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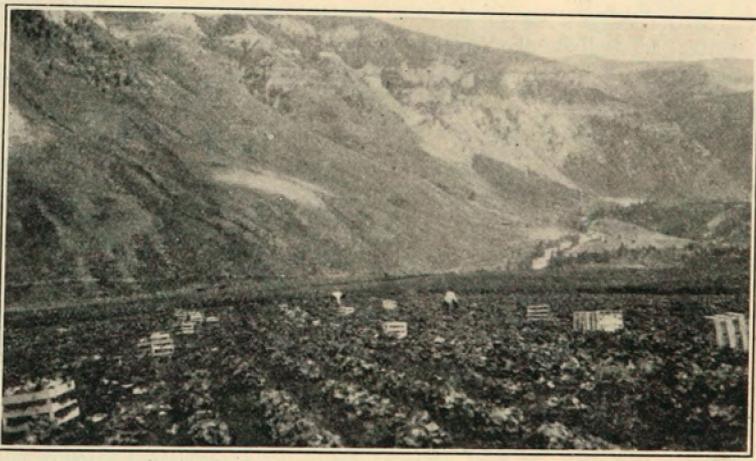
2) Agricultural Experiment Station

HIGH ALTITUDE VEGETABLE GROWING

LETTUCE—CAULIFLOWER—PEAS

By

R. A. McGINTY



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HIGH ALTITUDE VEGETABLE GROWING

By R. A. McGINTY

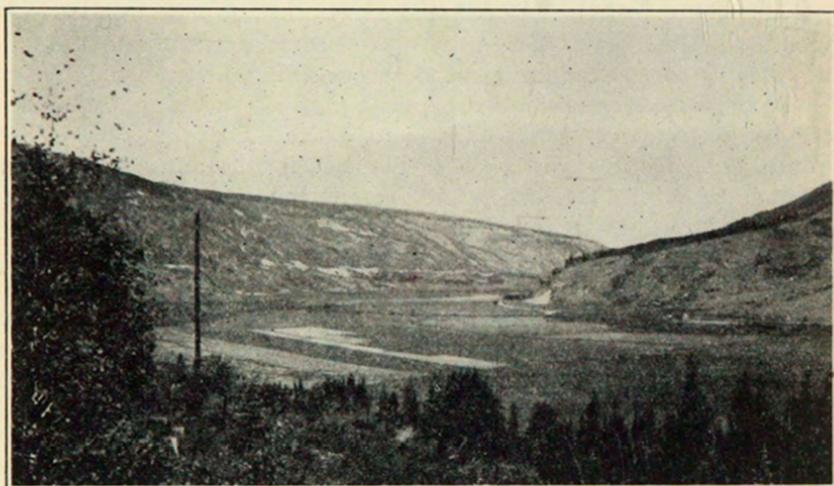
Within the last few years the vegetable growing industry in Colorado has made great strides. The chief feature of this advance has been the development of the industry in the mountain districts of the state, at altitudes of 7,000 feet and over, where head lettuce, cauliflower, peas, and other vegetables have been found to yield crops of unsurpassed quality. Due to the fact that a great many people interested in the growing of these crops are not familiar with the practices of gardening, especially under mountain conditions, there is an insistent demand for information as to the best cultural methods to use. It therefore seems desirable to publish suggestions for the handling of the vegetables mentioned.

Areas suitable for the growing of high-altitude vegetables are found scattered over all of that part of the state west of the line running north and south thru Denver. The mountain valleys of these districts and in some cases, even the mountainsides themselves, have a soil that is well suited to vegetable growing, and the supply of water is usually abundant. Stock-raising has, for a long time, been the chief agricultural pursuit of these sections, and in establishing the vegetable growing industry it has been necessary to plow up much hay land and clear away sagebrush and aspen groves to provide the space needed. Altho potatoes have been an important crop for a long time in some of the districts, the growers have usually had to learn vegetable growing from the ground up. The necessary implements had to be devised or acquired and their uses learned. No packing or marketing facilities were available, but had to be arranged for. Other factors, such as transportation, fertilizers, labor, etc., had to be given consideration. These factors and the problems connected with them have made for varying degrees of success among the growers, with a tendency toward the production of products of lower grade than is desirable. At the present time, however, the general trend is toward stability and standardization. The poorer growers are gradually being eliminated, and localities where lettuce and other vegetables have been produced under handicap are turning to other lines.

HEAD LETTUCE

In 1925, over 3,500 cars of head lettuce were shipped from the various districts in the state. Thus, from the small beginning in 1918 (10 acres) this crop has come to be one of the first importance among the vegetables grown in Colorado. Recognizing the importance and value of the crop, the horticultural department

of the Colorado Experiment Station, four years ago, inaugurated a series of experiments to investigate the problems which had already begun to vex the lettuce grower. On account of the unfavorable conditions under which the work has been carried on, not as much progress has been made as had been hoped for, but much information has been gained which will be of material aid in conducting the work in the future. The work for the four years has been carried on at a different location each year. A number of factors have arisen each season to upset the results of the experiments, but the most serious of these has been the lack of a uniform piece of land upon which to lay out the plots. Altho every year a



Mountain valleys of this type are adapted to the growing of vegetables.
Photograph taken 20 miles west of Leadville.

great deal of care has been used in selecting the ground for the experimental plots, some unknown factor, as for example, an application of manure to part of the field, not apparent at the time the location was decided upon, has rendered the data very unreliable. It is hoped and believed that these troubles can be largely avoided in the future, since the Experiment Station has purchased a farm where the experiments will be carried out and where something will be known regarding the uniformity and previous treatment of the soil.

The Outlook for Lettuce Growing

In the bulletin on head lettuce (Colorado Bulletin No. 283) published three years ago, it was stated that while a gradual expansion of the industry was to be expected and encouraged, it

would be better for growers to hold down their acreage of lettuce to a reasonable figure and diversify by planting part of their land to other crops. Attention was called to the fact that lettuce is essentially a garden crop and demands special attention at all stages of growth. It was also emphasized that if the lettuce industry is to attain its greatest development, quality, rather than quantity, should be the aim.

What was true three years ago is no less true today. There are still many growers who plant too much lettuce to look after it properly, and this is especially true of those who are just beginning. It is a fact that in some instances, fairly large acreages are handled successfully, but in such cases, there are especially favorable conditions of climate, soil and labor which may not prevail for the average grower. One man can look after five or six or more acres, depending on conditions, except at thinning and harvesting time, when help will be needed.

From many observations and from a study of reports from various sources, one is impressed with the uncertainty of lettuce growing as a financial venture. It is not the "get-rich-quick" scheme that many have supposed. There are many factors entirely beyond the control of the grower which may so contribute to his success or failure as to make of it a distinctly speculative proposition. Those who are contemplating the growing of lettuce for the first time, should bear this in mind. This is not said with the idea of discouraging the culture of head lettuce, but as a warning. The possibilities are great, and under right conditions, and with proper management, large returns may come. Good growers should make money growing head lettuce, but even these will have off-years when the balance is on the wrong side of the ledger.

Competition from other states is becoming more and more keen as time goes on. California, Idaho, Washington and other states all ship lettuce during the Colorado season. New York also ships a great deal of lettuce at the same time. The product from the latter state, however, is of the "Big Boston" type, which the markets are now beginning to consider inferior to the New York (Iceberg) type, but which, nevertheless may affect the price of Colorado lettuce in eastern markets.

On the other hand, the quality of Colorado lettuce is not excelled by that from any other section of the country, and with the growing interest in, and demand for vegetables of all kinds being stimulated by various health agencies, it seems reasonable to suppose that first-class head lettuce will always command a good price.

Where Lettuce Grows Best

Head lettuce in Colorado is a high-altitude crop. Experience has shown that elevations of from 7,000 to 9,000, or even 10,000 feet, produce the best lettuce. At these elevations the days are not often extremely warm and nights are uniformly cool, conditions that make for crisp, hard heads with a minimum of tipburn and seed stalks. In certain seasons successful crops may be grown at altitudes of 5,000 to 7,000 feet, but the chances for a good return are much less than at the higher elevations. About ninety days are required between the seeding and maturity of head lettuce. In some of the localities, at the higher elevations, seeding cannot be done until the middle of June, while hard freezes may damage the crop late in September, if it is still in the field. This leaves no time to spare and the grower must be prepared to plant, cultivate, and harvest without delay when the time comes for these operations, or his crop will be a failure.

