GROWING GREEN PEAS FOR MARKET AND MANUFACTURE

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Within the last few years the growing of green peas has assumed considerable proportions in the state of Oregon and the West in general, chiefly in the production of this vegetable for manufacture—canning and freezing. At the present time between 35,000 and 45,000 acres of land in Oregon are planted to peas for manufacture.

The U.S.D.A. Crops News Service divides the crop into two classes; (1) peas for manufacture, and (2) peas for shipment.

Production for Manufacture in the U.S. By far the largest acreage of peas lies in the production of the crop for manufacture. During the 10-year period of 1932-1941, 286,850 acres were devoted to this purpose. In 1943 the acreage was 433,870, about the same as in 1942.

The national canned pack of peas in 1943 was 33,826,568 cases, of which 14,958,311 were Alaskas, and 18,868,257 Sweets. The 1944 pack was 30,130,834 cases, which was considerably under the 1942 record year with just under 35 million cases.

A ten-year average yield of peas per acre for manufacture for the United States was estimated at 1561 pounds, and for 1943, 1858 pounds.

In addition to the above there was considerable volume of peas packed for freezing. In 1937, 26,198,000 pounds of peas were frozen-packed in the United States. In 1944 this figure increased to 79,152,398 pounds, which was 12 percent higher than the 1943 pack of a little over 70 million pounds.

Production for Manufacture in the Northwest. In 1932 Oregon packed about 1720 cases of peas, and the pack in 1943 was 2,619,187 cases. In 1920 Washington packed 400 cases of peas, and 4,377,189 cases in 1943. The combined pack of Oregon and Washington in 1944 was 6,071,236 cases, of which 861,712 were Alaskas and 5,209,524 were Sweets.

In freezing operations with peas, 1,750,000 pounds were frozen in Oregon—Washington in 1933. In 1943 this figure had increased to 41,000,000 pounds, and in 1944 the Northwest packed 51,232,400 pounds of frozen peas or 65 percent of the U. S. frozen pea pack.

* Data are not segregated for the two states individually.
Peas for Shipment. The acreage of green peas for the open market in Oregon for the past year or so has been between 800 and 1000 acres. This acreage has been divided between peas for local marketing and for carlot shipping. The average number of cars shipped for the past five years is about 35 per year, approximately half of which originated from Wasco county. Some carloads of peas are shipped from Coos county, and there are other coastal areas producing peas in less than carlots.

Influence of Climatic Conditions on Yields and Quality of Peas. An important factor in the growing of green peas of good quality is that of the temperatures prevailing during the growing and harvesting season. The pea is naturally a cool-season plant. In the development of plants and pods, moderate temperatures, such as prevail in certain sections of the northwestern states, contribute very markedly to the good yields and fine quality of peas. There is a three-fold effect of the temperature under which the peas are growing: first, on the length of time of growth from seed to harvest; second, on the extent of vine growth, size and number of pods and total yield; and third, on the quality of the peas themselves.

A study of temperature records in relation to yields indicates a definite relation between moderate temperatures and high yields or between high temperatures and comparatively low yields. In other words, as the temperature rises the yields fall rapidly. The lowest yields are most likely to occur in seasons of high and of rapidly increasing temperatures. When the temperature remains fairly moderate and equable the yields hold up fairly well over a wide range of planting dates.

Most of the loss in yield accompanying high temperatures is occasioned by lessened vine growth and a decreased number of pods per plant. There is, therefore, a close relation between high temperatures and yields for the period from blossoming to harvest. As the date of planting is delayed the mean temperature during which the crop grows and ripens increases. This may not be true in the coastal areas where the summer temperatures are comparatively cool. Peas reach a harvesting stage prematurely during warm weather.

Another important effect of temperature upon green peas is that influencing the chemical composition and the quality of the peas at the time of harvest.

Variations in elevations of land planted to peas for processing make possible a longer growing and harvesting season than in other parts of the United States where much pea acreage is planted on land of equal elevation.

Temperature conditions prevailing in the coastal counties bordering bodies of fresh or salt water furnish the most favorable climatic conditions for the growing of peas for summer and fall harvestings. Consequently, there is considerable acreage of peas grown in coastal areas for market shipments. Where the plants have the advantage of growing under a cool, moist atmosphere and moderate temperatures the pods grow to a fine size with an excellent quality of peas.

Soils. Soils for peas must be of at least average, if not better than average fertility and moisture-holding capacity if a good yield is to be obtained.
The yield of peas is determined to a considerable extent by the vigor and growth of the vines as well as by the temperatures of the growing season. Usually the larger the vine growth, the greater number of pods harvested, but this factor may be modified considerably by the variety characters. Scant vines usually produce comparatively few pods.

