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PREPARATION FOR MARKET

by

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Horticulturist (Vegetable Crops)

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CAULIFLOWER - GROWING AND PREPARATION FOR MARKET

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Cauliflower is generally regarded as one of the aristocrats of the vegetable garden. It has been said more or less truly that the test of a good gardener is revealed in his ability to grow cauliflower. It is certain that this vegetable is more exacting in its requirements than the average vegetable. In recent years cauliflower has been greatly improved so that it is now possible to grow a fine, solid, compact, white head surrounded by a tight formation of leaves naturally protecting it from discoloration.

Cauliflower has an important place in the home garden as well as the commercial garden. Some home gardeners do not raise this vegetable because of the somewhat exacting requirements of the crop, its susceptibility to unfavorable soil and weather conditions and a tendency to make small heads prematurely before the normal plant growth has taken place. These things can be avoided, however, by using proper cultural methods.

Cauliflower has had a peculiar rise and fall in volume of business in Oregon during the last 20 years. In 1921 the number of car shipments of cauliflower in the state was 83, which had risen to 415 in 1924 and to 1454 in 1926, subsiding to 445 in 1929, but again rising to 1056 in 1933 and 1042 in 1934. In 1935, however, the carlot shipments totaled but 111. They reached 271 cars in 1936 but fell to 221 cars in 1937 and to 57 cars in 1939.

A ten-year average from 1928 to 1937 indicates a slightly larger acreage of cauliflower during that period in the United States so far as car shipments are concerned than in the year 1939. Car shipments from California have not increased to any extent, neither has the acreage increased in Colorado, the next largest shipping district. Compared with the ten year average of 1928-1937, New York State produced no more cauliflower in 1939 than during the ten year period. The high point of carlot shipments for the entire country was reached in 1929 and 1930, and in 1939 it was slightly lower than the 1934 production.

No doubt a quantity of cauliflower is grown by market gardeners of which no account as to total volume is available. Likewise a good deal of cauliflower is transported by truck shipments which are unaccounted for in the above figures.

In 1939, 715,346 pounds of cauliflower were grown for preservation by freezing in Oregon-Washington. No data are available as to the amount of cauliflower used for canning or pickling.

Adaptation to Climate. Cauliflower is more exacting in its climatic requirements than other members of the cabbage tribe. The plant is sensitive to checks in growth during cool temperatures in the spring, the results of which are

apt to cause premature heading or buttoning. On the other hand, the plant grows to best advantage towards maturity under comparatively cool temperatures with a moist atmosphere preferred. It does not make its best growth until the cooler part of the late summer and fall months. This is indicated by the fact that the greatest amount of cauliflower is harvested during September, October and November. Cloudy, cool conditions are most favorable for transplanting plants in the field. Hot weather toward the time of maturity is undesirable as it causes the heads to develop too rapidly. Cool, wet weather may sometimes prevail during the season of harvesting, but if the heads are well protected, either naturally by the head leaves or artificially by having them tied over the heads, the latter will not particularly suffer. If frosts in the fall are delayed and the season is comparatively mild, there will be a much longer harvesting season.

Soils. Cauliflower is grown successfully on a number of different types of soil but in general grows to best advantage in a rich, loamy soil that is capable of holding moisture well. Various types of sandy and silt loams are used for this crop, as for example, the Columbia sandy loam in the vicinity of Portland. If the plants are not to be irrigated, the water-holding capacity of the soil is an important matter in areas where the summer and early fall precipitation is light. Ample soil moisture is necessary, not only at transplanting time but throughout the entire growth of the plant. A high humus content of the soil, therefore, is desirable to aid in holding moisture. The soil must also be well drained.

The soil reaction for cauliflower should be but slightly acid up to neutral. The club root disease thrives least in a neutral soil. On the other hand, the boron used for controlling hollow stem and head browning will not be so effective when the soil is heavily limed.

Soil fertilization. The object of the cauliflower grower in considering a program of soil fertilization is to grow plants of good size and vigor that will produce a uniform lot of heads of the most desirable size and grade. Medium to large plants are necessary to bear good-sized heads, hence the soil is usually fairly heavily fertilized. Land that is impoverished will produce small plants and consequently small heads. The experience of most growers seems to justify liberal fertilization, as the plants are heavy feeders and thrive in rich soil.

