width and of a length sufficient to hold 150 or 200 heads of cabbage. The cabbages are placed on the portion of ground thus levelled off, starting at one end and placing three heads in width, folding their heavy outside leaves under them as much as possible. On top of these three cabbage are placed two others, folding the leaves of that part of the head that is placed on the inside of the pit under the head proper, allowing the outside half of the leaves to fall down over the outside of the lower head. On top of these two is placed another cabbage, the outside leaves of which are allowed to fall down over the two heads beneath it. This is continued until your pit is twenty-five or thirty heads in length, and when cabbage are placed properly the outside leaves form a sort of thatch roof which will shed rain or snow from this long A-shaped pile. These pits should run north and south in preference to east and west for the following reason: should we get a period of warm weather the long south side of the pit would warm up too much and, in all probability, rot and decay would take place. This is avoided when the pit runs north and south, as both sides of the pit get almost an equal amount of heat from the sun. It is preferable to make a number of these pits, holding from 100 to 200 cabbages, instead of one long one. These are usually covered lightly with straw and then with three or four inches of soil, beginning at the bottom and working up. Care should be exercised so as not to pack the soil when covering the pit, as by doing so the frost will enter more readily. When the weather gets sufficiently cold, coarse litter or manure can be added. To keep the cabbage cool without freezing is the desired aim.

THE LONG TRENCH PIT.

This is another method in general use which is as follows: Plow out a furrow and place the cabbage, head down, along it, folding the loose outside leaves under the head as much as possible. A light covering of straw is placed over this row. The plow is then run along both sides of the row, throwing the furrow on and over the cabbage. This is supplemented with a man and a shovel to see that every part is properly covered.

A big objection to pitting cabbage is that considerable loss is often found just at the junction of the root and head. The cause ascribed is that the root or stump protruding from the top of the ridge or pit allows winter rains and thaws to enter and settle around his point, thus leading to decay.

The method in general use in cutting cabbage for pitting, is to use a sharp spade and a quick, strong, swinging drive, aiming the blade of the spade at a point on the stump two or three inches above the soil, which causes a sliding, driving cut that will surprise the beginner how fast cabbage can be cut by using this method.

ANALYSIS AND COMPOSITION OF THE CABBAGE.

This extract is taken from Bulletin No. 133, Maryland Agricultural Experiment Station, and is work done by H. J. Patterson in 1893. The samples represented a number of average mature plants, or plants with the heads in the best condition for market.

DRY MATTER AND PRINCIPAL MINERAL CONSTITUENTS OF DIFFERENT PARTS OF THE MATURE CABBAGE PLANT.

Components.	Heads per cent.	Refuse, leaves and stalk. per cent.	Root per cent.
Water	98.50	91.02	83.29
Dry matter	1.50	8.98	16.71
Total	100.00	100.00	100.00
Organic matter	1.29	5.40	14.21
Mineral matter	0.21	3.58	2.50
Dry matter	1.50	9.90	16.71
Pure ash	0.20	1.58	1.53
Sand	0.01	2.00	0.97
Crude ash	0.21	3.58	2.50
Lime (CaO)	0.019	0.441	0.107
Magnesia (MgO)	0.005	0.060	0.057
Phosphoric acid	0.023	0.080	0.111
Potash (K ₂ O)	0.087	0.402	0.762
Soda (Na ₂ O)	0.001	0.052	0.082
Iron and Aluminum	0.031	0.021	0.025
Chlorine	0.010	0.018	0.075
Sulphur (SO ₂)	0.056	0.035	0.030
Sand	0.010	2.000	0.97
Nitrogen	0.065	0.227	0.352

FOOD CONSTITUENTS IN HEADS AND REFUSE CABBAGE.

	Heads per cent.	Refuse matter per cent.
Water	98.50	91.02
Ash	0.21	3.58
Protein	0.41	1.42
Crude fibre	0.38	1.32
Nitrogen-free extract	0.46	2.41
Fat	0.04	0.25
Total	100.00	100.00

These results would indicate that cabbage is a very watery food and contains very little dry matter, but that the relative amount of protein in the dry matter would class it as relatively more nutritious than is usually recognized. The results in the above tables show the different fertilizing elements found in the various parts of the cabbage plants to be as follows:

FERTILIZING MATERIAL FOUND IN THE DIFFERENT PARTS OF CABBAGE PLANTS.

(Per cent. in Fresh Material.)

	Heads. Per cent.	Refuse leaves. Per cent.	Root. Per cent.
Phosphoric Acid	0.023	0.080	0.111
Potash	0.087	0.402	0.762
Nitrogen	0.065	0.227	0.352
Lime	0.019	0.441	0.107

An average crop of cabbage will yield per acre, say, 6,750 mature heads weighing three and a half pounds each, or 23,625 pounds. This will easily allow for ten per cent., or 750, immature heads. These, together with the refuse matter from the 6,750 mature heads, will average about two pounds each, or 15,000 pounds. The 7,500 roots, averaging one-quarter pound each, will make 1,875 pounds. Figuring on this basis, with the above amounts of fertilizing material, we find the following:—

POUNDS OF FERTILIZER FOUND IN CABBAGE FROM ONE ACRE.

	Heads. Pounds.	Refuse. Pounds.	Roots. Pounds.	Total Pounds.
Phosphoric Acid	5.43	12.00	2.08	19.51
Nitrogen	20.55	60.30	14.28	95.13
Potash	15.35	34.05	6.60	56.00

VARIETIES.

The use of descriptive words or phrases given to variety names confuses the grower. Oftentimes these descriptive words or phrases mark no real variety difference. As an example may be cited the Jersey Wakefield cabbage. The following descriptive words or phrases are used by different seedsmen to distinguish their stocks: Our Own Jersey Wakefield, Extra Choice Jersey Wakefield, Pedigree Jersey Wakefield, Improved Jersey Wakefield, Extra Select Jersey Wakefield, Select Very Early Jersey Wakefield, Special Stock Jersey Wakefield, etc., as well as the addition of the seedsmen's firm name, as per example, Maule's Prize Wakefield, Vaughan's Selected Early Jersey Wakefield, etc. Sometimes these descriptions mark real superiority of stock, but the practice of usage of the above has been so much abused as to have little or no significance.

The time is fully ripe for the American Seed Trade Association to take steps to simplify the variety names of vegetables. This can be largely done by eliminating descriptive words or phrases and firm names, as well as the use of such synonyms as are well known. In the Yearbook of the Department of Agriculture of the United States for 1900, it is stated that American seedsmen catalogued "685 real or nominal varieties of cabbage." So for the above reason I am not going to take up space describing varieties. Suffice to say, study the catalogues of good, reliable seed houses, study the varieties that do best in your locality, and this can easily be done by mingling with your fellow growers; try, and test, in a very limited way, new varieties, and adopt them when they show marked superiority.

AMERICAN METHODS.

The latest authentic information obtainable from the United States Department of Agriculture, Bureau of Statistics, relating to the extent of the cabbage industry in that country, is the twelfth census concerning the crop of 1899. Although these figures are somewhat old, they may be of value in showing the extent of the industry ten years ago in the States:

State.	Acreage.
New York	25,261
Illinois	7,082
Ohio	6,970
Wisconsin	4,400
Michigan	4,028

A total of 150,156 acres was devoted to cabbage production in the United States.

The total imports of cabbage into the United States from all countries, 1904 to 1908, were as follows:

Year.	No. of Heads.	Value (a).
1904	1,313,707	\$70,328
1905	8,729	589
1906	66,260	4,386
1907	5,808	390
1908	8,073	584

A farm crop report is issued by the State Board of Agriculture of Wisconsin, and from it and the Secretary of the Board I gathered that the average acreage for the past three years was approximately 5,000 acres and has not materially changed in the past five years. The average yield per acre for 1909 is given as twelve tons, the quality is given at 90 per cent., and the average price \$5.75 per ton.