In the Canon City, Pueblo, and Denver districts, and in other localities with similar conditions, it is possible to grow two crops of lettuce on the same ground in one season. The early crop matures in June and the late crop in October. As mentioned above, however, the crop grown under the conditions prevailing in these districts (elevation 5,300 feet or less) is likely to be inferior. In the majority of the lettuce-growing localities the season is long enough to allow plantings to be made from May to July with the harvesting of the crop extending over a corresponding period, but not sufficiently long to grow two crops.

The statement is often made that lettuce maturing late in the season, when the weather is cool, is more likely to be a success than the earlier crop. While this is perhaps true as a general proposition, it is of interest to note that in some years the earlier plantings have given the best results. With a comparatively cool summer during which seasonable rains occur, the early crop may head well. The prices for early lettuce are sometimes better than for the late crop, tho often the reverse is true.

Below is given a table showing the shipments of head lettuce from various points in the state in 1925. The figures give some idea of the importance of lettuce growing in the different localities. Much lettuce is shipped by express and in mixed cars. Carlot shipments of mixed vegetables are shown along with the lettuce shipments.

The transportation factor is an important consideration in the development of the lettuce industry in any locality. A glance at the figures reveal that the most important shipping points are located on standard gauge railroads where transportation and

handling charges are less than elsewhere. Many localities in the state, where there are ideal climatic and soil conditions for the growing of the crop, are handicapped by lack of adequate transportation facilities and must grow lettuce in only a limited way, if at all.

The figures shown in the table are compiled from two reports, one from Mr. John D. Snow, of the Denver office of the Bureau of Agricultural Economics and the other from Professor W. H. Olin, Supervisor of Agriculture, Denver and Rio Grande Western Railroad, to both of whom the author is much indebted for the figures given. There are several discrepancies between the figures of the two reports, and it seems doubtful if either is entirely complete or accurate. Absolutely accurate data regarding such shipments is very difficult to obtain, but the figures shown are the most reliable ones available. Some mixed vegetable shipments, as those from the Greeley district, comprising nearly 500 cars, are omitted since they have no especial bearing on the high-altitude vegetable industry.

CARLOT LETTUCE AND MIXED VEGETABLE SHIPMENTS FROM COLORADO

Shipping Point	1923	Cars of Lettuce 1924	1925	Cars of Mixed Vegetables, 1925
Alamosa	13	5	15	13
Antonito	1	28	197	80
Avon	173	145	415	82
Blanca	10	70	7	28
Brighton .....	...	...	8	225
Buena Vista.....	111	61	10	74
Canon City.....	22	28	33	15
Carbondale .....	...	1	22	7
Center .....	...	...	63	42
Coalmont .....	...	...	15	...
Como .....	...	...	1	...
Cotopaxi	1	25	7	7
Crested Butte.....	...	...	9	...
Del Norte.....	101	43	380	142
Delta .....	...	...	2	84
Denver	20	176	15	1,766
Dillon .....	...	...	7	...
Divide	90	9	10	3
Eagle	52	26	18	23
Florence	51	33	...	12
Fairplay .....	...	...	1	...
Ft. Garland.....	...	10	15	28
Granby	142	86	242	2
Gunnison .....	...	...	3	...
Jefferson .....	...	12	24	...
Kremling .....	...	...	58	...
La Jara.....	...	...	52	17
La Veta.....	2	...	7	...

Shipping Point	1923	Cars of Lettuce 1924	1925	Cars of Mixed Vegetables, 1925
Mesita .....	...	...	8	17
Minturn	56	84	230	1
Monte Vista	15	2	11	52
Montrose .....	...	...	8	12
New Castle	2	12	33	12
Oak Creek	20	2	13	...
Olathe .....	...	...	...	92
Pando	16	25	13	5
Parshall .....	...	...	98	3
Placerville .....	...	...	1	...
Pine Grove .....	...	...	14	...
Pueblo .....	...	...	...	14
Radium	24	37	40	...
Romeo .....	...	...	28	15
San Acacio .....	...	...	10	28
Salida & Sargent	72	20	60	29
South Fork & Granger	3	205	380	85
Steamboat Springs	8	15	11	1
Tabernash	25	5	9	...
Texas Creek	29	20	...	37
Toponas	6	4	21	...
Trapper	25	9	26	...
Troublesome .....	...	...	2	...
Webster .....	...	...	1	...
Westcliffe	59	34	5	23
Woodland Park	34	...	2	14
Wolcott .....	...	...	7	14
Yampa	193	125	410	...
Total	1,376	1,345	3,077	3,104

Culture of Head Lettuce

The Soil and its Preparation.—Head lettuce is grown upon a variety of soils, but a dark, rich, loamy soil containing considerable leaf mold such as is found in areas from which aspens have been removed is usually preferred. Such soils always contain a good deal of sand and while one containing an excessive proportion of sand is usually to be avoided, such a soil may grow first-class lettuce. Light-colored soils do not as a rule give as good results as the darker ones, since they are apt to be poorer in plant food and the lettuce grown on them more subject to tipburn. Land with some slope is preferable to the level areas on the valley floor. This is especially true where there is danger of early freezes in the fall which will damage the crop on the low lands, while more elevated and sloping areas are likely to escape injury. However, the valleys often produce good lettuce.

The land should usually be plowed in the fall so that freezing and thawing during the winter will leave it in a good, mellow condition, and so that manure applied before plowing, or other vegetable matter which is plowed under, will have a chance to become incorporated with the soil. If the soil cannot be fall-plowed, then the plowing should be done as early in the spring as the ground can be worked.

In the work of preparing the land for lettuce, the grower should keep constantly in mind that he is dealing with a garden crop and therefore the soil should be put into the best possible shape. The surface should be left as fine as harrowing and dragging will make it, and should be leveled as well as possible. A survey of the lettuce fields has shown very clearly that not enough attention has been given to these details in the past. A poor seedbed means poor germination of seed with the resulting poor stand of plants, and difficulty in cultivating the crop while the plants are small. Land which is not level also makes irrigation difficult and unsatisfactory.

Crop Rotation.—The growing of lettuce on the same ground year after year leads to disastrous results in the mountain districts as well as elsewhere. In some instances, good crops have been produced three years in succession, but usually there is a decline in yield, and diseases begin to cause trouble. It is necessary, therefore, for the grower to use some system of rotation by which lettuce is planted on the same land only once every three, or preferably, every four years. Potatoes and other vegetables, small grains and alfalfa may be grown the balance of the time. The system of rotation should provide for the plowing under of a green manure crop such as alfalfa, rye, peas or red clover, in order to maintain the humus content of the soil. Crop rotation also provides for diversification which seems to be one of the factors making for success in mountain vegetable growing.

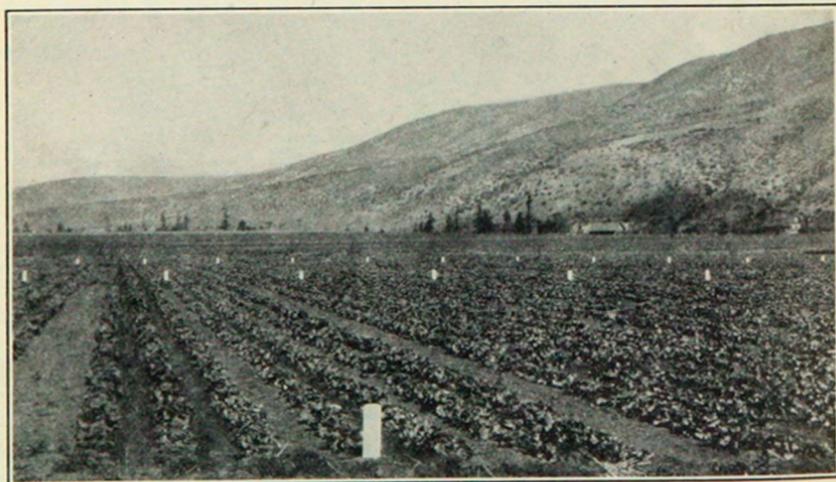
Fertilizers.—The soils in the lettuce districts, especially those which have been cultivated for a few years, are apt to be lacking in both humus and nitrogen, so that the use of fertilizers, where obtainable, is advisable. Manure supplies not only plant-food materials but improves the physical condition of the soil, making it more friable. It should be applied in the fall and plowed under before the ground freezes. If put on in the spring, it should be well rotted. The use of even small amounts of manure often gives profitable increases in yields.