Materials used in supplying plant food include stable manures, green manures, and commercial fertilizers. Well rotted stable manure furnishes valuable organic material as well as being a fairly balanced fertilizer. Twenty tons of manure will furnish approximately 200 pounds of nitrogen, 120 pounds of phosphorous and 200 pounds of potash. Where manure can be obtained at a reasonable figure, it is invariably used. Light soils are particularly benefited by the addition of manure. The best time to apply it is during the spring soil preparation, except in the case of an annual rotation of crops, in which event the manure may sometimes be applied the year previous to growing cauliflower. In cases where cauliflower is a crop succeeding an early vegetable, the manure may be applied before the planting of the first crop. Experimental work seems to indicate that a moderate amount of manure, possibly 10 to 15 tons or so per acre, supplemented with a complete fertilizer, makes a desirable combination for producing a good yield of cauliflower.

Green manures are becoming more widely used because of the increasing scarcity of stable manure. Crops used for green manures include various legumes such as vetch and clover as well as other materials such as rye. These organic

manures supplemented with liberal applications of commercial fertilizer often prove adequate for making a good crop of cauliflower with heads of the proper size for No. 1 grade.

Commercial growers of cauliflower are likely to use a complete fertilizer having an analysis of approximately 5-10-7 or a ratio of 1-2-1 or 1-2-2. It is important to have some quickly available nitrogen material in the complete fertilizer. Suggestions for fertilizing land for this crop are stated in Extension Bulletin 524 "Fertilizers for Vegetable Crops."

Boron has lately been found to be a beneficial minor plant food element in preventing hollowness of the stem and browning of the head. (See paragraph following insect control.)

Varieties, Seed Strains and Seed. A question is frequently asked regarding the difference between cauliflower and broccoli. Broccoli is the name given to two kinds or members of the cabbage tribe. In the United States the name is used mostly to designate the green and purple-sprouting broccoli, or Italian broccoli as it is commonly known, a plant which first makes a medium-sized central head, followed later by side shoots of stems and small carnation-sized flower buds. These stems and buds form the edible parts of the increasingly popular Italian broccoli. Improved Green Calabrese is the variety of green sprouting broccoli most widely grown. The other type of broccoli is a white-heading cauliflower type which matures in the late winter and early spring months. In view of the fact that this type very closely resembles ordinary cauliflower, it is usually considered by the trade as cauliflower, so as to distinguish it from the green or purple sprouting broccoli. Saint Valentine is the varietal name of the white heading cauliflower type of broccoli which matures in February, March and April.

In the northern states the true cauliflower plant usually produces its head during the summer and fall, the main variety of cauliflower being Snowball, with various strains of this variety being offered such as Henderson's, Catskill, Gilt Edge, etc.

The sprouting broccoli represents the oldest form of broccoli and the forerunner of both the white heading broccoli and cauliflower. It was the first type exhibited by the new vegetable in its evolution from a variety of earliest cabbage. After this, by continued selection and improvement, varieties were still further improved into kinds which are sufficiently early to complete their growth in the course of the same year. These last-named kinds are known by the name of cauliflower.

There is also a variety of purple heading cauliflower known as Purple Italian, having green stems and a purple head, which color disappears when it is cooked. This variety is largely grown for a fall crop.

The greatest acreage of cauliflower grown in Oregon is of the Snowball variety. A true plant of this variety has leaves from 27 to 36 inches long and from 9 to 12 inches at the widest diameter. Well grown plants have over 40 leaves, exclusive of about 12 smaller leaves which form the head protection. The latter are important in protecting the heads and are called jacket leaves, folding over the heads in such a way as to prevent them from being discolored.

There are several different strains of Snowball varying in their ability to produce a crop having a large percentage of No. 1 grade heads. The better seed strains of Snowball produce a head which is perfectly white, compact and free from roughness, riciness, fuzziness or leafiness, and which also bear the self-protecting jacket leaves. There is some difference, also, in the time of maturity of these various strains and this is a point which must be considered by the grower. In some of the important commercial cauliflower-growing districts various strains are constantly being tried out in order that they may be compared and their value for commercial production ascertained.

In past years, a considerable amount of cauliflower seed has been imported from Europe. In 1938, cauliflower seed imported from Denmark amounted to over 7000 pounds, valued at approximately \$5.00 per pound, and from the Netherlands between 6000 and 7000 pounds valued at approximately \$6.00 per pound. Due to conditions in Europe, importations have been temporarily halted.

