

ALASKA AGRICULTURAL EXPERIMENT STATIONS,

C. C. GEORGESON, SPECIAL AGENT IN CHARGE.

BULLETIN No. 2.

VEGETABLE GROWING IN ALASKA.

BY

C. C. GEORGESON,

SPECIAL AGENT IN CHARGE OF ALASKA EXPERIMENT STATIONS.

UNDER THE SUPERVISION OF
OFFICE OF EXPERIMENT STATIONS,
U. S. DEPARTMENT OF AGRICULTURE.

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A GARDEN AT EAGLE, ALASKA.

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**ALASKA AGRICULTURAL EXPERIMENT STATIONS, SITKA, KENAI,
COPPER CENTER, AND RAMPART.**

[Under the supervision of A. C. True, Director of the Office of Experiment Stations,
United States Department of Agriculture.]

STATION STAFF.

C. C. GEORGESON, M. S., *Special Agent in Charge, Sitka.*
F. E. RADER, B. S., *Assistant at Rampart.*
R. W. DE ARMOND, *Assistant at Sitka.*
P. H. ROSS, B. S., *Assistant at Kenai.*
J. W. NEAL, *Assistant at Copper Center.*

LETTER OF TRANSMITTAL.

ALASKA AGRICULTURAL EXPERIMENT STATIONS,
Sitka, Alaska, November 15, 1905.

SIR: I have the honor to submit herewith a manuscript entitled "Vegetable Growing in Alaska" and to recommend its publication as Bulletin No. 2 of the Alaska Experiment Stations. This bulletin gives suggestions regarding the choice of sites, preparation of soils, drainage, use of fertilizers, culture, etc., together with lists of vegetables that experience has shown are adapted to Alaskan conditions. The information is based upon experiments carried on during the past seven years at the several experiment stations and elsewhere, and it is believed that the dissemination of this knowledge will be of great advantage to the residents of the Territory.

The illustrations submitted are considered necessary for the proper understanding of the text.

Respectfully,

C. C. GEORGESON,
Special Agent in Charge.

Dr. A. C. TRUE,
*Director Office of Experiment Stations,
U. S. Department of Agriculture, Washington, D. C.*

Recommended for publication.

A. C. TRUE, *Director.*

Publication authorized.

JAMES WILSON,
Secretary of Agriculture.

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VEGETABLE GROWING IN ALASKA.

In this bulletin an attempt is made to present in an assimilated form what experiments and experience have taught as the best practice for vegetable growing in Alaska. It is of course understood that it is utterly impossible to give directions which can be followed in all places and under all circumstances. The Territory of Alaska is so extensive and the climatic conditions so variable that a practice which may be highly satisfactory in one section or in a given locality may result in total failure in others. Indeed, it is not infrequently the case that a practice which is successful in any given locality one year may result in failure the next year. This is the case, for instance, when the season is very wet one year and dry the next. In a wet season it is quite often desirable to raise the seed beds 4 to 6 inches by shoveling out the paths between them, but this practice is not a success in a dry season. It is therefore possible to give only general directions in a bulletin which is intended to be of use in the whole Territory.

There are two factors which modify the practice in Alaska as compared with farming and gardening elsewhere; and these are (1) the climate, and (2) the soil. The Alaska climate has a reputation for rigor and inclemency on which it is not necessary to comment here. This fact is accepted as a matter of course. The fact that the soil differs in many respects from soil in more temperate latitudes is perhaps not so well understood. Such is, nevertheless, the case, and before one can work it successfully he must learn, either from his own experience or the experience of others, in what respects it differs from soil in lower latitudes.

CLIMATE.

Only the general features of the climate will be treated, detailed characteristics, though all important, being omitted for two reasons—(1) they can be better treated of in a bulletin devoted exclusively to this subject (which it is hoped may be issued in the near future), and (2) because the data so far collected are not quite sufficient to make such a bulletin of real practical value.

In a general way there are two climatic belts in Alaska, which may be broadly described as the coast region and the interior. The climate of the coast region is by far the best known. Records of the rainfall and temperatures were kept at several settlements for many years during the Russian occupation, and these records have been continued and extended since the American occupation. In the interior, on the other hand, the Russians apparently made no observations, being concerned only with the coast, where their settlements were located.

During the last seven years the United States Weather Bureau has, through the assistance of the Alaska experiment stations, established voluntary weather bureau stations at more than thirty places in the Territory, and a special effort has been made to establish stations in the interior, in order that we may get records of the leading features of the weather there, viz, the temperature and rainfall, in these hitherto unknown regions. Some of these stations have been continued without interruption since their establishment. Other stations have been intermittent in their reports, or even abolished.

THE CLIMATE OF THE COAST REGION.

The leading features of the climate of the coast region are cool summers, mild winters, and a heavy rainfall. It seems incredible that the average annual temperature at Sitka, Alaska, is almost the same as that of Washington, D. C. While this is true, there is, nevertheless, a vast difference in the climate of the two places. Washington, D. C., has uncomfortably warm summers, and at times the winters may likewise be uncomfortably cold, the temperature falling several degrees below zero. At Sitka the highest temperature on record is 87° F., and this only for a single day. Often the maximum summer temperature does not reach 80°, and it is more frequently between 60° and 70°. The winters, on the other hand, are very mild for the latitude. The lowest temperature on record is 4° below zero. It is seldom indeed that the temperature falls to zero. During the winter of 1904-5 the lowest temperature recorded with the Weather Bureau instruments was 22° above zero. Now, what is true of Sitka in this respect is true of all southeastern Alaska. This remarkable uniformity in temperature throughout the year is of course due to the influence of the Pacific Ocean, which, being very nearly of the same temperature the year around, tempers the cold of winter as well as the heat of summer.

The climatic belt of the coast region is bounded on the landward side by the almost continuous mountain range which skirts the edge of the mainland. It is a high, snow-capped range, many peaks in which are more than 10,000 feet high. This range has an important effect on the climate, in that it is the main factor in the heavy pre-

precipitation. The moisture-laden winds from the ocean are chilled in their ascent over this range. They consequently lose their power to hold moisture, and the result is frequent and prolonged rain storms. The average rainfall at Sitka is 90 inches, or more than 7 feet a year, though the seasons vary greatly in this respect, some years being much wetter than others. Thus from October 1, 1901, to September 30, 1902, the rainfall at Sitka was 131.74 inches, while from October 1, 1902, to September 30, 1903, it was only 60.55 inches.

Usually the heaviest precipitation occurs in the fall of the year, from the middle of August until frost in the first half of October. The rainfall is generally quite heavy during April and May, but, as noted, there is as great variation in the coast region in regard to rainfall from year to year as there is in any other region of the United States. Some seasons are abnormally wet and chilly throughout the growing period, and other seasons are comparatively dry and warm; for it follows that the more rain the less sunshine, and the less sunshine the cooler and chillier the season.

The summer of 1904 was wet and cold throughout, though the rainfall was not excessive; so cold, in fact, that those vegetables which usually succeed here, such as potatoes and cabbage, were almost a complete failure.

This heavy rainfall is the chief drawback to successful farming and gardening in the coast region, not only because it interferes with the work, but many evils follow in its trail. One of these is that the soil is very generally too wet, and therefore does not warm up sufficiently under the influence of the sun's rays, and growth is retarded in consequence. Another is that the wet weather during the latter part of summer and fall causes all forms of vegetation to prolong their growth long after they ought to mature. This feature is particularly fatal to grain growing, for although all the hardy grains grow luxuriantly and would mature were the climate drier, it is only by dint of much labor and artificial shelter that grain can be saved in most seasons.

Now, while these conditions are, in general, true of this climatic belt, there are some variations which must be noted. In the extreme southeastern portion of Alaska, in latitude $54^{\circ} 40' N.$, the temperature is higher and the rainfall slightly heavier than in any other portion of this climatic belt. Passing northward and westward, there is a slight and gradual decrease in the average temperature, as well as in the precipitation. There is also a decrease in the temperature from west to east. Thus the islands which are west of the mainland have a milder winter climate than points on the mainland in the same latitude, though in many places it is also true that the same places on the mainland have warmer summers than the islands. Following the coast line to Prince William Sound, there is a gradual

decrease in the rainfall, which increases again on both the islands and mainland about Prince William Sound.

On the Kenai Peninsula, which is nearly surrounded on all sides by water, the climate is almost insular in nature, but colder and drier than in the Alexander Archipelago. At the Kenai Experiment Station, where a continuous record of temperature and rainfall has been kept for six years, we find the highest temperature in that time was 87° F. in June, 1903, and the lowest —43° in December, 1902, while the rainfall from September 1, 1902, to August 31, 1903, was only 31.45 inches.

Kadiak and Afognak islands have an even climate as regards temperature, and the rainfall is likewise less than in the islands of southeastern Alaska, probably because they are farther from the mainland and therefore not so directly dominated by the mountain range which extends along the Alaska Peninsula. At Kadiak in 1900 the highest temperature was 71° F., in June; the lowest, zero, in January; and the rainfall was 51.22 inches. In 1901 the highest temperature was 79° F., in July; the lowest, 2° F. above zero, and the rainfall was 62.51 inches. The mountains on the peninsula are lower than those on the mainland, and, owing to the direction of the range, extending from northeast to southwest, and also to the fact that Bering Sea and Bristol Bay wash the northwestern shores of the narrow peninsula, the climatic conditions are essentially like those on the adjacent islands, though somewhat colder. This region is treeless, and grass takes the place of the spruce forest of southeastern Alaska. The rainfall throughout this entire region is comparatively light, but there is a large proportion of cloudy and foggy weather during the growing season, which of course deprives vegetation of much sunshine.

Still farther northward along the coast of Bering Sea to Nome and beyond the same conditions prevail. The region is treeless. Mosses and other arctic forms of vegetation gradually displace the grass. The extreme range of temperature between summer and winter is not great, but owing to the ice in Bering Sea the springs are late and the summers cool. Nevertheless, very successful gardens are reported from Golofnin, Council City, and Nome, the crops being, however, confined to hardy and quick-growing varieties. Within the Arctic Circle, as far north as Point Hope and Point Barrow, the summers are never warm enough to produce even radishes, lettuce, or turnips satisfactorily in the open.

THE CLIMATIC BELT OF THE INTERIOR.

Beyond the mountain range there is comparatively little variation in the different sections—i. e., while one section may be more salubrious than another, due to the direction of the interior mountain

ranges, which in a measure influence the direction of the winds, the whole region has some general features in common. The climate is continental. In the absence of an ocean influence the land mass warms up rapidly in summer and again cools with equal rapidity in winter. As a result there is a brief but quite warm summer season and a prolonged and severe winter. Except among the mountains the snowfall is usually not heavy, 3 or 4 feet on the level being a good average. The summer rainfall is light, and it is yet a question if irrigation may not be necessary in the drier regions, as, for instance, in portions of the Copper River Valley and the Tanana Valley. The change from winter to summer is much more rapid than in the coast region, and the planting season is nearly the same in both belts—i. e., usually in the two weeks from the 5th to the 20th of May, some seasons later and in others slightly earlier. The rainfall and temperature during the months of May, June, July, August, and September at several stations in the interior have been as follows for the years named:

At Eagle in 1900 the maximum temperature was 87° F., in June, and the minimum —68° F., in January, and the rainfall for the year, 12.82 inches. At Holy Cross Mission, on the Lower Yukon, the data for the same year were: Maximum temperature, 77° F., in July; minimum, —55° F., in January; and rainfall, 28.54 inches.