In dealing with the cabbage crop of the Northern States, it will be found to be on a much different basis to what an Ontario grower would expect. This is apparently caused by a sort of reciprocity between the Northern and Southern States as regards cabbage growing. As is well known, cabbage is a cool weather crop and, in consequence, we find such States as Georgia, Florida, Carolina, Tennessee and Virginia growing cabbages which mature and are marketed in the north during late winter or early spring months, and the Northern States in turn supplying the Southern markets during the late summer and fall months. Owing to this arrangement of supplying markets, the growing of cabbage has very largely been taken out of the hands of the market grower and fallen into the hands of the farmer, and thus instead of being a garden or truck crop it becomes practically a farm crop, grown by a farmer who disposes of the crop to the shipper (usually a local man), and by him consigned or sold to a commission merchant or firm, and by them sold to the retailer. Owing to the high protective tariff on cabbage entering the United States, the Ontario growers are barred from shipping cabbage into those markets.

The cabbage growing sections in the States visited where a business is made of storing cabbage for winter markets is very largely confined to

(a) Average value at foreign ports whence imported.

the States of Wisconsin and New York, and in the former State to the Racine and Appleton-Shiocton districts, and in the latter State to the Rochester and Syracuse districts.

Kraut factories were found in the five States visited, but predominate in the States of Ohio and New York. This applies more especially to the Clyde-Sandusky district in Ohio, where there are eight factories, and the Geneva district in New York State, where in a radius of less than fifteen miles may be found five factories devoted to the business of making kraut.

All the sections visited do more or less of a shipping business direct from field to car. In speaking of varieties, they can be divided into two classes, Domestic and Danish. In the former the varieties will be largely All Seasons, All Head, Sure Head, Early Summer and some Flat Dutch. All are used in the manufacture of kraut and for shipping during the late summer and fall months. The Danish class will include Danish Bald Head, Hollander, and varieties of that type, and are stored for supplying the markets during the winter months.

SAGINAW DISTRICT.

This district lies in the vicinity of the city of Saginaw and in latitude 43.20 to 43.30, and is perhaps the largest in the State of Michigan, having an acreage of approximately 1,200 acres, an average yield of 10 to 12 tons per acre, and price paid at cars or factory varies from \$4 to \$6 per ton. No winter storage is practised. Varieties grown are Domestic and very little Danish. Soil varies from black sandy loam to clay.

APPLETON-SHIOCTON DISTRICT.

This district lies along the Chicago and Northwestern and Green Bay and Western Railways in the State of Wisconsin, and comprises a distance of about sixty miles, with storage houses at Appleton, Green Bay, Seymour and Shiocton. As the methods used vary in the different places mentioned in this district, a description of some of them may be of interest. At Shiocton there are two storage houses, the dimensions of which are 40 x 150 feet. The driveway through the centre is eleven feet wide, stalls 8 feet wide, and run from the driveway to within two feet of the wall. This two-foot space between the end of the stalls and the sides of the building serves a double purpose. First, it allows a good circulation of air from small doors or vents along the side of the building, and also the passage of a man to look after the opening and closing of the inside ventilators, according to weather conditions. Saplings four or five inches in diameter are placed across these eight-foot stalls, allowing a space of two or three inches between each sapling and about one foot above the floor. On these the cabbage are piled to a depth of four feet, stump down, then another row of saplings is placed across the stall in a manner similar to the first lot but about eight or ten inches above the heads of cabbage that have been placed in storage. Cabbage are placed

on these to a depth of three feet, then racks are used. These are eight feet long and two feet wide. The long sides are two by two or three inches. Slats are $1 \times 2\frac{1}{2}$ inches, with the space of a slat between two. The method of placing the cabbage on them is as follows: A row of racks are placed one above the other, one foot space between them, beginning at the back end of the stall. The cabbage are placed on these racks, and when one is full another row of racks is placed in front of the filled ones, and this is continued until the front of the stall is reached.

After the stalls are filled the driveway is used, the cabbage being piled on it to a depth of three feet and upwards. This district is the farthest



A Hand Transplanter.

north in which cabbage are stored, being in latitude 44.30. The soil varies from muck on lowland to clay on the upland. Seed in this district is usually sown April 20th to May 1st, and cabbage put in storage house from October 12th on. A preference seems to be given to Long Island grown seed. Average date of killing frost about Sept. 12th. Acreage about 600. Transplanting machines used largely.

Machine transplanters are a great aid to the grower, as with one a team of horses, a driver and two boys to set the plants, four acres can be set in a day. Should the ground be dry, the cask can be filled with water and by means of an automatic check valve each plant is watered at the roots before being covered with dry dirt. Some growers, with

smaller acreage, use a hand plant-setter. These stand about 30 inches high, about $6\frac{1}{2}$ inches in diameter and hold water enough to set 125 plants at one filling; an added advantage is that fertilized water can be used and an acre per day can be planted without stooping, thus doing away with the hardest feature of cabbage planting.

Green Bay.—The canning factory proprietor is the dealer and largest grower here. He has storage capacity for 2,000 tons—4 houses, 2 at farm and 2 in town; houses in town heated with steam pipes in cold weather; uses ventilators on sides and overhead, racks one foot apart and stores one layer deep. Has railroad tracks into the town houses and can load inside. Average yield for district, 8 tons per acre. Does not approve of contracts, for the following reason: Should price of cabbage be high at delivery time the average grower feels as if the dealer was cheating him, and if price of cabbage be low at delivery time the grower sometimes buys cabbage from his neighbour cheaper than the dealer is paying under his contracts and unloads them on the dealer with a profit on the cabbage he did not grow.

RACINE DISTRICT.

This is probably the oldest large shipping and storage section for cabbage in the State, some large storage houses being located at Racine. At Berryville, a small shipping station between Racine and Kenosha, there is a house 40 x 200 feet, with a capacity of 1,000 tons cabbage. The owner places the shrinkage of cabbage at 10 per cent. to February 1st; after that date it gets heavier. His business is 20 years old and he is growing 125 acres at Somers this year. Owing to continuous cropping of cabbage, soil is infected with what is known locally as "Yellows," which attacks the cabbage very shortly after planting. There is also some trouble with black rot, but not serious. Land is very dear in vicinity of Racine and Berryville. There is none for sale, but \$300 per acre is offered for it. Stable manure is used largely. This is usually supplemented with commercial fertilizer. Manure costs \$1.40 and upwards per ton and is shipped in from Chicago. Date of setting cabbage plants in field varies from June 20th to July 10th. Soil varies from sandy loam to clay and clay loam. The last killing frost in spring varies from April 7th to May 31st, with April 27th as the average, and the first killing frost in the fall from September 30th to November 7th, with October 17th as the average. Average rainfall is 31.65 inches. The cabbage growing district lies in latitude 41.35 to 41.45. A large kraut factory in Racine takes the product from a number of acres. A description of a storage house in this district which was built four years ago, at a cost of \$3,000, may be of service.

Size of house 40 x 80 feet, height to eaves 12 feet, 9-inch brick wall, 2-inch air space, $4\frac{1}{2}$ -inch brick wall—an air space of $1\frac{1}{2}$ inches—matched sheeting, also heated on both sides by means of a small hot water heater and 2-inch pipe; 4 ventilators on each side $1\frac{1}{2}$ x 3 feet; 3 ventilators on the comb of the roof and one on each gable end. Roof sheeted and paper

lined and runs right up to the comb; stalls 8 feet wide, 12 feet deep; passage way between stalls and walls $2\frac{1}{2}$ feet wide and 6 feet high; racks over passageway, also over driveway, right to roof; racks one foot apart and cabbage stored one deep. Capacity of storage house 400 tons. In conversation with the owner of the above house, the question was asked, "If you were building again, where would you improve upon the present house?" His answer was, "I would not put on the inside sheeting, and would burn more coal." That is to say, he would not build the house quite so warm, and in cold weather would use the hot water heater and pipes to keep out the cold and at the same time keep the house dry.

RIVERDALE DISTRICT.