Because of the fact that humus is usually lacking in Colorado soils, manures should be used, wherever it is possible to obtain

them, and if they are not available, some green-manure crop should be plowed under to supply the humus. Lettuce does not draw as heavily upon the soil as do many other crops, consequently applications of ten or twelve tons of manure per acre per year should give good yields. Too large amounts will cause the heads to be large and soft, or "puffy." It is possible that most of the manure should be applied to the crop preceding lettuce. If a good application is made for this crop, the residue should be sufficient for a crop of lettuce.

In the mountain sections it is often difficult to obtain sufficient manures for the needs of the crop. This has stimulated an interest in chemical or commercial fertilizers which are used so widely in other sections of the country. The department of horticulture has been experimenting with several forms of chemical fertilizers during the past three years, but, on account of lack of uniformity of the soil, where the plots have been located, and the somewhat conflicting results obtained, is not yet ready to make recommendations regarding them. Altho there have been some apparently good results from the use of certain of these fertilizers and combinations of them, the experiments have not been continued long enough to make the results conclusive.

The figures obtained during 1925 are more reliable than any others, and a comparison of the yields of the various plots is given below for what it is worth. Not a great deal of dependence can be placed in these results, since they cover only one crop. The plots upon which these experiments were carried out were each about



Lettuce fertilizer plots, experimental farm, Avon. Elevation, 8,000 feet.

one-thirtieth of an acre in size. They were located upon land which was in potatoes the year before. Preceding the potatoes, alfalfa had been grown on the land. The general indications were that the soil was sufficiently fertile for lettuce without manures or other fertilizers. Otherwise there might have been a greater response to the various treatments. There were fifteen different treatments, as shown, and each treatment was triplicated, making a total of forty-five plots. The yields per acre in each case, are calculated from the average yield of the three plots devoted to the treatment concerned. Many factors, such as percentage of stand, damage by rabbits, uneven irrigation, tipburn and soil differences prevented these results from being as reliable as desired, but they give some idea of how lettuce may respond to the various fertilizers.

YIELDS OF HEAD LETTUCE (VARIETY NEW YORK) UNDER
DIFFERENT FERTILIZER TREATMENTS—1925

Kind of Fertilizer.	Amount of Fertilizer Per Acre, lbs.	Yield Per Acre Pounds
Unfertilized	None	43,760
Manure	15 tons	46,850
Sulfate of Potash.....	225 }	47,400
Nitrate of Soda.....	175 }	
Sulfate of Potash.....	225 }	47,500
Ground Sulfur.....	300 }	
Sulfate of Potash.....	225 }	47,700
Acid Phosphate.....	150 }	
Ground Sulfur.....	300 }	47,750
Ground Sulfur.....	300 }	
Ground Sulfur.....	300 }	47,800
Nitrate of Soda.....	175 }	
Swift & Company—4-7-6.....	900	48,500
Swift & Company—3-10-7.....	900	48,800
Ground Sulfur.....	300 }	49,000
Acid Phosphate.....	150 }	
Acid Phosphate.....	150 }	49,100
Nitrate of Soda.....	175 }	
Ammonium Sulfate.....	225	49,400
Sulfate of Potash.....	225	49,850
Nitrate of Soda.....	175	50,350
Acid Phosphate.....	150	50,400

The manure plots were not well located in the test which is probably responsible for their comparatively poor showing. Manure is still recommended in preference to other fertilizers until there is more complete and dependable data showing that it may be replaced by some of the other materials. See the discussion of this data in the text.

All of the fertilizers produced yields which were significantly larger than those of the unfertilized plots. The differences in yield between many of the fertilized plots, however, were not of any consequence since they lay within the range of experimental error. Sulfate of potash, nitrate of soda and acid phosphate all gave yields higher than manure, but the differences between these fertilizers and ammonium sulfate were not of any significance. The per-acre difference between manure and acid phosphate amounted to 3,550

pounds, or something like seventy crates of lettuce if all the increase were marketable. This difference in yield is manifested by larger size and more solid heads. The manure plots were unfortunately located, which is responsible to some extent for their poor showing. There are inconsistencies in the figures which cannot be explained at this time.

If one wishes to try out some of the chemical fertilizers they should be applied in relatively small quantities per acre as in the experiments, and on small areas. They could probably be used to best advantage in connection with small quantities of manure or a crop plowed under to supply humus. It has been proved many times that the use of commercial fertilizers alone for any considerable period is a bad practice.

Seed and Varieties.—Lettuce seed is usually either supplied to the grower thru the firm which expects to market the crop for him, or it may be obtained thru an association or other growers' organization. In any case the growers should insist upon getting the best seed obtainable. There is a good deal of difference in the quality of the crop which may be expected from different strains, and the best is none too good.

New York (also known as Wonderful, Mountain Iceberg, Los Angeles Market, etc.) is the variety chiefly grown, tho some plantings have been made of Iceberg. The latter variety has been recommended in some cases for early plantings which will mature during warm weather. Tho a fairly good variety of lettuce, it is not as desirable as the New York.

Planting.—At elevations of 7,000 to 9,000 feet where the bulk of Colorado lettuce is produced, planting is done during May, June and the early part of July. The majority of growers favor the distribution of the planting over a considerable period rather than doing it all at one time. For example, one-third or one-fourth of the crop may be planted at a time, with ten days or two weeks between the plantings. This enables the thinning and harvesting of the crop to be done more promptly and satisfactorily as these operations are in this way distributed over several weeks instead of coming all at one time.

Planting at the lower elevations should be done as early as the ground can be worked so that the lettuce will have a chance to mature before extremely warm weather sets in. The late crop may be seeded in July and will mature in October. Fall planting has been tried and while in some cases it has been successful, on the whole it appears not to have been satisfactory. From some of the milder sections of the state, as the Canon City district, some good reports have been received regarding this method. In fall planting,

the seed is sown in October, and the plants make some growth before hard freezes set in. Being very hardy, they winter very satisfactorily and begin to grow with the first warm weather in the spring. Sometimes the seed is planted in the fall but does not germinate until spring, when it is ready to grow as soon as conditions are favorable.

The amount of seed to plant depends upon the quality of the seed and upon the condition of the soil at planting time. With good seed and the best of conditions for germination, three-fourths of a pound of seed per acre is considered sufficient, while a pound or a pound and a half may be required under more adverse conditions.

Seed is sown, as a rule, with some type of seed drill, those of the Planet Jr., Iron Age, and Iron King type being most used. These may be operated by hand, or they may be rigged up so that a horse or small garden tractor can pull two, three, or four of them, thus planting two to four rows at a time. Instances are known where beet planters have been used, the seed being mixed with sand, one pound of seed to thirty pounds of sand, to facilitate even planting. Planting distances vary considerably but on the average, rows are made twenty-four inches apart and the plants thinned from twelve to fourteen inches apart in the row.

Seed should be covered one-half to one inch deep depending upon the season, soil and moisture conditions. The depth of planting should be shallow if done early in the season when the soil is cold and damp, and deeper if done later when it is warm and dry.



Field of lettuce being irrigated on experimental farm at Avon.
Note irrigation furrows halfway between rows.

In light sandy soils the seed may be put deeper than in heavier types. If it is likely to be necessary to irrigate up the lettuce, irrigation furrows should be laid out first and the seed planted as close as possible to them. Observations indicate that in most cases the poor stands of lettuce are due to lack of sufficient moisture for germination. The irrigation furrows are made too far from the seed, or in light soils, the seed, tho having sufficient moisture at first, may dry out before it has time to germinate. This is an important matter which deserves more attention than has been given it in the past.