At the experiment station at Copper Center, in the Copper River Valley, from October 1, 1902, to September 30, 1903, the maximum temperature was 96° F. in June, the minimum —60° in January, and the rainfall 8 inches, most of which fell during the growing season. And from November 1, 1903, to October 31, 1904, the data were as follows: Maximum 87° in August, minimum —59° in January, rainfall 8.80 inches, most of which likewise fell during the growing season.

Owing to the very recent establishment of the interior stations, our data are as yet but fragmentary and very incomplete. At all places in the interior the ground is frozen to an unknown depth. In the spruce thickets at Fort Yukon the writer has found ice immediately under the surface coating of moss in the month of July; but where the surface was exposed to the full effect of the sun, the ground having been cleared and then covered with grass, it had thawed out to a depth between 2 and 3 feet. It is found that when the ground is cleared and the dark, bare earth exposed to the sun, the line of perpetual ice gradually sinks deeper and deeper. At Holy Cross Mission in digging a well in such ground to a depth of 24 feet no ice was found. As far as vegetable and grain growing is concerned, the ice is not a drawback after it recedes 2 or 3 feet. On the contrary, as it slowly melts from the heat above, it furnishes moisture to the growing plants, and in dry seasons is thus a substitute for irrigation.

This brief review of the climatic conditions in Alaska may serve to give the reader an idea of the differences in this respect between Alaska and sections of the States, with some of which all settlers in Alaska are more or less familiar.

SOIL CONDITIONS.

The soils of Alaska differ from those of more southern latitudes in several particulars. Glacial action is apparent everywhere. The surface is generally quite irregular, particularly in the coast region. In portions of the interior there are extensive stretches of comparatively level land, but even here glacial action is very noticeable.

The action of water is also very apparent. Along the lower courses of the larger rivers extensive alluvial deposits have been formed, as is the case under similar conditions in all parts of the world; but the action of water is also apparent higher up the valleys, where there are frequent extensive areas of nearly level gravel beds but thinly covered with soil. The gravel shows unmistakable signs of wear, and these beds were formerly shallow water courses, formed by the melting of the ice sheet. In many regions a yellow loam covers this gravel to a depth of from 6 inches to 2 feet. In other places there have been extensive shallow lakes, which have grown up with vegetation and gradually changed from a lake to a swamp and from a swamp to a peat bed, or when dry and the vegetation fully decayed the result is now a rich, black loam. In the coast region there is but little level land anywhere, but there are innumerable small valleys and pockets where the decayed vegetable matter varies greatly in depth and character. Usually it is more or less peaty. In southeastern Alaska particularly this is the dominant character of the soil. The moist climate has induced an abundant growth of vegetation. The Sitka spruce (*Picea sitchensis*) is by far the most dominant form of tree growth, and mosses are the dominant form of herbaceous vegetation. The accumulation of the imperfectly decayed remains of these forms for untold centuries has produced a peculiarly mucky and peaty soil, which is perhaps not found elsewhere. This soil retains moisture with great tenacity, and before it can be successfully cultivated it must be thoroughly drained. Owing to lack of warmth the processes of decay are slow and imperfect, and vegetable acids have developed, making the soil very sour, as is shown by its instantly turning litmus paper red. To correct this acidity lime must be applied; how much will vary with circumstances. At the Sitka Experiment Station we have applied more than a ton to the acre on soil of this character, and this is apparently insufficient.

Now, this peculiarity, that the vegetation turns into soil slowly and imperfectly, is common to all regions of Alaska and differentiates the surface mold from the soil in the States. Muck and peat formations are found in all sections of the Territory, but par-

ticularly in the coast region, and here, as noted, chiefly in southeastern Alaska. This soil is very generally unproductive until it is thoroughly drained and limed. Cultivation and exposure to the air will in time correct the acidity to some degree, so that fairly good crops can be grown, but it is slow work. It is a matter of common observation that seed sown on newly cleared soil of this character fails to do more than sprout. The writer has frequently been told by prospectors and settlers of their unsuccessful ventures at gardening. They will cut the moss and shrubbery from a likely patch of ground near their camp, sow the seed they have brought with them, and patiently wait for their radishes, turnips, or mess of greens, only to find that, while the seeds sprout, the young plants soon turn yellow and die, or at best make but slow and unsatisfactory growth. This is due to the sourness of the soil; but, as the soil is moist and looks rich, the disappointed cultivators are quite generally inclined to lay the blame on the seed or on the climate or the country, and they express as their opinion, based on experience, that farming and gardening can not be made a success in Alaska.

The effect of an extreme case of soil acidity was shown at the Sitka Experiment Station. The soil is an imperfectly decayed peat or muck. It was cleared in the fall of 1898. The vegetation consisted of scattered scrub pine, crowberries, cranberries, a small percentage of other plants, and a thick coat of moss. During the next three years it was thoroughly drained, broken, cultivated, and an attempt made to grow various crops, which only resulted in repeated failure. In 1904 it was all fertilized with fish guano. The strip through the middle, which showed a fair growth of oats, was limed at the rate of a ton to the acre, and the strips on either side, which gave a light growth of oats, were fertilized—one with potassium sulphate, 300 pounds to the acre, and the other with kainit, 900 pounds to the acre. The whole plat was seeded to oats. That portion which was neither supplied with potash nor lime was absolutely barren. The soil was sterile, as far as the growth of oats was concerned. Where the potash was supplied there was a feeble growth of oats, but where the lime was applied in addition there was a fair growth of oats. The lime, then, makes the difference between a crop and no crop. Now, of all the grains, oats are perhaps the one best adapted to unfavorable soil conditions.

Similar conditions are found in very many places throughout the Territory, for, as the writer has endeavored to point out, this kind of soil is found everywhere. And even if the soil is not peaty it is nevertheless often sour, a condition which can be corrected by the application of lime, if this substance can be secured without too great cost. Cultivation and exposure to the air will in time neutralize the sourness, but the process is slow.

In the coast region of Alaska much of the land available for culture has in past epochs been under the sea, from which it has evidently risen by a gradual process. The nature of the gravels and the marine fossils testify to this. If the gravel is not too coarse and it has an abundant mixture of humus and silt, such soil is in many respects most desirable for vegetable growing. It is found usually near the present seacoast. It is well drained and it is a warm soil, in that it absorbs heat readily. Its fertility is, of course, soon exhausted, but if fertilizers are applied it will produce most satisfactory crops of potatoes, cabbage, and all other vegetables which can be grown here. Such soil does not need liming.

As already pointed out, there is great variety in the soils of the interior, but they are generally of a sandy, gravelly, or light loamy character. Extensive formations of clay are rare. Those portions of the river bottoms which are or have been subject to overflow consist, for the most part, of a mixture of silt and fine sand. This is an exceedingly rich soil and when not too wet will produce anything which can be grown in the climate. Unfortunately such lands are often covered with willow thickets, and farther back on the borders of the upland with spruce forests, and for this reason require considerable expense for clearing. There are thousands of square miles of soil of this description along the Yukon, the Tanana, the Copper, and, in fact, in all the river valleys. This land is admirably adapted to vegetable gardening as well as to grain. The uplands in the interior are for the most part thin and will soon become exhausted of their native fertility. They will probably need nitrogen more than any other element of plant food, and this can best be supplied by plowing under leguminous green crops.

BURNING LIMESTONE.

In this connection it may be of interest to describe a successful experiment in burning native limestone for liming purposes. Some logs, stumps, roots, brush, and a little dry wood to start the fire were carefully built into a pile. On this were laid alternate layers of limestone and more fuel of the same character. The outside was inclosed with slabs (the outside cuts from logs) and the chinks closed with sod. When thus built up a few gallons of a low-grade kerosene were poured over the pile to promote combustion, and it was then set afire. The results were not quite as satisfactory as they would have been had a regular limekiln been available, but more than half the rock was thoroughly burned, and slaked readily. In slaking it only water enough was applied to cause the lime to crumble. Later the coarse material was screened out and the pulverized portion applied to the land. In this manner any settler who finds a limestone ledge within convenient reach can burn lime for himself. Owing to the

excessive freight rates, lime shipped from Puget Sound sells for \$4.50 a barrel at Sitka, and the price will be proportionately higher the farther it is carried. Ordinarily, therefore, the commercial article is too expensive to apply to the land.

VEGETABLES WHICH CAN BE GROWN IN ALASKA.

The following vegetables can be grown in Alaska. For convenience they are divided into three groups, according to their hardiness and adaptability to climate and environment.

GROUP I.—Radish, mustard, turnips, kale, lettuce, orach. These can be grown throughout the whole coast region and in the interior northward of the Arctic Circle, nearly to the Arctic Ocean, in favorable seasons and in picked localities.

GROUP II.—Carrots, parsnips, parsley, peas, cress, cabbage, cauliflower, broccoli, Brussels sprouts, kohlrabi, onions, spinach, endive, leek, beets, potatoes, rhubarb, and among the herbs, caraway, catnip, marigold, mint, sage, thyme. These can be grown everywhere in the coast region in Alaska, and in the interior nearly to the Arctic Circle if the gardens are selected with due reference to shelter and exposure to the sun.

GROUP III.—Asparagus, beans, celery, cucumber, squash, salsify. These can be grown in favorable seasons if planted in warm spots and given the proper care and protection.

Vegetables which can not be grown in Alaska out of doors under ordinary garden culture, though they are common in the States, are: Sweet corn, melons, tomatoes, peppers, eggplant, okra, pumpkins. People often call for seeds of these, but ordinarily it is wasted effort to try to grow them. However, with fostering and in warm seasons some of these may even yield a partial success.

GENERAL OBSERVATIONS.

There are a few points in regard to the growing of vegetables which apply to all places and nearly all classes of plants. They require only brief reference here. Among these are—

SHELTER BELTS.

Whenever possible the vegetable garden should be protected from the winds. The high winds and driving storms which visit Alaska are often detrimental to growth. They beat down small plants, break down or tear to tatters larger ones, and are injurious in other ways. If a natural shelter is not available, a shelter belt should be planted on the north, east, and west. In most parts of southeastern Alaska the most destructive winds come from an easterly direction.

The north wind is cold and chilling at all seasons of the year. Southerly and southwesterly winds are, on the contrary, usually warm or at least mild in character.