This district lies in the north-eastern portion of the State of Illinois and runs east into the north-western part of the State of Indiana—from Riverdale, Ill., to Highlands, Ind.—and includes about 2,000 acres of cabbage, all domestic and used for kraut and shipping. Lake County Produce Company is a co-operative association of farmers, manufacturing kraut and shipping cabbage at Highlands, Ind., which has been very successful. The yield varies from 12 to 15 tons per acre. Cabbage is shipped in refrigerator cars about August 27th, with an A shaped rack $3\frac{1}{2}$ feet high and 2 feet wide at bottom, running lengthwise of the centre of the car. Cabbage are piled on both sides and over this rack, about $4\frac{1}{2}$ or 5 feet deep in the car; twelve tons or more of cabbage in a car. Ice costs \$4 to \$4.50 per ton, and the A shaped rack is used to carry the cold air from the ice bunkers and distribute it out through the cabbage. Average price paid for past five years, \$5.50 per ton, all domestic grown, some Faultless, which seems to be a strain of All Head.

The dealer was loading 8 refrigerator cars with cabbage on August 28th. He used a rack 6 inches wide and 4 feet high, through centre of car lengthwise for ventilation. Average plot is 3 or 4 acres, none over 15 acres. All domestic, no storage, some imported. Holland seed of an Improved Brunswick variety used with success. Some black rot, but not serious. Some trouble with club root. Land, nice loam, worth \$1,500 to \$2,000 per acre, held for investment. Rents for \$9 to \$10 per acre.

CLYDE-SANDUSKY DISTRICT.

It is estimated that there are 3,000 acres of cabbage grown in this district. Eight kraut factories. Average yield 12 to 14 tons. Average price \$5 to \$6 per ton. "Yellows" very bad, so much so that older districts are quitting the growing of cabbage, and kraut factories are seeking acreage further away from factory. All domestic. Some growers complain of time lost at factory, waiting to unload. The farmers in this district are of a fine class, manure heavily and supplement with commercial fertilizers. Planters used almost exclusively and clean cultivation practised. A rotation of potatoes, cabbage, corn and wheat is very largely used.

New York State is divided into two districts, known as Rochester and Syracuse Districts.

The Rochester District reaches from Albion on the west, to Lyons on the east, and from Webster on the north, to Geneva on the south, and it embraces local districts where both domestic and Danish stock is grown, also districts where cabbage is grown for kraut factories.

Acreage about 500, almost all fall shipped. No large storage houses. Using ordinary box and stock cars (Nov. 3rd). Average grower has 6 to 10 acres cabbage. Soil, loam approaching black, subsoil gravelly. Plow deep, 9 inches. Barnyard manure, $\frac{1}{2}$ ton commercial fertilizer, used per acre—1-2 Ammonia, 10 Phosphoric, 8 Potash. Rotation used, potatoes, cabbage, wheat and hay. Plant in field June 1st to July 4th. Harvest from field as late as November 15th. Paul Martin, progressive grower, saves and selects his own seed of Surehead and Holland varieties, very upright, outside leaves very few; has small storage house, 3 air spaces, stone basement used for potatoes, cabbage on first floor and apples overhead. Uses A shaped racks 4 feet high and $1\frac{1}{2}$ feet wide at bottom, placed 3 feet apart on the floor, and piles cabbage between racks four feet deep with good success, no trouble from freezing.

HENRIETTA.

Acreage 250. 15 per cent. Danish, balance domestic. Storage house cement blocks, air space and matched sheeting. Cabbage in bins 8 or 9 feet deep and bins $4\frac{1}{2}$ feet wide and 1 foot air space between. Cabbage piled stump down. Average price past five years about \$5 per ton. Prices in 1907 averaged \$8 per ton, in 1908 ranged from \$15 to \$22, in 1909 started at \$8, dropped to \$5, now (Nov. 3rd) \$6.

HALL'S CORNERS.

One dealer here last year loaded over 500 straight cars of cabbage, also several part cars. This year will not load 200 cars. Cabbage a failure on account of dry weather and lice. 10 per cent. Danish, balance domestic. Small storage, average price paid past five years about \$6 per ton. Trouble experienced in growing plants owing to root maggot. Screening and salt used, but not satisfactory. Plants shipped in by express from Pennsylvania and Maryland for \$1.25 per 1,000 laid down, and are getting very good results. Some black rot, but not considered serious. Soil, clay loam.

SENECA CASTLE.

Acreage very heavy. Crop almost a complete failure this year owing to dry weather and aphid. One grower on Otley road harvested 12 tons from 5 acres. Some growers turned sheep on their cabbage fields. Storage house 40 x 120 feet, frame, 2 air spaces, frost proof, or nearly so; 6 ventilators on roof, 10 on each side, 6 inches square; bins $3\frac{1}{2}$ feet wide, air space between, slat bottoms, 1 foot above floor, driveway through the centre, 2 foot space all around house. bins filled 6 feet deep with cabbage, stump up, then slat floor, then cabbage 4 feet deep. The reason floor is

used is so as not to tramp the cabbage when placing them in the bins. House holds 600 tons. Cabbage is brought in by cars from Skaneateles, and is extra choice stock.

SYRACUSE DISTRICT.

The older portion of this district lies along the Syracuse and Binghamton branch of the D.L. & W.R.R and reaches from Onatavia to Cortland, with large storehouses at Apulia and Homer. All along this valley the farmers seem very prosperous dairymen, growing cabbage as a side



Cabbage Stored in Bins—Syracuse District.

line. Soil, clay loam. Stock very good, yields heavy. Variety Danish, some red. Seed beds screened on account of root maggot, but has not proved satisfactory; plants raised in New Jersey and shipped in by express for early crop. Apulia, four storage houses, total capacity, 2,200 tons.

The largest building is 40 x 150 feet, and has a capacity of 1,000 tons. These houses built of four thicknesses of boards, two of paper, and have 2 air spaces, including the studding. They were the only storage houses I saw that used glass in the upper side ventilators. The

sashes were double glazed and board shutters used on the inside, the reason for using glass being that by admitting light the cabbage would not bleach so quickly, but would keep green longer than where kept in darkness.

The storing here is in bins 3 feet wide, with space of eight inches between each bin and a two foot space left all around the inside of the building. The cabbage are piled in these bins six feet deep, then a floor is laid and cabbage piled 5 feet deep, then another floor and 4 feet of cabbage on this. The floors are laid for the protection of the cabbage, the men standing on the floors when placing the cabbage in storage or removing them. The above method is used for three of the houses. In the other small house, shelves are used. These shelves are about 7 feet in width and are spaced nearly two feet apart. The cabbage is stored on them as shown in the cut.

This dealer uses a method of loading cars out of storage not practised elsewhere. The cabbages are loaded out of the storage bins direct on to the waggon; they are then taken to the weigh scales and weighed and then to the car, where two men stand at the door and take the cabbage, six men trim, and as it is trimmed it is placed in the ends of car. The refuse is then put in the waggon and taken to the scales and weighed and thence to the dump, thus giving net weight of clean cabbage and keeping storage house very clean. This dealer started into business here fifteen years ago, handling two cars of cabbage, and has built up a business handling 600 to 700 cars annually.

HOMER.

This town has also two large cabbage storage houses, capacity 2,000 tons, and three or four small ones. The bin method is used. One of the dealers here who has been in business twelve years said his shrinkage varies from 15 per cent. upwards, depending on how late the cabbage is held, and the average price ranged between \$8 and \$9 per ton. Mostly Danish stock grown, some Autumn King, and it seems to be giving satisfaction.

At Albion, N.Y., there is a modern cabbage storage equipment. The building is 200 feet long, 60 feet wide, and 20 feet to the eaves. This building is built out of brick, and the brick were laid so as to leave a four-inch air space between the walls, each wall being plastered with Portland cement, on the inside wall building paper and matched sheeting. The roof has an arched ceiling with doors that can be let down for the purpose of ventilation, and it also has ventilating towers running out through the roof.