The transplanting of lettuce started in hotbeds or coldframes is practiced a great deal in other parts of the country and it is possible that growers may learn to use it to advantage in some cases in Colorado. A few have been successful with transplanting, but on the whole, it has not been satisfactory and cannot be recommended as a general practice at this time.

Cultivation.—Growers differ as to the number of cultivations which should be given head lettuce, some believing that two or three are sufficient while others recommend “one cultivation a week,” or “frequent cultivations.” Still others think that four to six cultivations will produce a successful crop. The Idaho Experiment Station recommends a cultivation once every week or ten days.

In 1920, Professor H. C. Thompson of Cornell University, reported the results of some cultivation experiments with several vegetable crops, including lettuce. The results, as far as lettuce is concerned, covered only one season and cannot therefore be considered conclusive. In these experiments, part of the plots were left uncultivated, the weeds being allowed to grow. On other plots the surface of the soil was scraped with a sharp hoe to kill the weeds, and on still another cultivation with a Planet Junior cultivator was given once a week in some cases and twice weekly in others. The results were as follows:

YIELDS OF LETTUCE UNDER DIFFERENT METHODS OF CULTIVATION
Reported by H. C. Thompson, Cornell University.

Treatment	Average yield in pounds per plot
Weeds allowed to grow.....	10.32
Weeds scraped.....	16.50
Cultivated weekly.....	21.44
Cultivated twice weekly.....	22.46

These figures show that the best yields followed frequent cultivation, and are in line with the recommendations usually made. Where the soil has been properly prepared, cultivation need not be

deep. What is needed is to stir the soil to a depth of two or three inches so as to kill weeds and form a soil mulch. In addition to killing weeds and stirring the soil around the plants, cultivation, by maintaining a soil mulch, conserves the moisture in the soil and also helps to keep the soil temperature lower. The latter condition is favorable for lettuce.

When giving consideration to the matter of cultivation, there are two or three points to which attention should perhaps be directed. Tho frequent cultivation is recommended and the experimental work which has been done, seems to lend its support to that view, many of the growers in Colorado do not believe it necessary to cultivate lettuce very much. Frequent stirring of the soil promotes rapid growth and this is not always favorable for the production of solid heads, but rather encourages loose heading. Also, the rapidly growing plant is more susceptible to tipburn. There is little doubt that weekly cultivations will produce a greater total weight of plants per acre than less frequent ones, but solid heading rather than a heavy yield of foliage is the aim, and many growers believe this can best be accomplished by a small number of cultivations. Frequent stirring of the soil is no doubt beneficial when the plants are small. Later, when the plants have reached some size, the cultivations may be less frequent, and should perhaps stop entirely ten days or two weeks before the crop is ready to harvest. Cultivation after irrigation and after rains is especially important as it prevents the soil from baking and conserves the moisture.

The leaves of lettuce are very brittle early in the morning and on cool, cloudy days. When the plants have reached good size, it is probably better to delay cultivation until the day is somewhat advanced as the leaves, due to the warmth and lessened turgidity, will not be so likely to be broken off when brushed by the cultivator.

Hand tools have been much used in cultivating lettuce, but growers are coming more and more to use horse drawn implements, which render the handling of the crop a more economical and less laborious proposition. One-horse cultivators of the seven and nine-tooth types are well adapted to lettuce culture. Some growers are using beet tools to advantage in handling the crop, while still others are experimenting with the light garden tractors. On level ground, which is in a fine state of tilth, some of the little tractors are able to do good work, but are not satisfactory unless conditions are favorable.

Thinning.—This is one of the most important as well as one of the most laborious operations connected with lettuce growing. It is a case where the cultivator must literally assume a prayerful attitude and get down on his knees to do the work properly. Only

one plant should be left in a place and the work should be done when the plants have developed only three or four leaves, or before they become spindling. A plant every twelve or fourteen inches is close enough on good soils. Hoes, knives and tablespoons are used in thinning.

Irrigation.—There is a great deal of difference of opinion as to how lettuce should be irrigated. The majority, however, is inclined toward the view that frequent, light irrigations are best. Over-watering when the plants are small, will do no particular harm, but light irrigations should be the rule later on, and especially as the plants near maturity.

It seems hardly necessary to say that water should always be applied in furrows, but cases are known where the flooding method has been used either thru ignorance or because the land was not



Field of head lettuce nearing maturity.

sufficiently well leveled to avoid it. Where this method is followed the plants are frequently covered with mud, which interferes with their growth. Also, when the ground dries out after irrigation, the surface is left in bad shape due to baking.

The character of the lettuce crop is greatly influenced by the amount of irrigation water used. Under favorable climatic conditions, fairly liberal irrigation will produce large size heads of good quality; however, with unfavorable weather, such as a period of hot days, occurring when the crop is ready to head, liberal watering

will cause the heads to be soft, develop tipburn, and shoot to seed. It seems best, as a general rule, therefore, to use water sparingly as the heads mature, and especially so if tipburn shows up and the weather is hot. Withholding water to too great an extent may cause the plants to shoot to seed, so the grower must often exercise fine judgment in deciding weather to irrigate or not.

There are a few localities in the state where lettuce has been grown successfully without irrigation. These sections are so situated that the rainfall is greater than the average for Colorado. While this is an advantage, there are disadvantages which offset it to some extent. For example, rainy weather may cause the lettuce to be dirty, and a dry period in the spring may result in poor germination and a poor stand, or delay the crop so that it does not have sufficient time to mature. For this reason, a water supply even in these localities is desirable.

Crop Troubles.

Shooting to Seed.—Under unfavorable conditions head lettuce often produces seed stalks prematurely. It is a common experience for a large per cent of the crop to be rendered worthless in this manner. Hot weather at heading time is one of the chief causes responsible, but other factors such as a poor strain of seed, improper irrigation and lack of cultivation probably have a good deal to do with the trouble. Planting so as to avoid having the plants mature during hot weather, the use of the best seed obtainable, and proper cultural methods, will all aid in reducing the number of seeders. Anything which will prevent the plants from becoming stunted will tend to prevent premature seeding.

Tipburn.—This is one of the most serious troubles of the lettuce grower in Colorado. The January, 1922, bulletin of the California Department of Agriculture contains the following discussion of this disease:

“Severe losses are sometimes occasioned by tipburn, which is characterized by the blackening of the edges of the inner leaves and which, under favorable conditions, will result in a partial or total decay of the interior of the head. It is, however, often impossible to detect any external symptoms of this condition. The disease is of a non-parasitic nature and the damage is usually done after the plants have started to head. It is most prevalent when bright, hot weather follows a period of cloudy or rainy weather. Considerable variation of infestation is found in the different classes of soil. Lettuce growing in soils of high water-holding capacity shows less injury than that grown in soil with an insufficient supply of moisture. In the Imperial Valley this disease seems to be closely related to alkali conditions. Slimy soft rot will often start in the weak tissues caused by tipburn, while the lettuce is being shipped or held in storage, causing total loss of that head. Heads which are only slightly diseased will invariably develop a bitter flavor.”

Good seed and good culture are probably the best remedies for this disease. The department of horticulture has demonstrated that withholding the water will check this disease where it is already in progress, or prevent its occurrence in other cases. Lack of irrigation, if carried to extremes, however, may cause the crop to go to seed. Too frequent applications of water, or heavy rains, near heading time, encourage the appearance of the disease.

It may be possible to develop a strain of lettuce which will be resistant to tipburn, and experimental work with this object in view has already been started.

Slime.—Heads of lettuce often exhibit a condition referred to as “slimy”, which renders them unfit for market. This trouble is generally considered to be due to decay organisms which gain entrance to the tissues through tipburned or other injured areas and cause a slimy rot. If tipburn can be prevented, slime is not likely to occur.

Harvesting, Grading and Packing.—Harvesting is preferably done in the morning, when the heads are cool and crisp, but in large fields it is often necessary to continue cutting thruout the day in order to get over the field. It is best not to handle the heads while frozen or wet, as they are then more susceptible to subsequent deterioration.

It is necessary to go over the field three or more times at proper intervals in harvesting the crop, so that the lettuce may be cut as soon as it is ready. Prompt cutting of matured heads is important during warm weather, but after the days become cool, cutting may be delayed somewhat if necessary.