When an artificial shelter belt must be provided, the best tree for the purpose is Sitka spruce in southeastern Alaska and the white spruce in the interior. Trees do not grow in the western coast region, and here a belt of alder or willow can be used. In the forest area in the coast region young spruce trees can be obtained almost everywhere for the trouble of digging them, and in that moist climate they can be transplanted with a very small percentage of loss. Select trees from 6 to 8 feet high, with branches to the ground. This size can be handled with little trouble, and they will afford some shelter at once. Leave plenty of roots and as much soil as will adhere to the roots in removing the tree. The roots should not be cut closer than $2\frac{1}{2}$ or 3 feet from the trunk. Transplant them in rainy weather, in the latter part of April or the beginning of May. Be sure that the holes are large enough to accommodate the roots, set them as deep as they stood before but no deeper, work the soil in between the roots carefully and firm it with the feet. Isolated young trees are always well branched, which is an essential point. Plant a double row, or, better still, a triple row, so that the back rows will cover the space between those in the front row. Do not plant them close. If the branches interlace they will eventually die and the object is defeated. The distance will vary with the size of the trees, but 15 to 18 feet will allow them to develop as individuals for many years, and the older they grow the better shelter they will afford.

In regions where the spruce can not be obtained the native willows will be of service for this purpose. They should be planted very close in order to afford the desired shelter.

We have as yet had no experience with hedge plants and other trees used for shelter belts in the States, but wherever the spruce grows no better tree can be obtained for this purpose.

The spruce of the interior is tall and slender. The writer has seen isolated trees 50 feet high, with the branches reaching not more than 3 feet from the trunk. It resembles in a way the Lombardy poplar in habit of growth. This spruce should be planted very close, not over 5 feet apart, and at least four rows will be necessary to make the wind-break effective, and twice that many would be better still.

EXPOSURE.

It is very important in these far northern latitudes that the garden spots should be located in places where they can have the full benefit of the sun. A gentle slope to the south, the southeast, or the southwest should be chosen wherever possible. In the event that a choice must

be made between good soil and a sheltered place with good exposure the choice should be for the latter. The soil can be improved, but the exposure can not. There are, of course, many places where the desirable exposure can not be had. In that case simply make the best of a bad situation.

DRAINAGE.

In the coast region, where the rainfall is heavy, good drainage is absolutely necessary. Sometimes the ground slopes so sharply that the water runs off freely from the surface, but this is exceptional. In other places there is natural underdrainage in the form of a gravel bed or other porous subsoil; but where one or the other of these conditions does not exist it is necessary to provide for the discharge of the water by artificial drainage. Sometimes it is enough to have one or two open ditches though the patch; but open ditches are always an obstruction to work on the ground, especially when horse labor is employed. Covered drains are much to be preferred.

When the soil is of the peaty character already described, it is utterly useless to attempt to work it until it is drained. In that case the drains must be close together. They should not be more than 15 feet apart. At the Sitka Experiment Station several acres of that kind of soil have been drained with good success. Ground that was almost impassable on foot before it was drained is now worked with teams.

CONSTRUCTION OF DRAINS.

Although drains may be constructed in several ways, there are certain principles to observe in all cases. These are the outlet, the direction, and the slope of the drains. The first thing to consider is the outlet. Find the lowest place on the patch or field from which the water can be discharged. This is the natural outlet, and an open ditch or closed drain should carry the water away from here to a water course or pond or other natural outlet.

The next thing to consider is the direction of the drains. They should in most cases run straight down the slope and discharge into a head ditch, which in turn discharges at the selected outlet. Lastly, the slope which the drains can have, or must have, has to be decided on, in order that the work can be properly planned. The slope of the several drains, or even of the same drains, will vary with the lay of the ground, and this again will cause a variation in the depth of the drains. In a well-constructed drain, with a smooth hard bottom, a fall of 1 inch in 100 feet is sufficient, but drains such as these, built by amateurs, should have a fall of 5 or 6 inches in 100 feet, and a foot would be still better.

Dig the ditches 4 feet deep and only just wide enough so a man can work in them. In order to give them the maximum slope and to

make this slope as nearly uniform as may be, the depth will vary somewhat with the lay of the ground. Before work begins, a plan should be decided on and the system laid out complete. When the patch or field is more than 10 acres in extent, and especially if it is almost level, the system should be laid out with a surveyor's level, but for smaller tracts an ordinary carpenter's level will answer, and if there is plenty of fall a true eye and good judgment are sufficient. Begin work at the lowest point, so that the water can run away as it collects.

A drain is merely an underground passage through which the water can escape. What is needed, then, is to place in the bottom of the ditch some material which will afford such a passage. For this purpose many things can be used. The best is of course the drain-tile, but no tiles are manufactured in Alaska, and owing to the heavy freight charges and also to the large percentage of breakage in handling them, tiles are scarcely worth considering.

Perhaps the next best substance is rock. Use blocks about 6 inches on a side or larger. Lay a row against the wall on each side of the ditch, so as to leave a passage between them about 4 inches wide. Cover these rock with larger rock, then with smaller ones, and finally with brush, to prevent the earth from falling through the openings and obstructing the passage. But stones will not often be used for the reason that the labor of handling them will make the drains too expensive.

Slabs from a sawmill are the next best thing when they can be obtained. At the Sitka Experiment Station we have used slabs largely. We lay two together in the bottom of the ditch, leaning them against each other in the form of the letter A, with the round side in, and tack them together with nails. The ends of adjoining lengths are fitted so as not to leave too large openings. Thus an A-formed passage is built through the length of the ditch. On top of this passage we put spruce poles and the brush cut from these on top of the poles, always taking care that the butt ends of the brush are turned down and the fine brush put on top. If brush is scarce or too coarse, it is the practice to finish with a layer of sod on top of all to keep the earth from falling through and obstructing the flow of water. The earth can now be shoveled on and tramped down, with the assurance that there will be an open passage underneath for many years to come.

When slabs can not be had, the cheapest boards obtainable can be used; but boards are straight edged, and it will be necessary to cut deep notches in them at intervals of 4 or 5 feet on the under side to admit the water. Cover them with poles and brush as in the case of the slabs.

Poles and brush will make a very effective and cheap drain. Lay a large pole 6 inches in diameter at the butt against the side of each wall. Put a third pole on top, taking care that the openings are nowhere too large. Put another trio of poles on top and then cover this a foot thick with brush so packed that it will keep the earth from falling through. We have laid some drains of this kind, which work satisfactorily.

If poles are not available, brush alone can be used. It should then be packed with the butt end down, leaning up the ditch at an angle of 60°. We have laid some drains of this kind, but we find that as the brush decays and settles the passage is apt to become obstructed.

FERTILIZERS.

All Alaska soils are improved by fertilizers. Barnyard manure is, all things considered, the best general fertilizer, but as there are as yet but few domestic animals in Alaska it is a scarce article in most places. Barnyard manure varies greatly in fertilizing power, according to the way it is cared for, and the quantity and kind of material used for bedding. Here, where hay and straw are costly, shavings and sawdust are often used to bed down the animals. When present in large quantities in the manure these materials have an injurious effect on the growth of plants, but, on the other hand, such manure is not overcharged with seeds of weeds. Horse manure acts more quickly than cow manure, and it is usually richer in plant food for the reason that horses are fed more grain feed. Manure kept under a shed is better than that which has been exposed to and washed out by rains. Twenty tons to the acre is not too heavy a dressing of ordinary barnyard manure. Apply in the spring and work it thoroughly into the soil.

Seaweed can be had everywhere along the coast, and experiments have demonstrated that it is an excellent fertilizer for many crops. As here used the word seaweed does not refer to any particular species, but is meant to include kelp and all forms of vegetation washed up by the sea. It is especially efficacious on gravelly and loamy soils and of little value on peaty soils. It has proved to be a good fertilizer for potatoes and cabbage and in less degree also for grain. Apply it fresh, at the rate of at least 20 tons to the acre, and plow or spade it in thoroughly.

Fish scrap from canneries, dead fish, and all other organic matter from the sea are also valuable.

Fish guano, an Alaska product manufactured at Killisnoo, has been used at the Alaska experiment stations with good success. It should be applied at the rate of at least 300 pounds to the acre. For grain crops and broadcasted crops of any kind apply it broadcast on top of

the plowed ground and work it into the soil with harrow or rake. For root crops and other things grown in rows it can be applied in the drill with the seed, especially if the amount available is but small.

Commercial fertilizers, such as sodium nitrate, potassium sulphate, and superphosphate, are excellent fertilizers when used with judgment and one knows the needs of the soil. The excessive freight charges will debar their use in Alaska to any great extent. Nitrates should not be used on peaty soils, but only on sandy, gravelly, or loamy soils, which are deficient in nitrogen. For garden purposes, when the soil is not naturally rich, a mixture of 200 pounds of nitrate of soda, 200 pounds of sulphate of potash, and 100 pounds of superphosphate is not too heavy a dressing. Sow it broadcast on top of the plowed or spaded ground and work it in with harrow or rake.

As already remarked, nearly all Alaskan soils, but particularly those of a black peaty character, stand in need of lime, and lime should be used in conjunction with all fertilizers.

PREPARATION OF THE SOIL.

The soil must be thoroughly plowed or spaded in the spring. The surface must then be reduced to a level bed, by the harrow first if on a large scale, and in any case by the vigorous use of a steel rake. Bring it to a fine tilth. Remove roots of trees and grasses with equal care. Of the two, grass roots are the worst. Nearly all garden seeds are fine, and they can not be covered properly unless the surface is fine and level, and they can not make a good growth unless the soil is deep and porous.

When spaded, level and pulverize the surface with the rake as the work proceeds, taking care, in order to avoid packing, not to step on the spaded soil.

HOTBEDS AND COLD FRAMES.

Hotbeds and cold frames are contrivances for starting plants early, before they can be grown in the open ground. They differ from each other only in this, that the soil in the hotbed is warmed by some artificial means, while in the cold frame it is not. In both cases the soil is placed in a frame covered with sashes. These beds should be located in a place sheltered on the north, east, and west and open to the south, so as to get the full benefit of the sun.

CONSTRUCTION OF A HOTBED.

Dig a pit 8 feet wide and as long as may be desired. The depth depends on the amount of heat one desires to develop and the amount of heating material that is available. Three feet will usually suffice. Board this up on the inside to keep the earth from caving in, and provide an outlet for the water which may collect in the pit. If one

wants a more substantial pit, dig it 10 feet wide and wall it up with brick or stone.

The sashes can be of any size, but a convenient size to handle is 6 feet long by 3 feet wide. They are made of 2-inch stuff and have three or four rows of glass, the panes overlapping each other like shingles to shed water. Plate I, figure 1, shows station hotbeds.

MAKING THE HOTBED.

Fresh horse manure is the most satisfactory material to produce the heat. It should, for this purpose, be kept dry and spread out thinly, so as not to ferment before it is wanted. It should be mixed with a large amount of the straw used in bedding down the horses. In the absence of straw, seaweed, or spoiled hay, or spoiled silage, or leaves can be incorporated with the manure instead. Horse manure does not make a satisfactory hotbed without some such long material. At the Sitka station two loads of fresh seaweed are mixed with one load of horse manure with very satisfactory results. Seaweed alone, if used fresh and in considerable quantities, will make a good, mild hotbed.