A railroad track runs through the centre of this building, so that cabbage can be loaded either in or out, without weighing on small scales. On each side of the track there are bins 33 inches wide in the clear; 6-inch studding is used between these bins, thus allowing a 6-inch air space for ventilation purposes; 3-inch slats are nailed on the studding 3 inches apart. Floors are put in, dividing the bin into three sections, regarding height. The bins are about 20 feet deep, so that each bin is 33 inches wide, 20 feet

deep and 20 feet high. All doors and windows are double. In addition to this, in the end of the building and above, there is installed a 60-inch fan run by a 5 h.-p. electric motor, and from that fan a pipe 20 inches in diameter branches each way and runs over the centre of the top of the bins and is gradually reduced until it gets down to 6 inches at the far end of the building. This pipe has openings about every ten feet and is so graduated as to draw the air equally from all points of the building.

On the floor under the bins and running lengthwise of the building and in about the centre of the bins is an air duct about 16 inches wide, with openings where the 6-inch space is between the bins. Every 15 feet on the outside of the building are small doors and openings about a foot square, from which ducts lead to the large long ducts that run lengthwise under the bins. When they want to change the air in the building the fan is started and this draws the air in through the ducts and up through the cabbage and out of the building at the fan. The claim is made that the air in the house can be completely changed in about an hour's time.

This building has been run for a number of years and the owner claims that cabbage is taken out with less shrinkage than from any other building in the country.

OTHER METHODS OF STORAGE.

In the Syracuse district I saw a dealer who, when his storage house is full, piles cabbage on a clean piece of sod, three deep, and covers this with marsh hay. If snow comes before hard frost sets in, the snow helps to protect the cabbage, and they will come out of those quarters with less loss and shrinkage than if placed in a storage house. If, however, cold weather sets in without any snow, the loss and shrinkage is very heavy.

Most growers of late cabbage either in the United States or Canada have some unmaturing cabbage left in the fields unharvested. With some growers this is left to be turned under by the plow. With others the cabbage are taken and stored in pits, as recommended and described in "Storing cabbage for seed," or they are taken and planted closely in cold frames and the frames covered with coarse litter or manure, and it is surprising how those soft heads will fill out or mature in the pit or cold frames. This method is well worthy of trial by most of our Ontario growers.

SAUER KRAUT INDUSTRY.

This industry, which is so closely related to that of cabbage production, is in its infancy in this Province. Some of the pickle manufacturers have started the making of kraut during the past two or three years. One manufacturer was visited who put up 1,000 barrels of kraut this year. Three years ago none was made. New Ontario is the heaviest consumer of it and the demand is increasing very fast.

As an evidence of the extent of this industry in the United States I quote the following from a letter received from the Secretary of the National Kraut Association: "It would be an impossibility to give you any accurate figures as to the number of kraut factories, the amount of kraut made, or cabbage used for making kraut, in the United States, the kraut business being most peculiar, in the fact that almost anyone can manufacture kraut in a limited way. There are probably several hundred concerns in our country which would consider themselves manufacturers of kraut. Many retail firms will cut sufficient cabbage to manufacture their own kraut, and call themselves factories. There are about twenty-five members in the Association who manufacture something over 3,000 carloads of kraut per year; this would probably figure in the neighborhood of 100,000 tons of cabbage. The average price paid for cabbage would be between \$5 and \$6 per ton to the farmer. There has been a very large increase in the manufacture and consumption of kraut during the past five years, but I can give no accurate figures as to the percentage of increase. Nearly forty per cent. of the kraut manufactured was sold in cans."

One would naturally think that the best cabbage for boiling would be the best for kraut, but those who make it say not. The manufacturers prefer a solid head of good size and medium earliness. All Head, All Seasons and Surehead are the varieties chiefly used in the manufacture of kraut.

It is not necessary for me to go into details of manufacture and distribution. From the above it will be seen that much may be accomplished in developing this industry in this Province.

HOW TO MAKE SAUER KRAUT.

Take good sized, firm cabbage of the Drumhead type, remove the outer green leaves of the heads, then the core. The heads are then put into the kraut cutter, to be cut in the longest, finest strings possible. This should be put into the barrel as soon as possible; if left exposed to the air without being salted, it will hinder fermentation and is also apt to turn grey or black. Clean, tight barrels should be used, a layer of the cut cabbage about six inches deep is put in and this is strewn with salt. The amount of salt used should not exceed 3 per cent. of the amount of cabbage (in weight 3 lbs. salt to 100 lbs. cabbage). After the layer of cabbage is salted, it is pressed or stamped down firmly and evenly so as to expel the air. In this manner layer upon layer is packed in, until the barrel is filled. The cabbage is then covered with a clean cotton cloth and this is covered with a perforated hardwood cover, which is weighted down with stones or other weights to prevent the air from coming in contact with the kraut. Always keep the kraut covered with brine.

By salting, the greater part of the water contained in the cells of the cabbage is extracted, and in combination with the salt forms the brine.

Kraut requires the most careful attention while it is in a state of fermentation. The best temperature will be found to be 59 to 64 degrees Fahrenheit. After fermentation it will keep best in a cool place.

CAULIFLOWER.

ONTARIO METHODS.

The cauliflower industry of this Province is as yet confined to the market growers in the vicinity of large cities and towns. They supply the markets from the month of August, until heavy frost stops production in the fore part of November. The early markets are supplied from the States of Florida and California from February until May. They can be carried safely in refrigerator cars without heating or damage in transit.

Cauliflowers are also grown in quantity for the pickle factory. This is usually done under contract—that is, the grower signs an agreement or contract with the pickle manufacturer to grow a stated number of acres or tons, usually tons, of cauliflowers, for a stated price. The usual price paid in this Province varies from \$25 to \$30 per ton. Some cauliflower has been imported from Europe by pickle manufacturers, but when freight and duty were paid upon the same it was found to be more expensive than home grown stock at the above prices. It is impossible to give an accurate statement of the amount of cauliflower used annually by pickle manufacturers in this Province, but a conservative estimate would be about 550 tons.

Cauliflowers delight in a cool, moist atmosphere, and for that reason most growers do not have success in trying to produce early ones. For the general crop of cauliflower the culture does not differ essentially from that of late cabbage. The soil is prepared the same, the seed is sown and the plants are set in the same manner, but the culture given to the cabbage by the average grower will not suffice for the cauliflower, which insist on thorough tillage and liberal treatment.

SOIL.

The soil for the production of cauliflower will depend partly on the climate. In a warmer climate a heavier soil is required than in a cool one. Generally speaking, a good rich loam, with a cool, retentive subsoil, will prove ideal for the growing of this crop. In the past, many growers have supposed the character of the soil to be of more importance than the condition of the same, but, in the light of recent developments, this seems to have been a mistake. Outweighing either character or condition of soil, stands climatic influence or conditions and this seems to have more to do with success or failure in growing this crop than any other one factor. There is no crop about which there is so much uncertainty as the cauliflower. No calculation can be made as to the exact time of sowing the seed or setting the plants that will insure success. The early, the intermediate, and the late plantings are in turn profitable, and by early, intermediate, and late plantings, I mean plantings that are made a week or so apart. So it will be seen that it is almost a necessity to make a series of plantings, one or more of which will invariably succeed. Cauliflower is more sensitive to checks in its various stages of growth than cabbage.

SEED.

In the seed bed, a strong, sturdy growth should be encouraged rather than a rapid one. Seed should be sown during the month of May, the exact date depending on the soil and climatic conditions governing the different portions of the Province. At Guelph, on a rather strong clay loam, we prefer to sow seed the first week in May.

PLANTING.

The best time to set plants is just before or after a rain, but they can be put out at any time, providing the soil has been kept moist by previous frequent cultivation. In dry, clear weather the planting should be done towards the close of the day. The plants to be set out should not be too large or they will be liable to button, especially is this liable to happen should the conditions be in any way unfavorable to growth. If large plants must be used, extra pains should be taken in setting, in order that there may be as little check in their growth as possible. With cauliflower, as with cabbage, large plants are easiest to grow, but for the reason stated it is less desirable to use them. The plants are usually set in rows three feet apart, and are spaced two feet apart in the row. They should be ready for planting in the field in five or six weeks' time after sowing the seed.