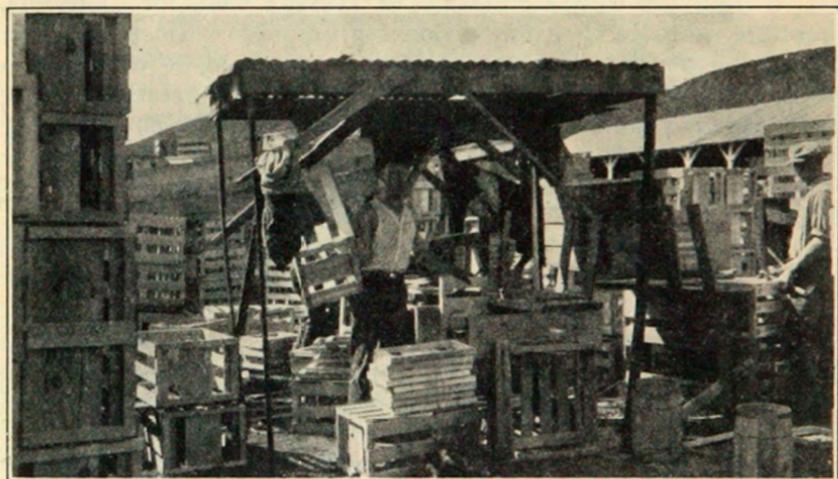
The plants are cut just below the head in such a way that all the leaves are left intact. One who is experienced in harvesting lettuce can tell at a glance what heads are ready to cut. The heads are put into field crates as soon as cut, and should be taken to the packing shed at once. Everything possible should be done to keep the heads cool and prevent wilting by sun and wind. Putting crates in the shade as soon as filled or covering with canvas will be of advantage in this particular.

At the packing shed the lettuce is trimmed, graded and packed into crates which are at once loaded into refrigerator cars. The standard crate used in Colorado is what is known as the Los Angeles crate, and measures 13x18x24½ inches. The crate is lined with waterproof paper, and the heads packed two to four or even five dozen to the crate, depending upon the size of the heads. Crushed ice is placed between the layers of heads in the crate, about 35 or 40 pounds being used for this purpose.

Grading and packing are in practically all cases done by the

firms or organizations which market the lettuce for the grower. The lettuce is delivered to the packing shed in field crates, the grower being paid on the basis of "packed out" crates. There is no question but that the strict enforcement of high grading standards is necessary in order for Colorado to maintain a reputation for first quality lettuce. Growers should lend their hearty support to such enforcement, as it is only in this way that the industry can be put on a firm foundation.

Marketing.—The marketing of lettuce is usually done by some large distributing agency or by commission firms. There are several organizations of growers in the state, but they do not attempt to



Making lettuce crates. Packing and loading platform in right background.

sell the lettuce grown by their members. Instead, they contract with some agency to do the marketing for them. Such agencies usually operate the packing sheds, furnish the crates, and do the grading, packing and marketing. They may also handle seed and other supplies needed by the grower.

It is important that the grower make some arrangement in advance for the marketing of his crop. Cash buyers are sometimes glad to pick up a few cars at a good price, but cannot be depended upon to handle the entire crop, and this is especially true when the supply of lettuce is plentiful. The established organizations or agencies cannot be expected to take care of the grower at such times, when he has not favored them at other times. A reliable agency should be selected by the grower to handle his product,

and agreements and contracts should be faithfully fulfilled by both parties.

Yields and Prices.—Both the yields of lettuce and the prices received for it vary greatly from year to year. Some growers have cut as much as 500 crates per acre, while others have harvested none at all. From the 10,400 acres estimated by the U. S. Department of Agriculture as having been planted to head lettuce in Colorado in 1925, 3,077 straight carloads are reported to have been shipped. The lettuce shipped in mixed cars would probably bring this figure up to 3,500 cars. This is at the rate of about one carload to every three acres, or some 105 crates per acre. In California during the years 1919 to 1923, inclusive, annual yields per acre varied from 208 to 335 crates. The average yield for California, therefore, is more than twice that for Colorado. Since economic production depends to a great extent upon yield, it would seem necessary for Colorado growers to use means to greatly increase yields in this state in order to place themselves on an equal footing with others. More intensive culture on reduced acreage, and more study and greater care in the handling of the crop at all stages would doubtless bring about a great improvement.

Regarding prices, the Colorado Co-operative Lettuce Association, at Buena Vista, one of the oldest lettuce organizations in the state, reports an average price to the grower in 1923 of \$1.25 per crate; in 1924 of \$2.25 per crate, and in 1925 of \$1.00 per crate. This is what the grower received for his lettuce delivered in field crates at the packing shed, but being paid on the basis of packed crates. This association reports also that the cost of production of an acre of lettuce in 1924 did not exceed \$100.00.

These returns are much higher than were received in a great many cases, and perhaps lower than those obtained by some individuals in other localities. It would seem that the grower should receive a greater proportion of the consumer's dollar than he does in many instances, and if the marketing of lettuce was more efficiently done by some of the agencies, the price per crate to the grower would be higher.

Storage of Head Lettuce.—In a number of instances, growers interested in head lettuce have asked questions regarding the possibilities of storing a part of their crop in order that it might be sold late in the season or to keep it over a period when the market is glutted. While good lettuce may be held in commercial cold storage for two or three weeks, it seems doubtful if any method of common storage would be satisfactory for this purpose, and it would be impracticable to provide cold storage at the shipping point. Many instances are cited where a few heads of lettuce have been

thrown into a cave or cellar and kept in good condition until Thanksgiving, or even Christmas. Such storage may prove satisfactory for small quantities for either home use or local sales, but its utilization on a large scale hardly seems practicable.

CAULIFLOWER

While head lettuce has assumed the greatest importance in the localities where mountain vegetables are grown, cauliflower has also claimed a good deal of attention, and justly so. It is a crop for which many of the mountain districts provide almost ideal conditions. It can very often be used to advantage in making up mixed cars of vegetables, and fits well into a rotation system involving lettuce and other vegetables.

Cauliflower has always been considered a rather difficult crop to grow, much care being required in starting and handling the plants, in transplanting them to the field, and in the cultivation, irrigation and blanching of the crop. In Colorado, however, conditions are so favorable, especially at the high altitudes, that a first-class product may be produced with less difficulty than elsewhere. This statement is not intended to suggest that cauliflower may be grown without effort, because skill, experience, and hard work are necessary for success with it, but natural conditions do favor the Colorado grower.

Possibilities of Cauliflower Growing

Cauliflower is often referred to as the most refined member of the large and somewhat disreputable cabbage family. When properly prepared for the table, it is really a delicacy, and there is no reason why it should not be used much more widely than it is.

The annual shipments of cauliflower in the United States amount to from 5,000 to 6,000 carloads, three-fourths of which is produced in California. Considering the desirability of this vegetable, it would seem that there should be room for considerable expansion. Gradual increase in production is taking place, and the markets are absorbing the increase, on the whole, satisfactorily. There are and will be seasons when low prices may be expected, but on the average, the crop should give profitable returns. The 1919 census gives the value of an acre of cauliflower as \$204. At the same time, lettuce had a value of \$396 per acre. The figures place both of these vegetables in the class of relatively high-priced crops.

Another fact of interest in connection with cauliflower growing is the importation into this country of considerable cauliflower from

Europe for pickling purposes. This is done because the American grown product quite often commands a price on the fresh vegetable market which is higher than the canners are able to pay for pickling cauliflower. Some attempt has been made by canners to contract cauliflower for pickling purposes, but with little success, for the reason just mentioned. Considering the adaptability of this crop to Colorado conditions, it would seem that more of it might well be grown for pickling in this state, and especially if there should develop a tendency toward over-production.

Best Conditions for Cauliflower Growing

Much excellent cauliflower is grown near Denver, Pueblo, and other points having similar conditions (4,000 to 5,000 feet above sea level), but as stated above, some of the mountain districts furnish an even more favorable environment for its production. Elevations of 6,000 to 8,000 feet, where there is an abundance of water and a rich soil, are preferred. At altitudes greater than 8,000 feet, the cold nights, and, at times rather cool days, which are favorable for head lettuce, seem to stunt the cauliflower plants so that they do not develop satisfactorily. On the other hand, cauliflower will endure without injury, a period of hot weather which would cause lettuce to tipburn or go to seed, thus making success with it at the lower elevations more certain than with lettuce.