Fork the material over until it is thoroughly mixed. Then pack it in the pit to the top of the boards and put on the sashes. Frames of inch boards a foot wide are made to fit the sashes, one frame to two sashes. Such frames are easily handled. They are put on the heating material and covered with the sashes to confine the heat, and thus facilitate the spreading of the heat to the whole mass. Should it heat unevenly remove the frames and fork it all over again, mixing the cold with the heated material. When the heat is uniform straighten and level the frames, giving them a slope to the south of about 10°. Smooth the manure inside the frames and pack it down with the back of a shovel. Then throw in 6 inches of good soil, prepared for the purpose, and replace the sashes. Watch the warming of the soil and shovel it over once or twice in the course of a week, so it may warm up evenly. This should be done so that the bed will be ready to seed by the middle of April. Seed of all the members of the cabbage tribe should then be sown. Sow also radishes and lettuce for early use. Celery and other plants wanted later for transplanting should also be started now. Early potatoes can be sprouted here, if desired, though they should not be started till the beginning of May, in order to keep them from getting too large before the weather is warm enough to set them out.

MANAGEMENT OF THE HOTBED.

From the time the seed is planted until the plants are removed the hotbed requires daily and constant attention. Ventilation is

the most important point. Place a thermometer in the shade on the bed, and as nearly as possible keep the temperature at 70° F. To forget to raise the sashes during a few hours of bright sunshine may work disaster to everything growing in the bed. For supporting the sashes use a piece of board 6 inches wide and 15 inches long, cut into four or five stair steps. Putting this under one end of a sash it can be raised to any height the occasion may require. Water with a garden sprinkler as often as necessary.

As the weather grows warmer and the plants grow larger more and more ventilation must be given, and in mild weather the sashes should be removed altogether and replaced only at night. And, finally, two weeks before the plants are to be set out, the sashes should be taken off altogether, in order to harden the plants.

CONSTRUCTION OF A COLD FRAME.

Build a frame to fit the sashes one has available. Ordinary rough boards answer the purpose well. Set this in a warm, sheltered place and incline the sashes about 10° to the south. Fill the frame, or box, about two-thirds full with rich, especially prepared earth, as for a hotbed. In this plant the seed and treat it in all respects as a hotbed.

A cold frame should be seeded some ten days later than a hotbed, because, having no under heat, a late cold snap may be disastrous if the plants are too far advanced. It is well to provide covering for both hotbeds and cold frames, to be used at night and in cold weather. A light frame covered with two thicknesses of tar building paper is perhaps the cheapest and simplest covering and it is easily handled.

For private use on a small scale large size ordinary window sashes will answer well for a cold frame. The illustration (Pl. I, fig. 2) shows such a frame in use.

In the absence of window sashes a substitute can be made of muslin tacked to a frame and treated with a coat of paraffin, to make it shed water. It does not admit enough light, however, and whenever possible, after the plants are up, remove it to admit light.

TESTING SEEDS.

It is often desirable to know whether the seed one has on hand has sufficient vitality to make it worth planting. This can be ascertained by a very simple test. Take a large plate or a tin pan; dip a piece of woolen cloth in water and put it in the bottom of the pan. Count out a given number of seed—a hundred, if that many can be spared—and scatter them over the cloth; then moisten a similar piece of cloth and put it on top. Cover the whole with a lid, or piece of board, to prevent its drying too fast, and keep this improvised appa-

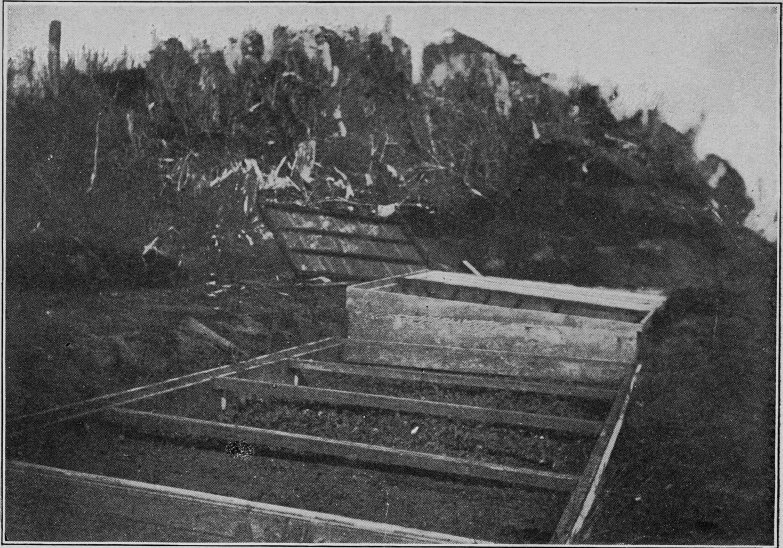


FIG. 1.—HOTBEDS AT SITKA STATION.

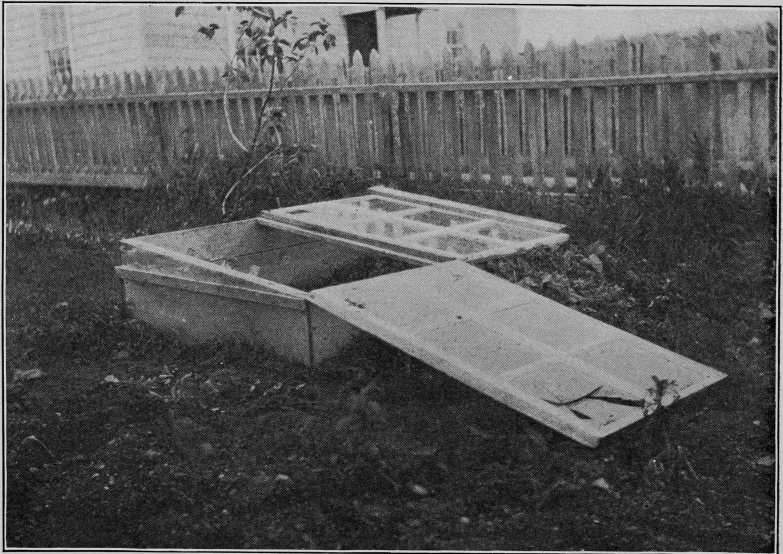


FIG. 2.—A SERVICEABLE COLD FRAME, FITTED WITH COMMON WINDOW SASHES.

ratus in a warm room where it will be subject to an even temperature of about 70° F. Sprinkle a little water over the top cloth every day or two to keep it moist, but water must not stand in the pan. In a few days the seed will begin to germinate. Then pick out and count those which sprout, and one can figure on the percentage that is likely to grow. The time required to germinate varies with the different seeds and with the age of the seed. Radish, lettuce, cress, and turnips will germinate in two or three days, under favorable circumstances, but onions, parsnips, parsley, and others may require two weeks or more, and if the seed is chilled at night or at any time the germination will be delayed. The seed should therefore not be condemned too hastily.

CULTIVATION OF VEGETABLES, GROUP I.

The few vegetables in this group can be grown farther north, and therefore over a larger area, than those of the other groups.

RADISH.

For early use sow in a hotbed. The short-rooted varieties, such as French Breakfast, the turnip-rooted and olive-shaped sorts, can even be grown in boxes in soil 5 inches deep and the boxes placed in a sunny window in the house.

Out of doors sow in drills as soon as frost is out of the ground, and repeat seedings every two weeks until August if they are wanted all summer. The seed should be sown thinly. If the plants are crowded the roots will not develop normally. There are innumerable varieties, which can be divided into three general classes, according to shape. They are the turnip-rooted and olive-shaped sorts, the half-long sorts, and the long sorts. The first-named class, including the French Breakfast, the Early Scarlet Turnip, and many others, are the earliest and should be chosen for the first seedings. For later seedings the Long Scarlet is a favorite variety. There are some so-called winter radishes which grow to large size and can be kept until along in the winter. These are not suited to the far north, however.

Several varieties of the Mammoth Japanese radish (Daikon) have been introduced in this country, and these can be grown in southern Alaska in favorable seasons.

LETTUCE.

Next to the radish, lettuce is perhaps the most commonly grown vegetable for early summer use. For early planting sow a little seed in a hotbed or in a window box. The soil in the latter case need not be over 3 inches deep. The seed can be sown thickly and the lettuce cut off as soon as it is large enough to use, or the plants can be trans-

planted to other boxes 3 inches apart each way, when the plants will grow larger. Finally, when the weather is warm enough, sow the seed in rows outdoors and cover half an inch deep. When the plants are 2 inches high transplant to 6 inches apart in the row.

Lettuce is not very hardy and it will not make much growth outdoors until the weather gets warm. Plants raised in the house can also be transplanted, but they should be "hardened," i. e., exposed to the outer air in a sheltered place for at least a week before they are transplanted. There are two general classes with several varieties of each. In one the plants form a more or less solid head, and in the other they do not. The nonheading varieties are the best for very early use. Simpson Early Curled and Simpson Black Seeded are favorite varieties for this purpose. Of those which form solid heads San Francisco Market has been very successful at all our experiment stations. Large Hanson, Philadelphia Butter, Morse, Victoria Cabbage, and Boston Market have all been grown successfully in Alaska.

MUSTARD.

Mustard grows up quickly and the tops can be used early for "greens." In the far north it is the most satisfactory cultivated plant for early greens. Sow the seed rather thickly in a row out of doors as early as the ground can be worked, and cut the tops off as soon as they are large enough for use. In cold, wet soil the plants have a tendency to run to seed at once. The tops can be cut a second time in two or three weeks. White London and Chinese Broad Leaved are favorite varieties for this purpose.

Black mustard yields the mustard seed of commerce. It can also be grown in Alaska, but if allowed to seed care should be taken that the seed is gathered before it "shatters," otherwise it will become a pest in the neighborhood.

TURNIPS.

Turnips are so well known as to scarcely require notice here. They are grown successfully all over the Territory. Indeed, it is a well-known fact that they are of better flavor, more tender and buttery, and attain a larger size in Alaska than they do in more southern latitudes, where they become tough, stringy, and acquire a pungent flavor. Radishes, lettuce, and turnips are the three vegetables which the prospector and miner desire to grow above all things. Turnip seed can be sown either broadcast or in drills as early in the spring as the ground can be worked. The plants should be thinned to at least 3 or 4 inches apart. The young leaves are rather rough, but in an emergency they can be used for greens. The roots will be large enough for use in a few weeks. All varieties so far tried have done well. Some of those grown at the experiment stations are White

Milan, Purple Top Strap Leaf, Yellow Finnish, White Finnish, White Egg, Early Snowball, and Early Dutch. These are all desirable and may be depended on to give satisfactory returns. The Purple Top Strap Leaf attains a very large size. Turnips weighing 10 pounds are not unusual in Alaska. When sown broadcast, the seed is covered sufficiently deep when raked into the surface; sown in drills, it should be covered about half an inch deep. Ruta-bagas, which are only a variety of turnips, do not belong in this group. They require a longer growing season and can not be grown successfully as far north as the turnip.

KALE.