CULTIVATION.

This should start almost immediately after planting so as to keep up a steady, vigorous growth, for if the plants are checked they are liable to either button, that is, to form a small, miniature head, prematurely, or to continue their growth so late as to fail to produce heads at all. Level cultivation is usually practised as for ordinary field crops. This should be fairly deep at first, working shallower and narrower as the plant makes growth and should be kept up until the leaves are so large as to be liable to be broken off either by the horse or cultivator, in their passage between the rows, or until the plant shows signs of heading. The crop may be seriously injured or delayed by cultivation after the plants begin to head. At this time the soil should be undisturbed, so that the roots may occupy the entire space. Dry weather and the compact nature of the soil after cultivation ceases check the growth of the plants and promote the formation of heads, provided the plants have attained a proper age and size.

BLANCHING THE HEADS.

The value of cauliflowers for use or market depends almost entirely on their being white and tender. To have them so, they must be protected from the sun. Heads which are left exposed to the sun become yellow in color, or even brownish purple, if the sun's rays are very hot. Such heads acquire a strong, disagreeable flavor and are unsaleable. There are various

ways of covering the heads, but it is nearly always done with the leaves of the plant. The practices in use in this Province are as follows: When the heads are about the size of a coffee cup, they are tied with twine or wire, bent so as to form a loop on one end and a hook on the other end, the leaves are all gathered up and the wire placed around them, hooking the one end into the loop, thus holding the leaves in an upright position and covering the head proper from the rays of the sun. The tying should be done when the plants are dry and during the warm part of the day



Cauliflower Plant Tied with Straw Band.

when the leaves are supple. Some growers prefer to tie their plants up tight, while others like to leave the top of the plant as open as possible so long as the sun does not spot them. By leaving the top slightly open the pressure of the leaf on the head is decreased, thus allowing it to broaden out more than where the plant is tied up tight. This artificial blanching of the head is most important early in the season while the sun is hot. The field should then be gone over every other day. Another object gained

by tying late in the season is to protect the heads from frost. A frosted cauliflower is practically worthless for market, as it is nearly certain to turn black after one or two days' exposure. Heads which are well covered will usually stand ten or twelve degrees of frost without injury, depending on the amount of cloudiness or moisture present.

CUTTING AND MARKETING.

The frequency of cutting will depend on the season and climatic conditions. In summer the heads will remain at the proper stage for cutting no more than a day or two, while late in the season they may be left a week without becoming overgrown. Frequent cutting is desirable, as it is best to let the heads get as large as possible, but not allowing them to become loose and warty. The gain in size increases the selling price, and the flavor also appears to improve as the heads approach maturity. It is better, however, to cut a head too soon than to leave it too long, for a small, solid head will sell for more than a larger, loose one. To judge when a head has reached full size requires some skill and experience. Usually this can be told by the way it forces the leaves outward. Upon examination it will be seen that the surface of the head becomes more distinctly grained as it approaches maturity. To examine a head do not untie the twine, but part the leaves at the side and the condition of the head can be easily seen. There are two methods used in cutting. Some growers prefer to cut and trim in the field. For this purpose a long, thin-bladed knife is used. The head is cut with enough of the stalk to leave two or three full circles of leaves to protect the head. The leaf is trimmed off by some growers even with the top of the head, or "flower"; others prefer to trim the leaf as low as possible without showing the bottom of the head, "curd" or "flower." A good many growers prefer to cut the stalk or stem of the plant below the bottom leaf and draw the heads to the packing shed, there to be trimmed and packed. The reason for cutting below the bottom leaf is to check growth in the remaining part of the stump or stalk; when it has no leaf, growth ceases. The heads must be handled with care to prevent the "flower" from becoming bruised or soiled. A bruise will turn black in a short time and thus injure the sale of the head. Slatted bushel boxes and berry crates are favorite packages used for the marketing of cauliflower. These should be lined with clean paper and the heads packed carefully therein, so as to carry without bruising. Cull carefully, discarding all flowers that will not grade as first class. Dispose of these to pickling factory.

KEEPING.

At the end of nearly every season most growers will have more or less small unmarketable heads in their fields. These can be used for the purpose of keeping or prolonging the season. When the weather gets cold so as to check plant growth, in the fore part of November, the plants that show signs of heading are stripped of their larger outer leaves, are taken

up and carted from the field to be set close together either in a cellar, under a greenhouse bench, or in beds covered with hot bed sash. When set in beds care must be taken to protect them from freezing. This is done by using straw or coarse litter, covering the sash with it. When planting the heads, just enough moisture should be given to keep the plants from wilting; if too much water is given they are liable to develop rot. A method used in Denmark is to make a bed of moist sand about four inches deep in a cool room protected from frost. Towards the end of the season, the heads are cut with a piece of the stem three or four inches in length which is stuck into the sand. All the outer leaves are removed except the inner course, which are trimmed down fairly close. The heads are then covered with flower pots. Sometimes early in the season the market price may be low and retarded development of the head may be desired. For this purpose the plants may be cut below the bottom leaf when the plants are nearly mature. They are then carted to a shed or some shady place and set up on the stump end, where they can be kept in this condition for a week or so, depending on where they are kept and weather conditions.

VARIETIES.

The varieties of cauliflower differ among themselves less than those of most cultivated vegetables. Their tendency to degenerate, especially under unfavorable conditions, and the readiness with which they may be improved by selection, has given rise to many so-called varieties. The growers in this Province may be said to use one strain or another of Dwarf Erfurt.

The Ohio Experimental Station, in 1889, in a variety test of cauliflower, reported twenty varieties under test as being so nearly identical with Early (Extra Early) Erfurt, as to be considered strains of that variety. Cauliflower seed is grown in France, Germany, Italy and Denmark. Puget Sound, in the State of Washington, is the only place in America where cauliflower seed can be grown successfully. Danish seed seems to be given the preference by discriminating growers and commands a somewhat higher price.

COMPOSITION OF THE CAULIFLOWER PLANT.

To show the relation of the cauliflower crop to soil exhaustion and the value of the refuse portion for fertilizing purposes, the following analyses are included. They were made by Mr. J. F. Harries, and are embraced in a study he is making of the chemical composition of the cauliflower. The plants were furnished him by the garden department of the College, during the season of 1909, and represented a good average crop. They were grown on a fairly rich clay loam. The samples were taken when the heads were in the best condition for market, and at different times covering a period of about a month. To make the terms Head, Leaves, and Root, clear, the following definition will apply. Head—represents

that portion of the plant known as "curd" or "flower," and is the part partaken of as food. Leaf—is all leaf growth. Root—embraces not only root, but that portion of the stalk between the head and root.

The following represents an average of the different samples:

DRY MATTER AND PRINCIPAL CONSTITUENTS OF DIFFERENT PARTS OF
THE MATURE CAULIFLOWER PLANT.

Components.	Heads per Cent.	Leaves per Cent.	Root per Cent.
Water	93.16	91.09	85.07
Dry Matter	6.84	8.91	14.93
Total	100.00	100.00	100.00
Organic Matter	6.12	7.23	13.20
Mineral Matter	0.72	1.63	1.73
Dry Matter	6.84	8.91	14.93
Pure Ash	0.712	1.571	1.589
Sand and Silica	0.008	0.059	0.141
Crude Ash	0.72	1.63	1.73
Lime (CaO)	0.067	0.402	0.281
Magnesia (MgO)	0.021	0.058	0.076
Phosphoric Acid (P ₂ O ₅)	0.102	0.105	0.151
Potash (K ₂ O)	0.245	0.225	0.464
Soda (Na ₂ O)	0.084	0.216	0.328
Sulphate (SO ₄)	0.064	0.218	0.138
Nitrogen	0.34	0.365	0.359

An acre of ground planted with cauliflower in rows three feet apart and plants two feet apart in the rows will allow for 7,260 plants, allowing for misses and ground used for headland or turning at the ends of the rows, say, 7,000 plants to the acre. Allowing that 6,000 plants head up and are harvested, yielding, say, five tons of heads per acre, the refuse matter, consisting of leaves from the 6,000 mature and 1,000 immature plants, will average 21½ lbs each, a yield of 17,500 pounds per acre and 7,000 stalks and roots averaging ¾ pound each will make 5,250 pounds.