Approximately three ounces of seed are used to produce enough plants to set one acre, although this will depend upon the distances of setting in the field and the conditions under which the seed may germinate.

Growing Plants. Plants for an early crop of cauliflower that will head in early summer are started under glass in somewhat the same manner as early cabbage plants. However, in view of the fact that it is not desirable to set out early cauliflower plants as early as cabbage plants for fear of them being checked in their growth, it is well to withhold seeding until about early March. Cauliflower plants are quite susceptible to damping-off and the soil or seed should be treated to prevent losses of plants. Directions for growing these plants are contained in Extension Circular 342 on "Growing Early Vegetable Plants Under Glass."

Plants for a fall crop of cauliflower are usually started about six to seven weeks before the time desired to transplant. The soil for the seedbed should be such as to produce a good vigorous plant but one that is not too succulent or soft. In contrast to cabbage plants, cauliflower plants must not be allowed to become toughened or woody before they are ready to be transplanted. Stunted plants often head prematurely after being put out into the field.

Seed is put into the ground with a hand drill at a depth of about one-half inch, the aim being to plant 20 to 30 seeds to a foot. A sufficient amount of soil to cover the seed is all that is necessary to provide for satisfactory germination. The distance between the rows of plants should be sufficient for cultivation for eliminating weeds. There is a possibility that the plants in the seedbed may be affected by insects, including maggots, aphids or other pests. Recommendations for treating these insects are discussed in another paragraph of this circular.

The ability of the grower to irrigate the seedbed may prevent poor seed germination or a delay in the growth of the plants.

Transplanting Plants. This is best done when there is a cool, cloudy, or moist spell of weather. If the weather remains consistently warm and dry, it is best to transplant the plants during the latter part of the day. Plants for a fall crop are usually transplanted during the middle to the last part of July.

Distances for setting the plants in the field are usually three feet between the rows and about 30 inches between the plants. All of the various operations in transplanting should be such that the plants are not exposed in such a way that much wilting will take place from the seedbed to the field. It is desirable to set out strong, well grown plants, eliminating the small weak ones. If the weather is warm and dry, some cutting back of the leaves may be desirable, leaving the crown intact.

A good deal of the commercial acreage of cauliflower is set out by means of mechanical transplanters. Some growers still use the spade or shovel method while others use a hand transplanting tool or setter. In any case, it is desirable to set plants at the right depth in soil which has ample moisture to start them out without being checked.

Cultivation. The main object of cultivation is to eliminate weeds and to maintain the proper soil mulch. If there is no rain such as to change the texture of soil, it is inadvisable to cultivate merely for the purpose of stirring the soil. Instances have been observed in cauliflower fields wherein cultivation has been a detriment rather than a benefit to the plants. If a light mulch exists on the soil surface, it should be left alone.

Irrigation. Cauliflower is benefited to a considerable extent where the soil moisture is sufficient for a steady growth of the plants through the season. Plants that are stunted due to a lack of moisture are apt to produce a poor growth and possibly seed prematurely. Both the furrow and overhead irrigation methods may be used for this crop. On well leveled land, furrow irrigation is satisfactory, but on rolling soil, overhead sprinklers are used to advantage.

Injurious Insects. There are possibly five major insects which do more or less damage to the cauliflower plant or head. These include root maggots, aphids, cabbage worms, cabbage loopers, and flea beetles.

Maggots are apt to do injury to the young plants in the seedbed which, however, can be treated by using corrosive sublimate.

Aphids, green worms and flea beetles are also liable to attack the young plants in the seedbeds and special care must be taken to prevent injury during their period of growth.

Loopers and green worms are oftentimes injurious about heading time and may render fine white heads useless by their excretions.

Details of controlling these various insects are discussed in Extension Bulletin 523 on "Vegetable Insect Pest Control Program."

Hollow-stem and Head Browning. Both of these troubles have been observed in various fields of cauliflower in spite of an apparently sufficient fertilizing program, including the usual materials contained in a complete fertilizer. The pith of the stem has become hollow and various brown spots have appeared on the surface of the white heads. Investigations in New York and other states have indicated that these troubles may be caused from a deficiency of boron in the soil. Twenty-five to 30 pounds of commercial borax applied per acre have eliminated a great percentage of hollow-stem and head browning. The borax can be mixed with the complete fertilizer before the latter is applied.