Scotch kale is a vegetable which is not appreciated as it deserves to be. It is, in fact, unknown to many people. In reality it is a most desirable plant for a northern climate. It does not do well under a hot sun in the Central and Southern States, and this may be the chief reason it is so little known. It is very commonly cultivated in all northern European countries, and there ranks even ahead of cabbage. It has been tried in all parts of Alaska, and grows successfully everywhere in the Territory. It belongs to the cabbage family and should be cultivated like cabbage. Sow the seed either in a hotbed, cold frame, or in a box in the house, and set out the plants toward the end of May. Plant in rows 2 feet apart and 1½ feet between the plants in the row. The growth is somewhat slow at first, but toward fall they develop more rapidly. They should be used for greens during the fall and winter. It may be pertinent to add a cooking receipt for the benefit of those who are not familiar with its use. Kale should never be eaten green as a salad. It should invariably be boiled. A good receipt is as follows: Tear the midrib from the leaf, cut the pile of shredded leaf through with a knife a few times, then place in pot, sprinkle a little salt over it, put in a piece of salt pork, cover with water, and boil steadily for two hours, then drain off the water, mix with potatoes which have been boiled separately, and serve while hot. During the fall and winter there is no more palatable green. Kale has the advantage that it is quite hardy. It can remain outdoors until wanted, protected only by the snow. A dish of kale at Christmas time, dug out from under the snow and prepared in this way, is unsurpassed at that time of year by any other vegetable. The quality is improved by frost. It is one of the vegetables which should be largely cultivated in Alaska, and the writer feels sure that it will be as soon as its merits and its uses become known. There are but few varieties. The best for table use is called the Dwarf Green Curled, or German Greens. It does not grow over a foot high, and has very crisp, curly leaves. Tall Scotch

is another variety which is grown for cattle feed quite largely in northern European countries. Another variety, known as the Dwarf Purple, has purple or variegated leaves, which are used for garnishing meat dishes on the table.

ORACH, OR MOUNTAIN SPINACH (*Atriplex hortensis*).

Orach is a hardy annual plant used for greens. It can be grown all over Alaska. Its culture is very simple, and it produces a surer crop than spinach. It can therefore be used as a substitute for spinach, and the writer believes it will become popular if given a fair trial. It is particularly suited to the interior. Sow either broadcast or in rows as early as the ground can be worked and use like spinach as soon as the plants are large enough.

CULTIVATION OF VEGETABLES, GROUP II.

The following vegetables can be grown quite successfully nearly all over Alaska, although toward the Arctic Circle they may fail in unfavorable seasons. They are mentioned here in nearly the order of their hardiness.

CARROTS.

Carrots can be grown on nearly all soils, though preferably on a porous loam. They do not do well on peaty soil. Sow the seed thinly in rows 2 feet apart, and cover $\frac{3}{4}$ to 1 inch deep. Thin the plants from 2 to 4 inches apart in the rows, according to the size of the variety. For early use they can be sown broadcast in the cold frame. For this purpose Early Forcing, a very small, round-rooted, rapid-growing variety is best adapted. For outdoor culture the following varieties have been successful in Alaska: Early Horn, a short-rooted, early variety, which will be ready for use before the larger sorts; Early Half-Long Stump-Rooted, a medium early variety of fine quality; Chantenay, a variety of French origin, stump-rooted in form, but which attains a good size; Danvers Orange Half-Long, a somewhat coarser variety than the foregoing and is often grown for stock feed; Large White Belgian, which attains great size and is grown chiefly for stock feed and one-third of whose root grows above ground. There are many other varieties on the market, most of which would undoubtedly do well in Alaska. One ounce of seed will sow 150 feet of drill.

PARSNIPS.

Parsnips are somewhat more tender than carrots while young. They require a longer growing period, and are not likely to succeed where the ground is cold or wet. In southeastern Alaska they do well everywhere. They grow deep in the ground and do best in a

deep, rich, sandy soil. The seed germinates slowly. Sow early in the spring, in rows 2 feet apart, covering the seed $\frac{1}{2}$ to $\frac{3}{4}$ inch deep. Thin the plants to 3 or 4 inches apart.

Hollow Crown is a leading variety. It forms a rather short, thick root, which is sweet and tender. Long White is another variety, the roots of which go very deep into the ground. Improved Guernsey and Magnum Bonum are two other varieties of good quality. Parsnips can stay in the ground all winter, and their quality is improved by freezing.

PARSLEY.

Parsley is grown as a flavoring for soups, stews, and for garnishing meat dishes. In this country only the leaves are used, but in Europe certain varieties are cultivated for their large, fleshy roots. Sow as early as the ground can be worked in drills 1 foot apart, and cover the seed half an inch deep. The seed germinates slowly, and it is well to soak it in warm water for a few hours before sowing, but after the soaking it should not be allowed to dry again. (This is true of all seed.) The leaves can be picked for use from the time they are large enough. There are only a few varieties.

Tripled Curled is a leading favorite. Moss Curled and Emerald are other varieties.

PEAS.

In their season no vegetable is more appreciated than green peas. The early varieties are grown successfully in nearly all parts of Alaska, while the late sorts may or may not be a success, depending on the location and the season. Peas are always sown in drills, and the writer prefers to sow them on beds of two rows each with only 6 to 8 inches between the rows. The next bed is then laid off 2 feet from the first. This arrangement facilitates "brushing." The two rows are brushed together, the brush being stuck in the ground just outside the peas, so that the tops lean together. Sow early in the spring. Peas are quite hardy and can stand a slight frost without injury. They can be grown on any soil, but do best in a good loam. They will not grow well on peaty soil unless it has been limed. Of the many sorts we have grown at the Sitka Experiment Station, two have so far proved superior to all others. They are: First and Best and Alaska.

First and Best is a variety that deserves its name. It is an excellent yellow pea, which in average seasons will be ready for use two months from the time of planting, or even a little earlier in favorable localities. It grows about $3\frac{1}{2}$ or 4 feet high, and requires brush of that length.

Alaska, or Earliest of All, is an early, smooth, blue pea. There is but little difference between it and the foregoing in earliness and

quality. It reaches a height of about 3 to 3½ feet. These two varieties easily take the first place for Alaska, but all the early varieties can be grown, among which are the following:

American Wonder, a very dwarf variety which does not require the support of brush. McLean Little Gem is a wrinkled pea of good quality. It reaches a height of 2 feet, and should be supported by low brush. Gradus is somewhat later than any of the foregoing. It produces large pods and wrinkled green peas when ripe. The quality is of the best. It requires brush. Horsford Market Garden is still later. It grows about 4 feet high and yields well. The peas are green and wrinkled when ripe. Abundance is a large-podded, wrinkled pea, which grows about 3 feet high. Telephone is a large-podded, medium early variety, which grows 5 to 6 feet high.

Of the later varieties, Champion of England and Large White Marrowfat can be recommended. They grow about 6 feet high.

Tall Sugar is a variety with edible pods. It has grown to a height of 8 feet at the Sitka station.

POTATOES.

Potatoes can be grown almost to the Arctic Circle. They succeed well at Eagle and Rampart, and favorable reports have been received even from Golofnin and Coldfoot. In 1904 they were almost a failure everywhere in Alaska, owing to the unusually cold season. It is useless to plant potatoes until the ground has warmed up somewhat, which is generally about the middle of May in most parts of Alaska. If they are planted too early they are liable to rot in the ground, especially if cut in pieces. The crop can be forwarded materially by placing the seed potatoes in boxes in a warm room until the sprouts start. Care should then be taken that they are not broken off in planting. It is customary to recommend that the seed potatoes should be cut up in from two to four or more pieces, even to single eyes; but the writer will not advocate this except when the seed is scarce. Our experiments have been decidedly in favor of medium-sized whole potatoes. They produce thriftier plants and yield better than pieces. Plant in rows 3 feet apart and from 1 foot to 1½ feet apart in the row, according to the scarcity of the land and seed. Cover 3 to 4 inches deep. Potatoes respond well to potash fertilizers, if the soil is not rich in this element. Cultivation is important. Hoe frequently, not only to keep weeds down, but to keep the soil mellow. When the tops are 6 inches high, "hill" them up, and repeat this two or three weeks later. On a small scale this is most conveniently done with a hoe; on a larger scale with a plow with two moldboards. The writer regards this operation as important. His experiments have proved that potatoes may form on the stems

thus covered with soil, where otherwise they would not. Again, if the hilling process is neglected some of the potatoes may form in the surface of the ground where they are partly exposed to light and air, which results in their developing a bitter taste.

Potatoes should be dug as soon as the vines are touched with the first frost. Spread them on the ground, or in a loft for a day or two to dry off, and then put them in winter quarters. The best place to keep them is in a frost-proof cellar. If such a cellar is not available, they can be covered with earth. In the latter case put them in one or more conical piles in a dry spot on the surface of the ground, cover them with straw or hay and a thin layer of earth to keep the straw or hay in place. Increase the covering of earth as the weather grows colder, thick enough to exclude the frost. A coat of seaweed affords good protection. This method of keeping potatoes is not practicable except in the coast region. In the interior frost-proof cellars must be provided. In the cellar they should be examined occasionally and those which show signs of decay picked out to keep them from contaminating others. It is often the case in Alaska that the crop does not ripen uniformly. In the coast region the wet weather keeps them growing too late, and in the interior an early frost is apt to cut short the period of growth. Such half-grown and unripe potatoes are neither so good in quality nor do they keep so well as those which have matured normally. There are many complaints that Alaskan potatoes are watery. This may be due to either or both of two causes, viz, lack of maturity, when the starch cells have not been fully developed, or it may be characteristic of the variety, some varieties being more prone to be watery than others. The Early Rose is one of these.

Of the several varieties tested, the writer would place the Extra Early Ohio first in the list. It is a smooth, oblong white potato of medium size which ripens with the earliest. If normally matured it is dry and mealy when cooked, and is a good average yielder. Garfield is a new variety and has not been sufficiently tried as yet, but it promises to be equal to the Extra Early Ohio. It is also an oblong white potato of excellent quality. Freeman is another variety new to this region, oblong in shape and light red in color. It promises to be valuable for Alaska. Hamilton Early is a very early white potato of good quality. Extra Early Triumph is an early red potato, which has recently been put upon the market. It promises well. There are many other sorts—too many to enumerate.

The Yakima is the common name of a potato which is, perhaps, more than any other supplied to Alaska through the channels of trade. It takes its name from the Yakima Valley in Washington, where it is grown. It is believed to be the Burbank or a variation of the Burbank. It is a medium sized rather long potato with white

skin and very small, shallow eyes. The Washington-grown product has good cooking qualities. This potato is often planted simply because no other can be had, but it is too late for Alaska and deteriorates here both in size and quality.

The Early Rose is mentioned simply because it is so well known. As grown here in Alaska it is not a first-class potato, and should not be planted when those varieties first named can be obtained.

Plate II shows the influence of fertilizers on potatoes when grown on new and rather sour soil. The three piles represent rows of equal length grown side by side.

BEETS.