Below is given a table showing the shipments of cauliflower from Colorado in 1925. These figures do not account for the large amount of the crop which was shipped in cars of mixed vegetables, in express shipments, etc. The shipments of mixed vegetables are shown along with the lettuce shipments in a previous table.

CARLOT SHIPMENTS OF CAULIFLOWER FROM COLORADO, 1925

Shipping Point	No. of Cars
Alamosa	1
Brighton	1
Center	1
Canon City	5
Denver	15
Florence	1
Fort Garland	6
Mesita	44
Monte Vista	1
Pueblo	91
Salida	9
San Acacio	11
Total.....	186

Culture of Cauliflower

The Soil: Its Fertilization and Preparation.—Good cauliflower may be grown on a variety of soils, but a deep rich loamy type is preferred. A high percentage of organic matter is desirable, since it improves the water-holding capacity of the soil, thus making it more favorable for this crop.

A soil which will grow lettuce satisfactorily usually needs considerable fertilization in order to grow good quality cauliflower. The fertilizer most commonly applied is barnyard manure. This should be broadcast over the field in the fall before plowing. It may be put on in the spring, but in this case, only manure which is at least fairly well rotted should be used. Liberal amounts of fertilizers are usually applied to land where cauliflower is to be grown. Twenty or more tons of manure per acre is a common application, and this is often supplemented with chemical fertilizers. In 1925, the department of horticulture used nitrate of soda on some cauliflower at Avon, applied at the rate of a teaspoonful to each plant. This was on poor land, and the improved growth of the plants so treated was quite noticeable. It is planned to carry out further tests of chemical fertilizers in the growing of this crop.

Cauliflower ground should be thoroly prepared. Plowing is best done in the fall, but if necessary may be done early in the spring. Fall-plowed land should be harrowed and leveled in the spring as soon as it is dry enough. If plowing has been delayed until spring, the harrow should follow the plow immediately to prevent excessive drying out and to provide a fine medium in which to set the plants.

Seed and Varieties.—Cauliflower seed is more expensive than that of most vegetable crops, often costing from \$3.00 to \$5.00 per ounce retail. Good seed of desirable strains is never cheap, and it certainly does not pay to plant inferior ones. Most of the seed used in this country is imported from Denmark.

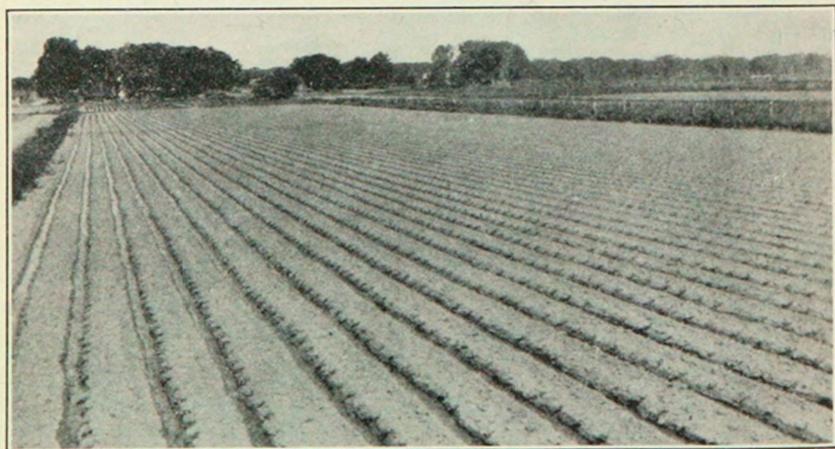
The strains of cauliflower grown in Colorado are mostly of the Snowball type, and are known under such varietal names as "Henderson's Snowball," "Danish Perfection," "Improved Self-Protecting Snowball," etc. There is considerable difference of opinion as to which of these is best. At Fort Collins, the Improved Self-Protecting Snowball has been found to be a very satisfactory strain. Some of the others are no doubt as good.

Growing the Plants.—The growing of cauliflower plants is quite similar to the raising of cabbage plants, except that somewhat more care should be exercised to provide favorable conditions for the plants, and to guard against anything that may have a stunting effect upon them.

In the high altitudes, the seed should generally be planted in hotbeds, tho coldframes may be used at elevations below 7,000 feet. Sowing of the seed should be done from the 15th of March to the 1st of May, depending on the elevation and the time at which the crop is to mature. At the experimental farm at Avon, where the elevation is about 8,000 feet, planting the seed in hotbeds the last week in April has proved satisfactory. The plants should grow in the hotbed for about six weeks, after which they are ready to be put in the field. During these six weeks the grower should provide the best growing conditions possible for the plants, so that they will reach the transplanting stage without becoming stunted. Especially should they be prevented from getting too dry at any time. Exposure to freezing temperatures should also be avoided. Both of these conditions tend to cause the plants to produce irregular or misshapen heads at maturity. Spindly growth should be guarded against by sowing the seed rather thinly, and by proper ventilation. Desirable plants are stocky, healthy, and dark green in color.

Before setting in the field, the sash should be left off the hotbed, both day and night, for three or four days, in order to "harden off" the plants and make them better able to resist the unfavorable field conditions. It is a good idea to give the hotbed a liberal watering a short time before the plants are pulled, as this fills the tissues with water and enables them to be removed with a greater proportion of the root system.

Transplanting Plants to the Field.—Cauliflower plants should not be set in the field until danger from hard freezes is over. Light frosts will do no damage, but a severe cold spell may cause poor



Field of young cauliflower near Pueblo. Note that plants are set along the sides of the irrigation furrows.

heading. The plants are not as hardy as cabbage, which will endure a great deal of cold weather. With this in mind, transplanting may be done from May 15th to June 10th, depending on the elevation and other local conditions.

In moving the plants from the hotbed to the field, the grower has opportunity to exercise the skill which may mean the difference between success and failure. The plants should not be allowed to dry out while being carried from the hotbed to the field, nor after setting them in the ground. To prevent this, the plants should be kept covered with a moist gunnysack until set out. In preparation for setting, furrows should be laid out where the rows are to be. The plants are then set along the edge of this furrow. They are preferably placed a little inside of the furrow rather than outside, since in this way the water reaches the roots sooner. In some cases, water is run thru the furrows a half day in advance of transplanting to establish a water-line along the side of the furrow and to settle the soil. The plants can then be set along the water-line. In other cases, the plants are set along the furrow without previous irrigation. Setting may be done with the hands, a spade or a dibble. In planting with a spade, one person handles the spade while another puts the plants in position. A dibble is simply a pointed stick, the size of a broom handle, which is used to make holes for the plants. When the soil is in good condition, plants can be set rapidly with this tool.

As soon as the plants have been set in the ground, the water should be turned into the furrows and allowed to run until the soil around the plants is well watered. Where the rows are long, the water can be started as soon as the planter has set 25 to 50 plants, and allowed to follow slowly down the row so as to prevent any drying out and wilting. This is important in giving the cauliflower plants a good start, but a matter often neglected by growers.

Planting distances vary somewhat, but 30 inches between rows and 14 to 18 inches between plants in the row gives sufficient room. Fairly close planting is advisable, since the leaves of the plants are thereby made to grow in more of an upright position, which facilitates the blanching of the heads.

Cultivation and Irrigation.—Two or three days after the plants are set in the field, they will have become established, as is shown by the small leaves in the center of the plant taking on a brighter green color. At this time a second irrigation should be given, and as soon as the ground is dry enough, the plants should be carefully hoed to break up any crust which may have formed following transplanting. The irrigation furrow should then be cultivated up, and

at the next irrigation a new furrow should be made on the other side of the row and slightly further from the plants.

Cultivation of cauliflower is best done with horse-drawn cultivators, those of the five and seven-tooth types being quite satisfactory for the purpose. The ground should be stirred following rains and after each irrigation. When the plants are small, cultivation may be deep, but later when the roots have spread thru the soil, just the surface should be stirred.