Combining the above figures it will be found that an average crop of cauliflower will require, during its growth the following amounts of plant food per acre:

POUNDS OF FERTILIZER FOUND IN CAULIFLOWER FROM ONE ACRE.

	Heads. Pounds.	Leaves. Pounds.	Roots. Pounds.	Total Pounds.
Phosphoric Acid	10.2	18.4	7.9	36.5
Potash	24.5	39.4	24.4	88.3
Nitrogen	33.9	63.8	18.8	116.5
Lime	6.7	70.4	17.2	94.3

CAULIFLOWER GROWING UNDER GLASS.

Cauliflower is also grown under glass by a few growers who have found it to be a profitable crop. Although Florida and California ship cauliflower which are strong competitors against the greenhouse grown, as they are on the markets at the same time, yet greenhouse grown cauliflower will usually command a price fifty per cent., or upwards, higher than stock shipped in from these States. This is owing to the acknowledged superiority of the greenhouse grown product, such as less acidity, more delicate flavor, whiteness and finer texture, in comparison with outdoor grown stock.

Although the forcing of plant life is an expensive enterprise, and one not to be entered into lightly, or unadvisedly, yet I can see no reason why a demand for greenhouse grown cauliflower cannot be built up in this Province, providing some good grower would undertake to supply the goods and, by doing some advertising and building up a reputation for quality and reliability, make a success not only of the growing of cauliflower under glass, but the building up of a profitable business as well.

Seed of the Snowball or Dwarf Erfurt type is sown in flats or beds, about November 1st, if the crop is to be marketed in April or May. When the plants are in their second leaf they are given their first transplanting, about two inches apart. This is followed by a second transplanting, this time into pots of the 3 or 3½-inch size. When they have made good, strong, stocky plants, they are planted into the permanent bed. By the second transplanting, root development is encouraged, and by the use of pots the change can be made into the permanent bed with the slightest possible check to the plant. It is a well known fact to the cauliflower grower that this crop cannot be stunted without serious loss; from the start to the finish the one main object is to keep up a steady growth.

Ground beds are always used for this crop. The soil should be a rich loam, into which should be thoroughly incorporated plenty of well rotted manure; a liberal dressing of fine bone meal should be worked into the surface—say one pound for every 20 square feet of bed.

Some growers use a dressing of air-slacked lime before planting; others prefer to use a small handful of shell lime sprinkled around the plant. The distance apart of setting plants varies with the different

growers from 18 to 22 inches each way. The intervening space between the plants is usually utilized by some quick-growing crop, generally radishes.

A day temperature of 65 to 70 degrees F., with a drop of 10 to 15 degrees at night seems to be the best for this crop.

Care should be exercised in watering, and although cauliflower like moisture, care must be used not to get the soil too wet.

When the plants commence to develop, a little nitrate of soda worked into the soil will be found helpful. The methods of bleaching the heads differs from the outdoor crop. Breaking the leaves down over the head, even tying the leaves, is not as satisfactory as the placing of several thicknesses of paper directly over the head. Folded newspapers answer this purpose.

Green aphid can be kept in check by ordinary fumigation with either tobacco stems or any of the prepared forms of nicotine. Cabbage worms will generally put in an appearance and will need to be picked off.

The prices received for this crop vary from as low as \$1.50 to as high as \$5 per dozen, with perhaps an average of \$3.50. This would give a return of about 13 cents per square foot of bed for plants set 18 inches apart. The above returns do not take into account the radish crop, which occupied the ground when the plants were first set and which should give a return of 10 to 15 cents per square foot of bench, allowing for the space occupied by the cauliflower plants. Some large greenhouses were seen at Mattituck, N.Y., where the grower harvested two crops of radish and one crop of cauliflower. This was done by growing the plants in a separate plant house, and if enlargement of plant, neatness and thrift are evidence, he is well on the way towards the goal they call success.

CAULIFLOWER IN THE UNITED STATES.

It is almost an impossibility to secure any figures as to the extent of the cauliflower industry in the United States in latitudes or districts similar or applicable to districts in Ontario. The conditions in the Buffalo district in New York State would, probably, be the nearest approach to those in this Province. The growing of this delicious vegetable is as yet largely in the hands of the market grower and the grower who grows under contract for the pickle factory. The two districts to which exception is taken are both in New York State, viz., the Buffalo and Long Island districts.

LONG ISLAND CAULIFLOWER DISTRICT.

This lies in the Eastern portion of Long Island, and from figures furnished by the Long Island R. R. Industrial Department the following is noted: In 1905 the freight shipments of cauliflower by rail

amounted to 10,075 tons, and the express service handled 3,500 tons of cauliflower, a total of 13,575 tons of cauliflower for that year. In 1909, the cauliflower special train ran from Sept. 10th to Dec. 20th inclusive. This train carries nothing but cauliflower and has been known repeatedly to carry over five thousand barrels, or thirty car-loads, of cauliflower at a time. The shipments by freight for 1909 were 17,969 tons. This will give a better insight into the size of the industry as conducted on the Eastern end of Long Island than any other example that may be cited. The truckers at the western end of the Island, lying close to and adjacent to the City of Brooklyn, also grow many tons of cauliflower. These are sent into the New York markets in large truck waggons and are not included in the above figures.

The methods used by the growers at the Eastern end of Long Island from Calverton to the extreme east end of the Island vary very little, except in what appear to be minor details. A large number use the horse transplanting machine for setting the plants, others still cling to the old-fashioned method of planting by hand. Stable manure varies in price, depending on the season of the year, from \$1.40 to \$1.90 per ton on the cars. Commercial fertilizers are used freely by most growers. Methods of production of plants, planting and cultivation, differ very little from those practised by the growers of this Province. It is in their methods of tying up, preparation and packing for market, where they differ, not only from growers elsewhere, but among themselves. The Long Island cauliflower grower practises three different methods of tying his plants for bleaching purposes; this is for the purpose of saving time when cutting. When the plants get to the tying stage a man carrying a small bundle or sheaf of long rye-straw in a sack (made for the purpose and tied around his waist) passes down between two rows of plants. When he sees a plant which needs tying he draws a few straws out of the bundle, making a short band of them. Then he passes both arms around the outer leaves of the plant, drawing them together and tying them with the straw band, so as to exclude the rays of the sun.

Another method is to select two nice long leaves, one on each side of the plant, say lengthwise, of the row. Then all the other leaves on that quarter of the plant on the side where you selected your first leaf are folded over the flower or curd, then the quarter of the leaves directly opposite are treated in the same way, then either one of the remaining quarters is treated likewise, and then the last and remaining quarter is folded over the others. The operator now takes the leaves he first selected and tucks or draws the end of the upper one through or under the one below it, forming half a knot. This is called tucking, and while it seems difficult very little practice makes it so simple that it is surprising how fast you can tie cauliflower in this way. The plant, when tied, is inclined to be balloon-shaped and by folding (not breaking) the leaves over each other, the bottom portion of the leaf bows out and away from the "flower" or curd, thus allowing it a better chance for development.

Some growers vary this tie by having the "tuck" crossways of the row at the point of tying, and lengthwise of the row the next time, while other growers will carry a bunch of toothpicks or some short pieces of rye straw in the pocket and stick one into the tuck to distinguish one day's tying from another.

The main object of having the three distinguishing ties is that when the time for cutting comes all those tied on a certain day are cut at the same time. The assumption is that, if all the plants are not ready for cutting, they should be, and, if the grower had not used the three different marks for tying, he would be compelled to look at every head before cutting.