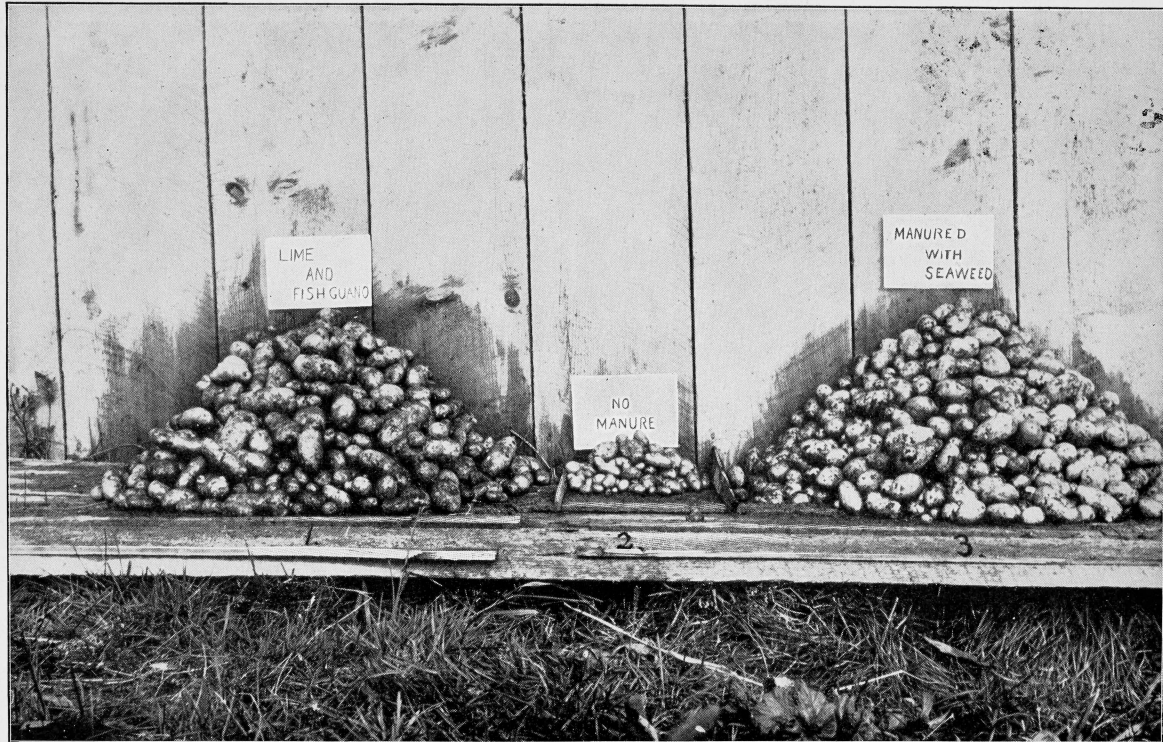
Beets are more difficult to grow than any of the foregoing, though in average seasons and on well-drained land they do fairly well. Beets 4 inches in diameter and even larger can be grown in favorable seasons. On wet ground the plants run to seed almost at once and form no roots. Sow the seed thinly in rows $1\frac{1}{2}$ feet apart at the same time or slightly later than the planting of carrots and parsnips. Each seed contains three germs and if all grow the plants require thinning, no matter how thinly the seed is scattered. The plants thus pulled up can be transplanted if desired, and they also make excellent greens. Early Bassano is a good early variety of rather a light color. Early Blood Turnip is a dark-red variety with good keeping qualities. Crosby Egyptian is another early and desirable variety. Dark Red Turnip is still another good variety, which is slightly later than the foregoing. All of these are globular or turnip-rooted in form, and they are to be preferred to the longer and later sorts, which it is not necessary to describe here. Young beet leaves make excellent greens.

CRESS.

This is a salad plant which does not receive the attention from Alaska gardeners that it deserves. It is eaten raw, with a sprinkling of salt or other dressing, if desired, and has a pungent, appetizing taste. Cress can be very readily grown in boxes indoors, in which case the seed should be sown broadcast very thickly, covered lightly with sand, and kept moist. It will germinate in a few days, and in a warm room the young plants will be large enough to use inside of three weeks. Then cut them just above the roots with a sharp knife and serve fresh.

For outdoor culture sow the seed thickly in a row early in spring and cover lightly. Cut the cress when three or four inches high. If not cut too close the plants can be cut several times during the summer. If not cut they will soon go to seed.

There are but few varieties. Curled, or Pepper Grass, is the one commonly grown. Since the seed must be sown thickly and the



EFFECT OF FERTILIZERS ON POTATOES.

Yield of three rows of equal length. No. 1 was fertilized with lime and fish guano; No. 2, no fertilizer; and No. 3 was fertilized with seaweed.



FIELD OF CABBAGE AT SKAGWAY, ALASKA.

plants cut when young a little 5-cent package does not go very far. If one is fond of cress he should provide half a pound of seed in order to have plenty.

CABBAGE.

This universally cultivated plant can be grown in favorable seasons as far north as the Arctic Circle, but in unfavorable seasons it may fail even in southeastern Alaska. In 1904 the summer was not warm enough to cause it to head anywhere in Alaska.

Sow the seed either in a hotbed or a cold frame or in boxes placed in sunny windows about the middle of April. The plants should be large enough to plant out, without forcing them in the least, by the end of May or early in June, which is early enough. The present season we have raised cabbage plants successfully in so-called "flats," or shallow boxes, placed in the greenhouse, which was, however, not heated at all.

The writer knows one prospector who built a bay window in his cabin, put earth in it, and who now raises his cabbage plants there with conspicuous success.

Cabbage thrives best in a rich sandy mold, thoroughly drained. It does not do well on a peaty soil unless the natural acidity of such soil has been entirely neutralized by the use of lime. It is grown with great success and in large quantity on the sandy soil about Skagway, where Mr. H. D. Clark cultivates a large market garden. Plate III is a view of one of his fields.

In favorable seasons both early and late varieties do well, but when the season is cold and backward only the earliest varieties can be expected to head. One practical farmer, Mr. W. H. Swinehart, of Fort Selkirk, Yukon territory, writes that he has had better success when the seed was planted directly in the open ground where the cabbages were to grow than when the plants were raised in the usual way, under shelter. He writes: "As a result from experimenting with this plant [cabbage] we drill the seed like other vegetables in the field, this year [1903] May 16. Last year we had all our cabbage plants that had been transplanted to the field killed by a frost on June 9. They were of a good size, about 3 inches high, and were frozen to the ground. Alongside was cabbage from seed sown a month later in the field, none of which was touched by the frost. Acclimated during growth, they made fine heads, some of them bursting, they were so solid. The house-raised plants were a failure. From this experience we have abandoned all transplanting, confining our efforts to the method outlined." Experiments by the Alaska stations go to confirm Mr. Swinehart's statement.

At this writing very many varieties have not been tested, attention having been confined to the earlier sorts. The present year,

however (1905), a comparative test of 26 varieties is being made with a view to ascertaining what sorts to recommend in the future. Early Jersey Wakefield and Early Winningstadt have been grown with good success. Of the two the Jersey Wakefield appears to be the surer header and from two to three weeks earlier than the Winningstadt. Marblehead Mammoth and Premium Flat Dutch, both late varieties, have succeeded in favorable seasons, but they have not been quite satisfactory in cold summers. On the subject of varieties Mr. H. D. Clark, of Skagway, wrote as follows in 1902:

“ We tried a few of the Flat Parisian cabbages again, but they do not give satisfaction for the shipping trade. For an early cabbage I like the Alpha best, although I shall plant a few of the Jersey Wakefield again. We raised a good many of a kind called Long Keepers this year. For solidity and quality I never saw any cabbage equal to them, and they yield well. We shall depend on them for the main crop next year.”

For the present the writer recommends Alaska gardeners to plant mainly early varieties.

CAULIFLOWER.

Cauliflower succeeds even better than cabbage. In 1904, when cabbage was all but a complete failure at the Sitka Experiment Station, a number of cauliflowers produced small heads. They are raised and cultivated exactly like cabbage plants, except that they can be planted closer. Two feet by a foot and a half will ordinarily give them room enough. Plants grown as above described for cabbage, and properly hardened, can be planted out the latter part of May or beginning of June. Well-advanced plants may have marketable heads by the Fourth of July. Hoe often, not only to keep the weeds down, but to keep the soil loose. When the weather is bright break the midrib on one or two of the inner leaves so they will shade the head and keep it from turning brown. Cauliflower heads have been raised at the station which measured 14 inches in diameter. The quality of Alaska-grown cauliflower can not be surpassed anywhere.

Seed sown in the open ground in the middle of June and the plants transplanted in July will, in favorable seasons, produce a good crop in September.

The best variety we have so far tested is the Early Snowball. It is a sure header, the heads are large, mature early, and keep well. The Extra Early Dwarf Erfurt is another variety that has done almost as well as the Snowball. Early London and Early Paris are two varieties which have been tried, and while they have done fairly well they do not head so surely and uniformly as the foregoing sorts. Good seed is of first importance in cauliflower growing.

On the subject of cauliflower Mr. H. D. Clark, of Skagway, quoted above, wrote in 1902: "We raised two crops of cauliflower from the same ground; both were fair crops. The second crop was the more even—not so many small ones and none very large."

Cauliflower can be grown to perfection in the interior. It succeeds even farther north than cabbage, for the reason that it has a shorter growing period. Plate IV, figure 1, is from a photograph of Mr. A. Lawson's garden in the middle of August, 1903. His cauliflower, which had then large heads, is in the middle foreground.

Mr. J. F. Karshner, who has a ranch on Baker Creek in the Tanana Valley, raised fine cauliflower, and, indeed, fine vegetables of all sorts, in 1904, when, as noted, most crops were a failure everywhere. The high price of cauliflower seed, which is due to the difficulty of growing it, is somewhat of a drawback to the cultivation of this crop on an extensive scale.

BROCCOLI.

Although classed as a distinct vegetable, broccoli is really only a variety of cauliflower. The plants are raised and set out like cauliflower, and they head in the same manner. We have grown them at the Sitka Experiment Station and found that they were rather later than the early varieties of cauliflower, nor were they quite so tender. Some of the varieties have purple heads, and even those which are claimed to be white often have splashes of purple on the heads. It is claimed that they are hardier than cauliflower, and the seed is cheaper. It is hardly necessary to explain that the useful portion of cauliflower and broccoli is the budding flower stem.

BRUSSELS SPROUTS.

This plant is but little known in Alaska. It is especially adapted to home use and for this purpose deserves much wider culture than it now receives. It is a member of the cabbage family, and the plants are raised and cultivated like cabbage. They do not require so much room, however, and can be planted a foot or 15 inches apart in the rows. Instead of producing a head like cabbage, Brussels sprouts produces a stalk about 2 feet high, thickly studded with leaves, and at the base of each leaf is a bud which toward the fall of the year develops into a small head, which is exceedingly tender and palatable when properly cooked. The plant is grown for these little heads. It is as hardy as kale and can be left out until severe cold weather sets in, when the stalks can be pulled and hung up in a cool place for use during winter. There are but few varieties, the Improved Dwarf German being the one most commonly grown.

KOHL-RABI.

This plant occupies an intermediate place between the turnip and the cabbage. It grows like a cabbage, but forms a solid bulb like a turnip. The stem enlarges at the surface of the ground until it forms a thick globular body half below ground and half above. This thickened stem or root is the edible portion. It should be pulled and used before it is fully grown, as it becomes tough and stringy with age.