Club-root. This is a disease living in the soil that affects members of the cabbage tribe. Cauliflower should not follow in rotation after another member of the cabbage group. Keeping the soil reaction up to neutral will also be of value.

Blanching. A perfect type of cauliflower head is naturally white and in view of the demand of the market for a snow-white color, it is important that this color be maintained when the head is quite small. Various factors may spoil the head such as sun, rain, frost, insects, soil, etc. Certain varieties and strains of cauliflower have the heads well protected by the incurved jacket leaves, such types being called self-protecting. It is not uncommon to find some strains of cauliflower of which the jacket leaves closely fold over the head and naturally protect it and keep it white up to the time when it is ready to be cut. As a rule, however, while the jacket leaves may at first afford protection to the head when small, later on as the curd enlarges, it pushes through the jacket leaves and is partly exposed and subject to discoloration unless cut. The general practice of growers, therefore, is to tie the large outside leaves over the small heads when they are about the size of a teacup. In New York state it was found that eight ten-hour days or 80 hours was the time needed to tie an acre of cauliflower, accounting for 18% of all labor on the crop.

The time elapsing between tying the leaves and cutting the heads will be determined by weather conditions. In moderately warm weather, harvesting may occur three to five days after tying. During the cool days of the fall, the time may be considerably longer. A careful inspection of the field at regular intervals is necessary to be sure that the heads are not tied up too long. The outer leaves tied around the head will often protect it from being injured by light frosts which would discolor the curd.

Harvesting and Preparation for Market. It is important that cauliflower heads be cut at the right stage of maturity or development of the curd. The solid head with its white color must be preserved in order that the product may arrive on the market in the best possible condition. At the time that the head is cut, there should be no signs of segmentation or spreading of the head. There is probably a tendency for cauliflower growers to cut heads that are over-mature rather than immature or too small.

In harvesting the heads, each plant is severed with a sharp knife at the base of the outer leaves, the aim of the cutter being to leave sufficient leaves attached to the head so that it has ample protection in the crate. After the heads are cut, they are carried to the outside row to be packed in crates if the weather is favorable or to be conveyed to a packing house. In this work, especial care must be used to prevent the heads from being bruised, blemished, or discolored.

Sorting and sizing heads after cutting is necessary for the establishment of a definite standard and grade. The segregation of heads is based on maturity, color, size, condition and formation of the head, and blemishes which may occur through insect or mechanical injuries. Copies of Oregon standards for cauliflower can be obtained from the State Department of Agriculture, Division of Plant Industry, Salem, Oregon. U.S. No. 1 grades are stipulated to consist of compact heads which are not discolored, ricey, fuzzy, or over-mature, which are free from damage caused by large bracts, dirt, or other foreign matter, bruises, diseases, insects,

mechanical or other means. The jacket leaves shall be fresh, green and well trimmed. Unless otherwise specified the minimum size shall be  $3\frac{1}{2}$  inches in diameter. The sizes of heads most desirable are those running from 9 to 12 per crate. Eights are large and 14s are small.

Containers used in marketing cauliflower are flat, one-tier crates, sometimes called flat or pony crates. These measure approximately  $18\frac{1}{2}$  x  $24\frac{1}{2}$  inches, outside dimensions.

A good pack of cauliflower will consist of (1) uniform sizing or packing of equal sizes, (2) apex of heads at uniform height in the crate, (3) tight pack, (4) correct proportion of jacket leaves about the head, and (5) a slight bulge that will not exceed one and a half inches. After the heads are put into the crate, the tops of the jacket leaves are trimmed with a slight bulge above the top of the crate and the three-slat top nailed on.

The main form of icing used in refrigerating cauliflower is the top icing of the load. The crates are placed upside-down in the car and snow or block ice is put over the entire load. The melting ice water trickling down over the leaves of the plants cools them and prevents them from turning yellow.

Yields and value. Good yields of cauliflower are 400 per acre; moderate yields, 250 to 300; low yields, 150 to 175 crates. Small sizes of heads such as 14s may contribute to low yields. In good fields the yield of No. 2 grade heads may be as low as 10%. Other good fields run from 12 to 18 per cent No. 2 grade heads. In some highly producing fields, yields have reached as many as 600 packed crates per acre.

Cauliflower varies greatly in value according to supply and demand. Usual values per crate run from 40 to 75¢ but the market fluctuates widely according to volume and grade.