There are two methods of packing, known as short cut and long cut. Long cut is almost always put up in the field. Barrels are taken to the field and placed at convenient distances apart along the row or driveway. With a good, strong, sharp knife the plant is cut a short distance above the bottom leaf. Another cut three or four inches above the top of the head or flower removes the surplus leaf growth; the balance of the leaf is folded over the head as a protection when packing it in the barrel. Usually second-hand ventilated barrels are used and the cauliflower should be well and tightly packed with the top of the barrel nicely rounded. The top hoop of the barrel is removed, a piece of burlap or bagging is placed over the cauliflower for a cover, the hoop is replaced and fastened on one side; the operator leans over the barrel, pressing the heads of the cauliflower and drawing the cover as tightly as possible, drives the hoop down and nails it in place, thus holding the cauliflower securely.

Short cut are put up both in the field and packing house. When put up in the field the barrels are distributed in the same way as for long cut. The head is cut in much the same manner, with perhaps not quite so many leaves attached and is trimmed much the same as in Ontario. It is then placed in a basket which, when full, is taken to a barrel, and a layer placed in the barrel with the head of the flower facing in, a good strong sheet of paper is placed over each layer and an inch or so of excelsior or marsh hay is added and then another layer of cauliflower. This is continued until the barrel is well filled, when the cover is put on in the same manner as described for long cut. Field packing can only be carried on when the weather is fine and dry. Some growers prefer to use the packing house altogether and, when this is done, it necessitates the removal of all trimmings, and a little more labour, but it permits of better grading being done and barrels are labelled No. 1 or No. 2. A considerable amount of cauliflower is grown for pickle manufacturers and when delivered to salting stations the head or "flower" is cut out entirely from the plant with no leaves attached. In 1908, a Mr. Young had 15 acres and delivered to the salting station 90 tons 300 lbs., at \$40 per ton. The average price paid at salting station the past five years has been \$35 per ton, and the average yield per acre for the same period has been slightly over four tons per acre.

There is a marketing association in this section known as the Long Island Cauliflower Association. By loading solid or full cars the railroad gives a reduction of four cents per barrel delivery at New York market. The Association charges the grower the four cents, but in return the Association looks after the supply of empty barrels and seed, keeps a man at the New York end to look after markets, and pays a dividend to the holders of stock. It also diverts shipments to other markets as well as acting as agent in accepting orders from commission merchants in other cities.

BUFFALO DISTRICT.

In the vicinity of Buffalo, N. Y., cauliflowers are grown and shipped in quite large numbers. The varieties grown are Snowball and Early Dwarf Erfurt. The usual date of sowing seed is about May 20th, so as to produce the flower the latter part of September and during October.

They are grown on soils of varied nature, clay, sandy loam, clay loam, gravelly loam, and black muck, and on all of these with success, depending on the season. Barnyard manure is used largely, also a commercial fertilizer analyzing 4-8-7. The Erie County Growers' and Shippers' Association use a crate for the shipment of cauliflower which holds 12 heads and these are trimmed with the outside circle of leaves about an inch longer than the head is high. By trimming the heads in this manner the heads can be packed in the crates alternately on their face and on their stump, and so far this method has proved satisfactory. All goods are graded and sales pooled. Crates cost 13 cents each. During the season of 1908, 33,816 crates were handled at an average return of 55.22 cents per crate to the grower. In 1909, 34,926 crates were handled at an average net price of 62.7 cents each. The cauliflower shipping season opens with the Association about August 20th and ended in the season of 1908 on November 5th, and in 1909 on November 26th.

BRUSSELS SPROUTS.

The cultivation of this, one of the most delicious of the cabbage family, does not differ materially from that of cabbage and cauliflower.

Most of the information contained herein was secured from Mr. Frank H. Case, a grower on the eastern end of Long Island, who for the past fifteen years has been growing and selecting this vegetable with a view of having the sprouts more firm and smooth and, at the same time, keeping a watchful eye on quality.

A variety of strain of the half dwarf is usually grown. Seed is sown on Long Island from June 1st to 10th and transplanting to the field takes place when the plants are five or six weeks old.

A sandy soil in good tilth with plenty of available plant food in it, seems best suited for this crop. About four months from the sowing of the seed they will be ready for picking.

HARVEST AND MARKETING.-

The harvest lasts in the field until the ground freezes up for the winter. An extra good yield would be a quart per plant. The Sprouts



A Good Specimen of Brussels Sprouts.

grown on Long Island are all marketed in quart berry boxes. The little heads are broken off the stems, taken to the packing shed and washed or well rinsed in clean water. They are then trimmed (that is, the loose outside leaves are removed and the small stem trimmed), and are care-

fully packed in the berry boxes, special care being taken to put the little heads in firmly, so that they will not shake or damage in transit. Care is also used in having the sprouts in the top layer top or headside up and many growers have their sprouts in regular rows.

Brussels Sprouts are sent by express from this section to supply markets as far west as St. Louis and Denver. As an evidence of the extent of this industry in this section, during the year 1905, there were shipped by express 160 tons of Brussels sprouts. The average price received this season has been low on account of the acreage being large and the crop heavy. They are worth in New York City at the present writing (Jan. 6th) from 6 cents to 12 cents per quart, strictly fancy bringing a little more. A crop grown by Mr. Case in 1904 netted over \$400 per acre. Last year the crop was nearly a failure and netted him a trifle under \$100.

The market has doubled in the consumption of this vegetable during the past five years, and most growers think it will double again during the next five years.

To Ontario growers contemplating the growing of Brussels sprouts, Mr. Case offers the following advice: Sow seed for this latitude from May 1st to 8th and plant out in the field in rows 36 inches apart and 30 inches in the row, working both ways with the horse cultivator, hand hoeing frequently, while the plants are small, and store in a locality where there is plenty of snow in the following manner: Cut the plant even with the top of the soil. Put into a windrow about three feet high, A-shaped, being careful to have the tops up and on the outside. Cover with straw to the depth of a foot or so. After the sprouts have settled, the row proper will be not over two feet high. It is preferable to have this row run north and south for the same reason as given in pitting cabbage. Be sure and keep the snow off the apex, even in zero weather, if there be so much that the plants cannot get ventilation.

CABBAGE SEED PRODUCTION.

It is estimated that the American seed trade handles annually about 600,000 pounds of cabbage seed; less than half of this is imported from Europe, consisting mostly of early varieties. The remainder is produced chiefly on Long Island and Puget Sound, on the Pacific coast. Some seed is also grown in New York, Rhode Island, Connecticut, Eastern Virginia, and some few of the Middle Western States. The source of supply of the cabbage seed used in America, as given me by a reliable authority, is as follows:

Long Island	20 per cent.
Washington State	30 per cent.
Elsewhere in the United States	10 per cent.
Imported	40 per cent.

Cabbage seed may be produced by three methods from solid or perfectly developed heads, from partially or half-formed heads and from stumps from which solid heads have been removed.

From Solid Heads. This is practised for obtaining extra selected stock seed, or seed to be used for growing a commercial or field crop.

From Partially or Half-Formed Heads. With stock seed produced as above for starting the crop. A crop of commercial seed may be raised from partly developed heads. This is the method pursued by leading commercial seed growers. The advantages claimed for it are later sowing and such plants winter better than do solid heads, also heavier seed production and the promotion of earliness in the crop grown from such seed. The growing of seed for this crop is so timed that the plants will be just coming to a partial heading stage when it will be necessary to take them up for winter storage.

On Long Island, the sowing of the seed for Early Jersey Wakefield is done from the 1st to the middle of July, for medium early varieties such as All Head, about June 20th, for late varieties about June 10th, transplanting the plants to the field about five or six weeks after sowing the seed. Cultivation is carried on the same as for a crop of cabbage. About the middle of November the plants are taken up for storage.

STORING THE PLANTS.