Sow the seed in drills in the open ground in the first half of May. The rows should be 2 feet apart and the plants thinned to 6 or 8 inches apart in the row to give them room to expand. The plants are hardy and can be grown in Alaska wherever ruta-bagas can be grown, and the roots can be kept all winter like the latter. They are sometimes grown for cattle food. There are several varieties. The Early White Vienna can be recommended. The roots are cooked and used in the same manner as turnips.

ONIONS.

Alaska gardeners have not been very successful in growing onions from seed. The average summer weather is not quite warm enough for their best development. However, in many cases onions have been grown which have measured upward of 2 inches in diameter, and being a valuable vegetable, especially to people who live largely on canned goods, onions should never be omitted from the garden, even though the prospects for great success are not promising. Onions may be grown either from seed or from sets. Seed onions are for winter use, although they can be used for green onions from the time they are large enough. Onions grown from sets are ready for use as greens almost as early as radishes and continue in use all summer. Sets are of two kinds, either small onions grown from seed the previous year or the small bulbs which develop in the tops of the so-called tree onion. The former are to be preferred, though the latter are better keepers. It should be noted that there are many varieties of onions which are only adapted to warm climates, and these should be avoided in selecting seed for Alaska. To these belong the Bermuda onion, the Giant Rocca, the Madeira, and in general all those which are called Spanish or Italian as part of their names.

Onion seed should be sown thinly in rows 1 foot apart as early in the spring as the ground can be worked. When the plants are up and established they should be thinned to 2 or 3 inches apart in the rows. The weeds must be kept down and the soil kept mellow with the hoe. They succeed best on a rich, well-drained sandy loam. Under favorable conditions young seedling onions should be large enough to use



FIG. 1.—CAULIFLOWER AT SUNRISE, ALASKA.



FIG. 2.—BROAD WINDSOR BEANS AT SITKA STATION—FOREGROUND, SECOND ROW.

by the beginning of August. At the appearance of frost they should all be pulled and spread out in an airy place to dry. The tops and roots should then be cut off and the bulbs put away in a dry, cool, frost-free place for winter use. The small onions up to the size of pecans can be used for sets the following spring. The settler in the interior who can not get sets from the outside can raise his own sets in this manner. The varieties to grow from seed in Alaska are Extra Early Red Flat, Large Red Wethersfield, and Yellow Danvers. There are others, but these are among the hardier sorts. They do not grow large, but are firm and keep well.

Onion sets, as above referred to, should be planted early in the spring in rows a foot apart and about 3 inches apart in the row. The "set" is stuck in the ground so that the top is just below the surface. They can be used as soon as they attain a height of 5 or 6 inches. As already stated, top onions can be used for sets, and they have the advantage that being better keepers they are not so likely to spoil during a long shipment. On the other hand, they do not produce so large onions.

LEEK.

The leek is an onion which is grown for its leaves and thickened stem. It has a mild flavor and is extensively grown in Europe for soups, stews, and the like. Sow the seed in the same manner and at the same time cabbage seed is sown. Set the plants out in the beginning of June. They are not likely to grow large, and if the rows are a foot apart and the plants 6 inches apart in the rows they will have room enough. They are used through the summer and fall. They are not hardy and must be taken up before severe frost, but they can be kept in a frost-proof cellar, planted in damp sand, until consumed.

The following members of the onion family are not generally known; indeed, but few seedsmen offer seed or plants for sale. They are, nevertheless, valuable for Alaska, because they possess the antiscorbutic qualities for which onions are prized, and most of them are hardy and can be grown with little trouble.

SIBOULE, OR WELSH ONION.

This is a hardy plant, which does not produce a bulb, but the seed can be sown in the spring and will produce young green onions in a short time. In the coast region they will live through the winter, and hence can be sown in the fall for early onions next year.

SHALLOT.

The shallot is a small onion, which is propagated by sets usually, though it also produces seed. The sets should be planted in a row 6 inches apart early in the spring. The set which is planted does

not grow to a large onion, but instead forms a cluster of onions about the roots. After the sets have started to grow it is well to scrape the earth away from them, so that the new onions can be formed right on the surface of the ground. They are taken up in the fall and kept frost free during winter. They are rather strong and are used like other onions.

THE POTATO ONION, OR UNDERGROUND ONION.

It resembles the shallot in that it forms a cluster of onions at the root, but is, nevertheless, a different species. It is planted like the shallot, and it is prolific and quite hardy. In southeastern Alaska it can remain in the ground all winter. The bulbs keep well.

THE TREE ONION.

This is still another species, which forms its bulbs in the top of the stem. Plant like shallot. The bulblets are used for pickling, for sets, and like other onions.

ROCAMBOLE.

This is a hardy perennial onion which grows wild in Scotland and northern Europe, but it has been domesticated and is sometimes cultivated. It forms little bulbs inclosed in a sheath about the one planted. It is used chiefly for flavoring, and is milder than garlic.

GARLIC.

This, too, is a hardy perennial onion which grows wild all over North America. The cultivated form is valued for flavoring. Like the foregoing, it forms little bulblets about the root. A few plants are sufficient for the needs of a family.

CHIVES.

This is also a hardy perennial plant which produces clusters of short leaves. It is used for flavoring, and can be grown far to the north.

SPINACH.

Spinach has not done very well in Alaska. When the summer is warm it is a success, but in cold and rainy seasons it is either a partial or a complete failure. It requires a rich, well-drained soil. Sow the seed either in rows 6 inches apart or broadcast in the early spring. It is used as greens. On wet soil it runs to seed at once.

ENDIVE.

This is a hardy salad plant from northern China. It is used like lettuce in the fall of the year. Sow the seed on a small bed in early spring, and when the plants are 3 inches high transplant them a foot apart. In early September the leaves should be tied up about the heart of the plants so as to bleach the interior leaves, which makes them more tender and palatable.

HORSE-RADISH.

For some reason horse-radish has as yet not obtained a very strong footing in Alaska. It will do well in the coast region and probably moderately well in the interior. It requires a deep, rich, loose soil to grow large, fleshy, and tender roots which are the portion used. Horse-radish deserves to be much more widely cultivated and more generally appreciated in cooking than is the case. It is propagated from pieces of the root. To facilitate digging, it is best to plant these pieces on raised beds. Lay out a bed $2\frac{1}{2}$ feet wide and raise it a foot by throwing the earth from either side on top. Take long slender pieces of root of the thickness of a pencil, shorten them to 12 inches, then with a long dibble make holes in the edges of the bed a foot apart and at an angle of 45° and plant a piece of root in each so that the top is just below the surface. If the roots make a good growth they will be large enough to use at the end of the first season, but they can also be left in the ground for two, three, or more years, and they will continue to increase in size and also in toughness. Most housewives do not know how to prepare horse-radish. The root should be grated, then boiled thoroughly with raisins or currants, and served warm as a sauce for boiled meat. Thus prepared it is a very superior condiment. Eaten raw with vinegar in the usual way it is a much more pungent condiment.

RHUBARB.

Rhubarb does well everywhere in southeastern Alaska. In the interior it must be well protected by straw, hay, or other litter to keep it from winterkilling. It is propagated either by division of the old roots or from seed. The former method is preferable when the roots can be obtained. In the interior it is perhaps best to raise it from seed because of the difficulty of transporting live plants. Sow the seed as early as the ground can be worked. When 3 to 4 inches high transplant to 6 inches apart, and let them remain there until the following spring. Then set them 3 feet apart in deep, rich, well-prepared ground. Complaints occasionally reach the station that the leaf stems, for which the plant is grown, do not get as large as they

ought. This is because the plant is starved. To grow large stems the ground must be rich and well drained. Seedling plants should furnish stems large enough to use the third year. Old plants will throw up a flower stem each summer; these should be cut off to prevent the plant from wasting its strength in their production. At no time should all the leaves be removed from the plant, as it will reduce its vigor. It is well to place a few forkfuls of horse manure on each plant in the fall, to be dug under about the plant in the spring, care being taken not to injure the roots in so doing. We raise fine rhubarb at the Sitka station.

RUTA-BAGA.

A large, late winter turnip. Sow in rows in early spring; thin plants to 6 inches apart. Pull the roots in the fall and keep them frost free. Ruta-bagas can attain a weight of 30 pounds.

SEA KALE.

This plant is much esteemed in Europe, but it is seldom grown in America, and it has as yet not been introduced in Alaska. It is a native of central and northern Europe, where it grows wild along the seashore. It has been brought under culture for the sake of its stems, which are used as a salad. Being naturally a sea plant it should do well in the coast region of Alaska, and seaweed is one of the best fertilizers for it. Sow half a dozen seed in clumps 2 feet apart, and let the plants remain where they grow. They will not be strong enough to bear the cutting of their stems until the spring of the third year. The stems must be bleached to make them tender and crisp. To this end cover the plants with frames a foot high and fill these gradually with sand for the shoots to grow through. They are cut at the base when upward of 6 inches tall.

CULTIVATION OF VEGETABLES, GROUP III.

The plants which follow are classed together because they are half-hardy and require in a measure the same treatment. They will succeed in warm spots and in favorable seasons, but they can not be grown generally over Alaska. Some of them will do well in the short, warm summers of the interior.

ASPARAGUS.

Although not a tender plant asparagus requires a warm season. We have repeatedly raised plants at the Sitka station, but when they have been planted in the permanent bed they have either died or made a very indifferent growth. However, the writer believes that in warm situations they may make a moderate growth.

It saves time to buy plants from nurserymen or others who have them for sale. Strong 1-year-old plants are to be preferred to older ones. For the permanent bed select a warm, well-drained spot. Cover it with a layer of about 6 inches of stable manure. Work the soil up to a depth of 2 feet and mix the manure thoroughly with it. This amount of manure may seem excessive, but it must be remembered that the bed is to last for many years and that this is the only chance for thoroughly enriching the soil. When the ground is prepared set out the plants about the middle of May. Lay off beds $2\frac{1}{2}$ feet wide. Plant two rows on each bed 18 inches apart and a foot between the plants in the rows. In planting make a shallow hole 2 inches deep, a little higher in the middle than at the sides and wide enough to take in the full length of the roots without turning up their ends. Spread the roots in this hole like the spokes of a wheel and cover them with soil so that the bed is level. The only care needed the first season is to keep the weeds down. In the fall cover the bed with a layer of stable manure, or seaweed, if it can be had, as a winter protection. In the spring before growth starts rake off the seaweed, or the longest of the manure, and throw about 2 inches of soil on the bed from the paths on either side. Let the shoots from the now established plants grow undisturbed. In the autumn cover the bed again with some protective material, and the following spring dig out the path some 4 inches deep and put 2 inches of the soil on top of the bed. If the plants have made a satisfactory growth, a few of the larger shoots can now be cut, but if the shoots are still small let them grow undisturbed another year. There are three reasons for raising the bed somewhat above the general level: (1) It warms up sooner in the spring, the sun having a better chance at it; (2) it aids in drainage, and (3) the shoots growing through a layer of several inches of soil do not turn green, but can be cut while they are white and delicate. Asparagus shoots should be cut just as they break through the surface, but in cutting them care must be taken not to injure the buds at the base of the shoot, from which other shoots will spring if not injured, hence the soil should be dug away from the shoot before it is cut, so one can see what he is doing. The best canning asparagus are white shoots about 5 inches long, cut just as the head breaks through the surface soil. Market gardeners prefer, however, to let them grow to a height of about 5 or 6 inches above ground before they cut them. They are then green and have developed a pungent taste, but they can be handled more rapidly and cheaply. An asparagus bed in rich soil and well cared for should be productive for fifteen or twenty years. A dressing of coarse salt scattered over the bed aids growth, and nitrate of soda likewise sown over the bed in spring is a good fertilizer for asparagus.