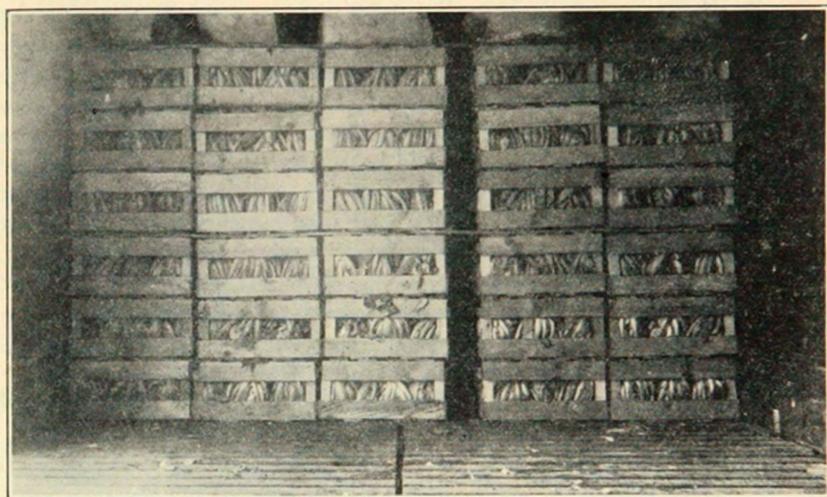
The crop needs a good deal more water than lettuce and should not be grown where there is likely to be a water shortage. Allowing the plants to become too dry at any stage, may cause a poor crop. Especially is this true as the plants near maturity. When the plants are small the water should be run in a furrow made close to the row, but as they increase in size the irrigation furrows may be moved further away until they are finally made half-way between the rows.

Blanching.—By this term is meant the protection of the head so that it is perfectly white when ready for market. If left unprotected, the heads become greenish in color, and develop a strong undesirable flavor. Blanching is accomplished by tying the leaves of the plant over the head so as to exclude the light. This is done when the heads are quite small, say two inches in diameter. Soft string is used for tying. The plants must be gone over every two or three days and the heads which are in the right stage tied up each time. If different colored twine is used at each tying, harvesting will be simplified, since the heads tied up at any one time will likely be ready to cut at about the same date, while others will not be ready and will not need to be examined.

The heads of cauliflower develop quite rapidly, especially if the weather is warm. Only three or four days may elapse during hot weather between tying and the time the heads are ready to harvest, while in cool weather 10 to 12 days are required for the same degree of development. Some varieties, such as Improved Self-Protecting Snowball, have leaves which naturally cover the head to a considerable degree, and are thus more easily blanched. During some seasons such varieties may require very little tying.

Harvesting and Packing.—When the heads are ready to harvest, they are cut just above the lower leaves of the plant, but with most of the foliage left on. They are placed into field crates and taken to the packing shed, where they are trimmed and packed for shipping. At this time, any excess foliage is removed, as are any leaves which are broken or damaged in any way. A number of leaves are left to protect the head during shipment. In packing, 12 to 15 heads are put into a crate, in one layer. The crate used is the type known

as the "California pony crate," and measures $8\frac{1}{2} \times 18 \times 24\frac{1}{2}$ inches inside. Since the crate is only $8\frac{1}{2}$ inches deep, when the heads are tightly packed in it, most of the leaves extend above the top and must be sheared off with a knife before the top can be nailed on. The crates are not lined with paraffin paper, as in the case of lettuce, nor is ice put into the crates.



Cauliflower loaded in refrigerator car. Pieces of ice have been placed on the crates in the top layer.

Grading and packing of cauliflower is usually done by the growers themselves. Two grades, No. 1 and No. 2, are packed. A description of these grades, as well as those of other vegetables, may be obtained from the Colorado Director of Markets, at Denver. The grading of cauliflower, as well as that of lettuce and other vegetables, should be more rigidly done in the future, if Colorado is to maintain its reputation for quality products.

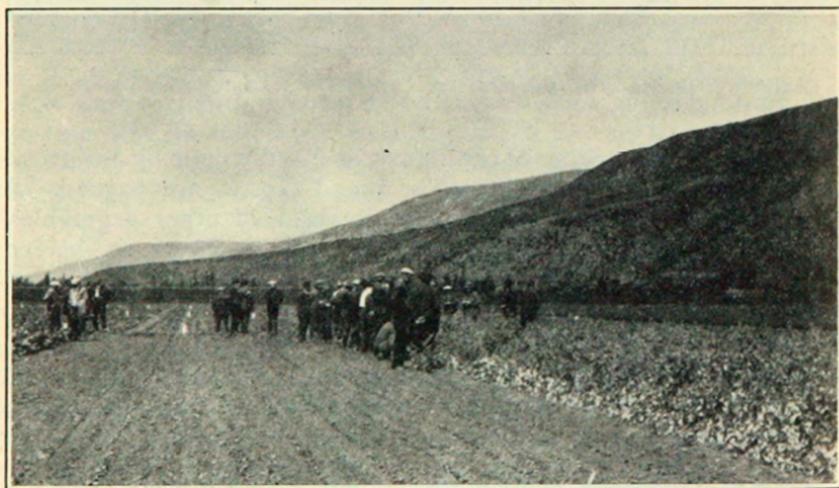
Marketing.—Cauliflower is marketed by the same agencies and in the same manner as head lettuce. Many straight carloads of this crop are shipped from Colorado, as shown by the table above, but in many localities the shipments included in cars of mixed vegetables are of large volume.

Yields and Prices.—Data as to yields in Colorado is lacking, but it should be possible to obtain 300 to 400 crates per acre on the average, tho larger yields may be obtained under good conditions. Prices vary greatly from year to year, and they may be much higher at one time of the year than another. Estimates are found which give figures varying from \$100 to \$1,000 per acre. The Lettuce

Growers' Association at Buena Vista handled 7,500 crates of cauliflower in 1925, for which the grower is reported to have received an average of 60 cents per crate. The average for the last three years is given as 78 cents per crate.

PEAS

Of all the vegetables grown in the high-altitude districts of Colorado, peas, to the writer, are the most interesting. The quality and flavor of the mountain-grown product is unsurpassed, and the sight of a field of them at the height of the season is sufficient to arouse the enthusiasm of the most conservative gardener. The several possibilities which this crop offers make it an attractive one from the grower's standpoint. It is grown primarily for shipment as a green vegetable, but may be utilized in other ways. If of a good strain, and some attention is paid to removing off-type vines, they may be sold for seed purposes. Also, considerable interest has been manifested in the possibilities of canning mountain peas, and in time there will doubtless be factories established for this purpose. They may be used for feeding if not disposed of otherwise. In addition to these possibilities, it should be remembered



Growers inspecting experimental plots of lettuce and peas at College Farm, Avon.

that the pea is a legume, and therefore easy on the land and valuable in any system of rotation. Altogether, it seems that this crop should gain in popularity as time passes. It would no doubt be possible to grow more peas than the market could absorb, but com-

mission firms seem to be generally optimistic regarding the handling of any reasonable quantity of them.

Conditions Suitable for Growing Peas

Peas can be grown with some success in any of the irrigated sections of the state, but it is at elevations of about 8,000 feet that they reach their greatest perfection. Here, the quality is excellent and the yields are high. The time at which the crop reaches edible maturity is usually right for a good market, and growing conditions are such that the pods may be left on the vines for a longer time than can be done at lower elevations and still remain in good condition.

The importance of the crop in the various localities of the state is indicated by the following table which shows the number of straight carloads shipped from these localities in 1925. There were, of course, many peas sent out by express and in mixed cars of vegetables which do not show in this table.

CARLOT SHIPMENTS OF GREEN PEAS FROM COLORADO, 1925

Shipping Point	Number of Cars
Buena Vista	16
La Jara	6
Monte Vista	4
Center	9
Total.....	35

Possibilities of Canning Mountain Peas

A question that is frequently being asked is "what are the possibilities of establishing plants in the high-altitude districts for the canning of mountain vegetables, particularly peas?" It seems, off-hand, that since good yields of high-quality peas may easily be produced, that the canning of them would be a logical and profitable procedure for both grower and canner. There are, however, several factors to be considered in this connection and they are briefly discussed below.