The general practice in storing is to run a cabbage plow close to the edge of a row of plants, loosening and lifting them. Every eighth or tenth row is then made into a trench to receive the plants which are taken out of the rows. This is made wide and deep enough for plants to be packed closely therein, three or four plants in width, roots down, slightly slanting, the roots being covered slightly with soil, and the tops but a trifle above the ground. The trench is then covered with earth by means of a large plow throwing up big furrows on and over the plants on each side. An asparagus ridger is then used to move the dirt over on to the middle of the trench, and it is dressed up with the centre slightly higher, to keep water off and prevent hard freezing.

The trenches are uncovered in spring by running a plow as closely as possible to be buried plants, throwing the furrow away from the plants. The remaining dirt is then removed with a large wide hoe, leaving the plants ready to be taken out.

PLANTING.

In the spring, as soon as the soil can be worked, the plants are set out in rows or furrows, which may be made in the same field in which the plants are stored. These furrows are made with a medium-sized plow, going and returning in the same furrow, and they are four feet apart for early and five feet for later varieties. The plants are laid about two feet apart in the row or furrow, the stem of the plant parallel with the row, the head of the plant raising the stem, so that it will be on an angle

of 30 or 40 degrees. The root is covered by the use of large hoes drawing the soil from the side of the furrow on and over the root of the plant. Cultivation is kept up the same as for an ordinary crop. After the seed stalk grows up, the cultivator is used to throw earth up to the seed stalk to support it, so that when the plants begin to bloom they are growing on a ridge.

In planting out solid heads it is necessary to use a knife to cut the head so as to allow the seed bud to make its appearance. This is usually done by cutting the head across the top, making two cuts in the shape of a cross, cutting the head in quarters. Care must be taken not to cut so deeply as to injure the tender bud.

SEEDS FROM STUMPS.

Stumps from which extra choice heads have been removed are wintered over in much the same manner as partially formed heads. This method is not to be recommended for the production of good seed.

HARVESTING.

When the seed pods have passed what seedsmen call their "red" stage, they begin to harden, and as soon as a third of them turn brown the entire stock may be cut. The cutting should be done on a clear, dry day, early in the forenoon, when the dew is on. For this purpose a long, heavy-bladed knife is used. The seed stalks are gathered in small heaps five or six stalks to a heap, the heads all one way, lying across the ridge on which they have been growing, the butt of the stalk in the hollow between two of the ridges. They are allowed to remain there for from three or four days to upwards of a week to become dry.

THRESHING.

This is generally done by laying a large cloth on the ground, one man bringing the small heaps of seed stalks and laying them on the cloth, while the other man beats the seed out with a flail. Some of the growers beat the seed out over the side of a barrel, holding the butts of the seed stalks in their hands; others use a threshing machine for the purpose.

CLEANING.

The seed is cleaned by running it through a fanning mill, after which it is spread on a cloth in the drying room and left for several weeks to become thoroughly dry. It is then run through the seed cleaner and stored in sacks ready for shipment.

On Long Island an average yield of seed is from 300 to 500 pounds per acre, and the price paid the grower ranges from 35 to 50 cents per pound.

INSECT ENEMIES AND FUNGUS DISEASES OF THE CABBAGE AND CAULIFLOWER.

FLEA BEETLE.

This insect, also known as the ground flea, is very troublesome in some parts. The general remedies used are tobacco dust sprinkled over



A Club-Rooted Cabbage.

the beds, just as the plants make their appearance above ground, also land plaster and Paris green mixed in the proportion of one pound of Paris green to twenty-five or thirty pounds of plaster dusted very lightly on the plants, early in the morning, when the dew is on and the plants are a few days old.

CABBAGE ROOT MAGGOT.

This is one of the most serious pests that trouble the grower of early cabbage. As yet no sure remedy has been devised, and the best thing to do is to use preventative measures such as planting cabbage in a new place each year, as far removed as possible from the ground on which cabbage or any of the allied crops were raised the preceding year. Cook's carbolic wash is also used successfully; this is made as follows: One pound of hard soap, one pint of crude carbolic acid, one gallon boiling water. Dissolve the soap in boiling water and while still hot add the carbolic acid and emulsify thoroughly. For use dilute the above with 30 to 50 times its bulk of water; apply a cupful to the root of the plant. Tarred paper disks about three inches in diameter, with a slit from one side to the middle and placed around the stem of the plant, are also used with success.

Where it is found that the root maggot troubles the young plants in the seed bed, the use of cheese cloth screens for covering the bed is fairly satisfactory. Boards ten or twelve inches in width are laid on edge so as to form a frame, this is then covered with cheese cloth, thus preventing the fly from laying eggs on the young plants. The objection to this plan is that it tends to make the young plants of a spindly growth. Mosquito bar-netting is also used and seems to be an improvement over cheese cloth on account of allowing more light to the young plants.

CUTWORMS.

The most successful remedy for this pest is the poisoned bran mash made as follows: Mix half a pound of Paris green in fifty pounds of bran, adding the poison to the bran a little at a time, stirring continually until the whole is tinged with a green color, then add water sweetened with sugar or molasses until the mixture is sufficiently moistened to crumble through the fingers. The mash should be scattered about the plants that are liable to attack, in the evening. The worms will feed on this mixture in preference to the plants.

CABBAGE BUTTERFLY.

The most effective remedy for this troublesome insect is pyrethrum insect powder—one pound thoroughly mixed with four pounds of flour and placed in an air-tight jar or can for twenty-four hours, so that the poison may become thoroughly incorporated with the flour. The mixture can be applied with a powder gun or a cheese cloth bag, dusting the plants lightly. This powder will kill the insects, but is perfectly harmless to human beings. Pyrethrum can also be applied in a liquid form, as follows: Dissolve two ounces of the powder in three gallons of luke-warm water and spray at once. Hot water applied at a temperature of 130 degrees F. will kill the worms and not injure the plant.

APHIS OR PLANT LICE.

These are very troublesome, some seasons, to the growers of cabbage and cauliflower, prolonged dry, hot weather being favorable to their increase. Kerosene emulsion and strong soap suds are the usual remedies applied, but are not satisfactory, especially where the acreage is large.

FUNGUS DISEASES.

For most of these diseases there is no remedy and it is advisable for the grower to keep a close lookout for the advent of these diseases in his soil and to use preventive measures at all times, clean culture and crop rotation being the principal means.

CLUB ROOT.

Preventive measures are: Practise crop rotation and do not grow cabbage or any allied crop, such as cauliflower, kale, Brussels sprouts, khol-rabi, turnips or radish, on any soil oftener than once in three years. Do not use manure from stock fed with infested roots. Burn all refuse from infested crops. The application of lime, two or three tons per acre, has a beneficial result. Winter ridging of the infested land curtails the disease to a limited extent on the following crop. It can be carried from one piece of soil to another by the roots of the plant; if the seed bed is infected, the plants from that seed bed will infect that part of the field to which the plants are transplanted.

BLACK ROT.

The first symptoms are darkening of leaf veins. Avoid low, damp soils. Practise rotation of crops as recommended for club root. Some varieties of cabbage are much more resistant to this disease than others. Houser, St. Louis, Drumhead and Savoys may be especially mentioned as being strongly resistant to this disease.

WILT.

Wilt, in some parts known locally as "yellows," is caused by a fungus which attacks the roots, causing the leaves to wilt and die. No good remedy is known. Avoid infested land and use preventive measures as outlined above.

STEM ROT.

This disease affects the cauliflower much more than it does the cabbage crop. It is a bacterial disease and its development is favoured by moist, close weather. There is no satisfactory remedy known for it. The

avoidance of damp soils and locations might be of some benefit, but it is not practicable with the cauliflower.

DAMPING OFF.

Damping off is usually associated with too moist a condition of the soil or atmosphere. When the plants are in the bed avoid overcrowding and give plenty of air.

BLACKLEG OR MILDEW.

This is a disease which attacks the stems of young plants either when wintered over or in the hotbed. It is prevented and kept in check by keeping the seed bed dry. A dressing of sand or air-slacked lime is also beneficial.

For further and more complete directions regarding Fungus or Insect Pests, not only affecting cabbage and cauliflower crops, but other vegetables, write to the Ontario Department of Agriculture for a copy of Bulletin 171.