BEANS.

Of the many varieties of beans in common culture a few can be grown in Alaska in favorable seasons, but even under the best conditions the writer has never seen them grow as well as they do in lower latitudes. If attempts are made to grow beans they should be given the warmest place in the garden and they should have a well-drained sandy loam to grow in. Try only the early bush beans and the English Dwarf beans mentioned below. Lima beans and pole beans only invite failure. (In exceptional cases, where the soil is warmed by hot springs, etc., like Mr. J. F. Karshner's farm on Baker Creek, pole beans and many other tender things can be grown, but such conditions are not normal.)

Plant some time after the middle of May in rows a foot and a half apart, or farther, so as to admit of being hoed. Keep weeds down and the soil loose. Snap beans are grown for their pods, and the varieties which have produced small pods at the Sitka station are the Extra Early Valentine, Extra Early Refugee, the Golden Wax, and the Black Wax. Possibly other varieties may do as well. It is hardly necessary to add that the pods are used from the time they are about 2 inches long until they are nearly full grown. In no case should any but the earliest sorts be planted.

ENGLISH DWARF BEANS.

This is a class of beans which can be grown with reasonable expectation of success. The plants are coarse, stocky, and hairy, and while they can not stand frost, they do better in a cool, damp climate than the common beans. For this reason they are largely grown in England and in northern Europe, and the writer believes that they will become popular in Alaska as soon as they are known. They have been grown successfully every year except in 1904, when everything failed. Only the seed, or bean proper, is used. One class of these beans is known as the Broad Windsor. The bean is as large as a Lima bean and resembles the latter in taste, and, properly cooked, it is even better.

The Broad Windsor plant is stiff, coarse, woolly, and about 4 feet high. The stalk is studded with numerous fleshy pods about 4 inches long. The beans, i. e., the seeds proper, are used when nearly full grown, but before they are ripe. There are numerous varieties of the Broad Windsor; thus there are at this writing upward of forty varieties under test at the Alaska station. Plant the beans 4 inches apart in rows 2 feet apart, about the middle of May. Give them good culture, and when the pods begin to form pinch the top off the plants. The beans are most delicious when properly cooked. Since they are practically an unknown vegetable it may not be improper to

insert here directions for cooking them. The following two receipts have kindly been furnished by Mr. David G. Fairchild, agricultural explorer of the Department of Agriculture, to whom we are also indebted for the beans now under test:

PREPARATION OF BROAD WINDSOR BEANS FOR THE TABLE.

It is of prime importance in the preparation of the broad bean for the table that the pods should be gathered while the young beans are still small, because they develop a strong flavor as they grow older. Not only should the pods be picked while still young, but the beans should be prepared for the table as soon as possible after gathering. The following receipts are those in use in a private house in England:

“Ordinary style.—To each half gallon of water, allow one heaped teaspoonful of salt. The beans should be young and fresh gathered. After shelling put them in boiling water salted as above. Boil rapidly until tender, then drain in a colander, dish, and serve with them, but in a separate bowl, a sauce of parsley and butter. Boiled bacon is often served with the beans. Time for cooking: Very young beans, fifteen minutes; moderate sized, twenty minutes or longer; old beans should have the skin removed. Allow 1 peck for six or seven persons.

“Broad beans à la poulette.—Take 2 pints beans, one-half pint stock or broth, small bunch of savory herbs (including parsley), small lump of sugar, yolk of one egg, one-fourth pint of cream. Pepper and salt to taste.

“Shell some small fresh-gathered beans; boil as in preceding receipt until nearly done, then drain and put in the stewpan with the stock, finely minced herbs, and sugar. Stew until the beans are perfectly tender, and the liquid has dried away a little, then beat up the yolk of the egg with the cream and add it to the beans; let the whole get thoroughly hot, and when on the point of simmering serve. Large beans should have the skins removed before boiling. Time: Ten minutes for boiling; fifteen minutes for stewing.”

OTHER VARIETIES.

Sword Longpod is a variety which is cultivated like the Broad Windsor, but the beans are of smaller size. Early Mazagan is a bean of the same class, but rather earlier and smaller. Small Horse Bean is, as its name indicates, often grown for horse feed in Europe, but the beans are of good quality. All are cooked like the Windsor.

The Windsor bean is illustrated in Plate IV, figure 2. The long row of beans in front is the wax bean, and the taller bean next to it is the Windsor.

CELERY.

Celery is one of the plants which can be grown successfully in favorable seasons and in favorable situations. It can not be depended on to yield satisfactory results every year. When grown at all it is necessary to start the plants earlier than is the practice in the States. Their growth is very slow at first, and they require the whole season to develop. The seed bed must be a fine sandy loam, otherwise the

fine seed can not be properly covered. Sow in a hotbed or cold frame in the latter part of April. The seed can be scattered either broadcast or in rows 3 inches apart, and should be covered very lightly, not more than a tenth of an inch deep, with sifted sandy loam. The plants will need no care except to keep them watered and free of weeds. But, as in all other cases, plants raised under glass must be ventilated daily, and in bright weather abundantly, to prevent the temperature rising too high. If the room is available, it is a good plan to transplant the seedlings to another cold frame, with rich soil, to give them a chance to develop without crowding and to hasten their growth. They should here be planted 3 inches apart each way. In the latter part of June they should be planted in the open. Select a protected spot where the soil is rich and thoroughly drained. A sandy loam is to be preferred, and if not naturally rich, it must be fertilized. Thoroughly decayed stable manure and pulverized chicken manure are good fertilizers. Work these well into the soil. Set the plants in rows 3 feet apart and the plants 6 inches apart in the row. About the 1st of September the blanching process can begin. This consists merely in excluding the light from the stems, which will cause a removal of the green coloring matter. A good way to accomplish this is first to tie the leaves of each plant up in a loose bunch, then put a board on edge on each side of the row, and fill the space within between the plants with soil. The boards are used only to confine the earth, and if desired it is sufficient simply to draw the soil up about the plants.

If one wishes to economize space celery can be grown in the following manner: Make a bed 3 or 4 feet wide and of any desired length. Fertilize the soil heavily. Set the celery plants upon this 6 inches apart each way; in a rich soil they will make almost as good a growth as they will in a single row. When the time for blanching arrives, inclose the bed with boards and fill the space between the plants with soil as before. It is sometimes advocated to set the plants still closer, so that they will crowd enough to exclude the light, and no further blanching is necessary.

The plants can remain where they grow if one has no better place to put them. In that case cover them completely with boards to shed water, and as the cold weather advances cover the boards with earth, seaweed, hay, or other protective material to exclude the frost. This plan works well when they are grown in a close bed as just described. If they are grown in rows farther apart, dig a trench in a place where the water will not stand and as deep as the celery is tall. Pack the plants in this in an upright position and cover the tops first with boards, then with earth and other material to exclude frost. There are many varieties, but only a few have as yet been grown at the experiment station. The following can be recommended:

Giant Pascal, a large, vigorous variety, which will perhaps make a larger growth under similar conditions than other sorts. In a warm climate the stems are likely to become fibrous and tough, but in Alaska this is not the case to the same extent.

Improved White Plume, an excellent variety, which has given satisfaction not only at the station, but also in some of the market gardens.

Golden Self-blanching, a variety which is somewhat less vigorous than either of the foregoing, but is of the very best quality. It is naturally of a yellow color, and when planted close will blanch of itself. It has done well at the Sitka station.

CUCUMBERS.

Cucumbers are even more difficult to raise than celery. They require bright sunshine and considerable summer heat. They are, however, grown in Alaska under favorable conditions. Plant them in a sandy, well-drained soil, in a protected place, where they can get the full benefit of the sun. Choose varieties which do not run too much to vine. Plant the seed in hills 4 feet apart, or, if preferred, in rows 5 feet apart, and then drop the seed 3 inches apart in the row. Thin the plants to 6 inches apart, and train alternate plants on opposite sides of the row. Do not sow the seed until the weather has become settled—warm—usually about the 1st of June. Their culture is simple. Keep the ground hoed until the vines cover it and pull the weeds as they appear. Under favorable conditions fair-sized cucumbers will be produced by the 1st of September.

Cucumbers can not be sown in a hotbed as we do cabbages and then transplanted. But if one has the facilities for doing it, they can be started in 2-inch pots about the latter part of April, and the pots sunk in the earth in a hotbed or cold frame, where they are kept until early June, when the plants are set out. Put two seeds in each pot, and remove the weaker of the two plants. Water them well before transplanting to make the earth cohesive, so that the plants can be turned out without disturbing the roots. The varieties which we can recommend from experience are Improved White Spine, Early White Spine, and Early Cluster.

SQUASH.

Squashes require the same culture as cucumbers, except that the varieties which grow vines should have more room. Early White Bush Scallop is perhaps the most likely sort to succeed in Alaska. Other bush varieties are: Extra Early Jersey White Bush, Early Golden Bush, Summer Crookneck, and Giant Summer Crookneck.

SALSIFY.

This vegetable is grown for its roots, which are stewed and eaten in various styles. It is sometimes called oyster plant, because the taste suggests that of the oyster. Salsify is generally classed with the hardy vegetables, but from the experience with it at the Sitka station it should probably be placed with the tender plants of Group III, because it has never given satisfaction. It requires a well-drained sandy loam. On a wet peaty soil the root branches so as to be worthless. Sow in rows 2 feet apart. The seed, which is quite large, should be covered three-fourths of an inch deep. Give it the same care you would accord to carrots or parsnips. It needs the warm weather only during the growing period. Once grown the roots are as hardy as parsnips, and can be left out during winter, at least in southeastern Alaska. There are but few varieties. The Large White is the one most likely to succeed.

FLAVORING HERBS.

Many of the flavoring herbs can be grown in Alaska. The culture of all is very simple. Sow short rows in warm dry soil in early spring. Those which have done well are:

MINT.—A hardy perennial with running underground stems. It is best propagated by dividing these stems in the spring. It requires no protection in the coast region. Can also be raised from seed.

SAGE.—This is an evergreen, half-woody plant well known everywhere. Propagate by seed; also by burying the branches, which will take root. It requires protection in winter.

THYME.—Also a half-woody evergreen. Sow the seed in early spring, and set the young plants where wanted. It is winterkilled if not protected.

MARIGOLD.—A hardy annual, which is sometimes used for flavoring. It is also grown for its flowers. Sow in spring.

DILL.—A hardy annual, grown for its seed, much used in flavoring pickles.

CARAWAY.—A biennial plant grown for its seed. It is much prized in Europe. Sow in early spring. The plants seed the second year. Must be protected during winter.