In the first place, the varieties of peas now grown in the mountain districts are considered unsuitable for canning. The public has been led to associate quality in canned peas with small size, while the varieties commonly grown produce peas of such large size as to place them in a low grade. Possibly a trade could be built up for this type of peas, but the canners hesitate to try to overcome a long established prejudice of this kind. Another disadvantage of the varieties grown at the present is the fact that they

do not mature a sufficiently large percentage of their pods at one time to make them altogether suitable for canning.

The department of horticulture has tested in a limited way a few varieties commonly used for canning purposes, but has not been entirely satisfied with their behavior. They do not seem to yield nearly so well as the larger-podded kinds grown for market. Further tests, however, might perhaps disclose strains which could be used satisfactorily.

There is some doubt, in view of the prices received for green pod peas, if the growers could be induced to grow them for canning in sufficient quantity to make the building of a factory advisable. The returns per acre for canning peas under present conditions could not be expected to be as good as where they are grown for market, tho of course larger acreages could be handled. A canning factory entails considerable financial outlay, and before beginning operations the individual or firm concerned would have to be assured of substantial support by the growers, not for one season only, but for a period of perhaps five years.

Finally, the canning of a single crop like peas is a somewhat hazardous proposition from the canner's viewpoint. He prefers to utilize several different vegetables so as to lengthen the season and to provide a variety of canned products for mixed car shipments. The canning of several products also reduces the loss due to crop failures and to over-production of any particular product. While it might be possible, at high altitudes, to grow other crops for canning besides peas, their number is very limited and much difficulty might be encountered in interesting growers in them.

In view of these facts, it seems doubtful if mountain peas will be canned to any great extent in the immediate future, tho one or two projects with this in view are being seriously considered at the present time. It might be mentioned, in this connection, that one large canning company in the state, contracted a considerable acreage of cauliflower two or three years ago for pickling purposes. Some of the growers did not hesitate to break their contracts when they found that a somewhat better price could be obtained for the cauliflower by turning it over to commission firms. This resulted in considerable loss to the canner and has made him hesitant regarding further operations in the mountain districts.

Culture of Peas

Soil.—Peas will succeed on a variety of soils, but a sandy loam or clay loam is usually preferred. Where earliness is important, the more sandy soils are best, but where large yields are desired a heavier type should be used.

Land where peas are to be grown should be plowed in the fall if possible. This puts the soil in better physical condition and enables planting to be done earlier than where plowing is delayed until spring. Before planting, the land should be well harrowed and leveled as for any other vegetable crop so as to facilitate planting, irrigation and cultivation.

Fertilizers.—Peas are legumes and ordinarily are not fertilized very much. Fresh manure encourages excessive vine growth and chemical fertilizers have not so far been used with this crop in Colorado. It is probably best to grow peas following some other crop which was well fertilized with manure, or after a green-manure crop has been plowed under. If this is done, good yields should be obtained without applying fertilizers to the peas themselves.

Seed and Varieties.—It is usually possible to obtain good seed peas with very little trouble. A considerable quantity of seed is produced in Colorado and dealers are well supplied. Many growers save their own seed which may be done satisfactorily, since varieties of peas do not mix in the field and the strain may be kept pure by pulling out off-type plants.

The Dwarf Telephone is the most important variety grown in the high-altitude districts. It is a dwarf form of the old Telephone variety which it resembles in all characters except height of plant. It is only 2 to 2½ feet tall, making it easy to handle. The pods are of large size, well filled and of desirable shape, color and shipping quality.

Other varieties grown to some extent are Alderman, Tall Telephone and Laxtonian. The first of these has been grown to a considerable extent because of the darker color of the pods, but it is a tall-growing variety (height about 4 to 4½ feet) and is not planted as much now as it was three or four years ago. In the San



Dwarf Telephone peas as grown at 8,000 feet elevation. They give a high yield of fine large pods.

Luis valley it has been reported to do a good deal better on some of the light sandy soils than the Dwarf Telephone. The height of the Tall Telephone has prevented it from being planted to any great extent. The Laxtonian is a very dwarf early pea of good quality, but has not so far been grown to any considerable extent. The small podded, early varieties have not yet found a place in the mountain districts, the growers and shippers preferring the late large podded kinds which are of better quality and more easily harvested.

The tall-growing varieties are not provided with supports but are grown in the same way as the dwarf types. Due to this fact the tall vines fall upon the ground and become entangled to some extent, which makes them less desirable to handle.

The department of horiculture has been testing out a number of varieties of peas, but so far has found none superior to Dwarf Telephone, when considered from all standpoints. An effort is now being made to improve this and two or three other varieties by very careful selection for desirable plant characters and high yield of large size pods.

Planting.—Peas may be planted by hand or with drills of various kinds, but the ordinary grain drill is used perhaps more than any other implement. By stopping up the holes not needed and making the proper adjustments, peas can be planted very satisfactorily with such a drill.

Planting should be done the latter part of April or the first half of May. Usually, the seed is sown in double rows seven or eight inches apart. Then a space of from twenty-eight to thirty-two inches is left and another double row planted. By growing the crop in this manner, the vines in the double row support each other to some extent, and the distance between the double rows is great enough for horse cultivation. About 100 pounds of seed are required to plant an acre. In some cases peas are planted in single rows sixteen inches apart, which may be done by stopping up alternate openings in the grain drill. The seed is planted about three inches deep in sandy loam soils, while two inches is sufficient in the heavier types. If the soil is dry and planting is done a little late, slightly greater depths than these are preferred.

Since peas are usually planted early in the season when the soil is moist at the depths mentioned above, it is very seldom necessary to irrigate them up.

Cultivation.—Shallow cultivation should be given peas until the vines begin to interfere with the operation. After this time it may be necessary to go thru the field and pull out any large weeds which appear and which may check the growth of the crop.

Harvesting.—Green peas must be picked by hand which makes

the harvesting of the crop the most expensive item in growing it. In fact the cost of harvesting often is as much as all the other expenses combined. Pickers are paid from one and a half to two cents per pound for picking.

Two to four pickings are necessary in harvesting the crop, the number depending somewhat upon the variety and the conditions under which the crop is grown. The harvest period begins about August 1st and may continue until frost.

Peas should be picked when the pods are well filled, but before they have become too old. Buckets and baskets are generally used to pick in.

Packing.—Peas are packed for shipment in crates slightly larger than cauliflower crates, measuring 10x18x24½ inches. These crates hold about fifty pounds of peas and are packed with a chunk of ice in the center of the crate. When shipped in straight carloads, refrigerator cars are used. Many peas are included in shipments of lettuce and cauliflower.

Yields and Prices.—Both the yield of peas and prices received for them vary greatly with conditions. There are no reliable figures covering these points. Yields of green peas have been known to vary all the way from one to four tons per acre. Two and a half to three tons per acre is a fairly good crop. One firm claims to have paid an average of about seven cents per pound for peas in 1925. The general average was less than this, probably five to six cents per pound.

In the growing of peas, yield is an important consideration,



Field of peas grown for seed. Planted in double rows.
Variety—Dwarf Telephone.

as it is with any other crop. A perfect stand of plants well cared for entails practically no more expense, aside from the picking, than a poor stand cultivated in an indifferent manner, while the much larger crop obtained in the first case may be sold at a lower price and still show a profit. Observations have shown that growers in many cases have failed to get satisfactory results because of poor stands and insufficient care in cultivating and harvesting the crop.

Peas for Seed.—The production of peas for seed has engaged the attention of a number of Colorado growers the last few years. In some of the mountain districts, ideal conditions exist for the growing of the crop for this purpose. When raised for seed, they are planted and cultivated in the same manner as when grown for sale as green pod peas. The crop should, however, be well rogued in order to eliminate all off-type or undesirable plants.

When the crop is contracted by seedsmen, the grower usually receives from $4\frac{1}{2}$ to 5 cents per pounds for the peas. Roguing is done by the seedsman and sacks are also furnished by him. In some cases growers sell to their neighbors, or in other ways, at a considerably higher price than that mentioned.

Good peas should yield 2,000 pounds or more of seed per acre.