While peas are grown on a great many different kinds of soil, for an early market crop a sandy or silt loam is desired so that the pea seed can be planted early, but for a main crop, possibly in the coastal areas, a soil of slightly heavier nature, which is more retentive of moisture, is desirable.

In any event, the land should be mellow and well drained. Roots should be able to penetrate the soil well to be able to provide a good vine growth and to provide sufficient moisture in the event of a dry spell.

For canning and freezing peas in which the crop is harvested all at one time, it is particularly desirable to have land of an even character, though it may vary in altitude. Such variation in canning or freezing crop areas is useful in lengthening the period of harvesting. Most of the canning and freezing pea acreage east of the Cascades is of a wind-formed silt loam soil. Peas grow best in a soil that is of a non-acid character.

Soil Fertilization. Land for peas should be well supplied with organic matter furnished by application of rotted manure or by the turning under of soil improvement crops. In a market garden, methods of soil fertilization will be more intensive than those used for the extensive culture of peas grown for canning or freezing. A common rotation in extensive areas is to have two or three crops of peas followed by a crop of grain. In other instances there will be one crop of peas and one crop of wheat. In some cases peas have been grown on the same land for six or seven years. Some growers may discontinue peas for a period in order to better control weeds. In the market garden, peas constitute an early crop which is followed later on by a fall-maturing crop, such as late cabbage, cauliflower, broccoli, Brussels sprouts, lettuce, celery, spinach or late root crops, etc.

Where manure is used, possibly no further application of fertilizing materials may be made; however, when the land is not manured, commercial fertilizers may be applied in conjunction with the use of a soil improvement crop. In using commercial fertilizers it is important to consider the analysis of the fertilizer used, the number of pounds applied per acre, and the placement of it.

Fertilizer Placement. Experimental application at the Wisconsin Station of 250 pounds of a 2-12-6 fertilizer placed alongside the row at seeding time gave a greater yield than double the quantity of the same analysis broadcasted.

Field trials indicate that if the fertilizer contains nothing but phosphoric acid, it may be drilled directly with the seed. However, application of fertilizer with the seed is harmful if either nitrogen or potash is present in the fertilizer. With such fertilizer, placement alongside the row, lower than the seed, is recommended.
Placement of the fertilizer up to 2\frac{1}{2} inches to the side and one inch lower than the seed at the New York Experiment Station proved to be an early stimulus to this quick-growing crop. A distance of 3\frac{1}{2} inches from the row was found to be too far away. Tests at the Western Washington Station indicate that side application closer than 2\frac{1}{2} inches increases the yield, but it probably is not practicable to place so close without endangering the seed.

If phosphorus fertilizer is used alone, from 100 to 125 pounds of treble phosphate, or 300 pounds of 18\% phosphate may be used. If 11-48-0 ammonium phosphate is used, 200 to 300 pounds may be applied. If a complete fertilizer is considered, it would probably be one with a ratio of 1-4-1, such as a 4-12-4 fertilizer.

Market gardeners sometimes make a practice of side dressing pea rows with a nitrogen fertilizer such as sulphate of ammonia, nitrate of soda or calcium nitrate while the plants are small and preferably during a rain. The fertilizer should be put on about two inches from the row and two inches below the soil surface.

Varieties. Pea varieties are chosen according to their adaptability for the open market or for manufacture. Varieties automatically divide themselves into dwarf, semi-dwarf and tall, as well as varying in season of maturity. For production of peas for the open market one can use various varieties differing in season to continue harvestings or make several successive plantings of one kind. For market gardens, growers use World's Record, Improved Gradus, Thomas Laxton, Pacific Market, Stratagem, and Alderman.

Canning pea varieties must concentrate the majority of their pods in a marketable stage at one time, a character that most of the market garden varieties do not possess. Varieties of peas grown for canning include Perfection, Climax, Early Sweet, Surprise, Alaska, Mardelah and Profusion. Wando seems to have unusual promise in producing a good yield and desirable canning quality.

For freezing, market garden varieties are used at present, including Thomas Laxton, Alderman, Gradus, Glacier, and Teton. Extensive tests with new freezing varieties of peas are being constantly made and the approved varietal list will no doubt be changing as new varieties and strains are introduced.

Seeds and Seeding. Inoculation of pea seed is important, particularly if the crop is being grown on land that has not previously produced peas. Some growers have the opinion that it pays to inoculate seed every year regardless of whether there has been a rotation between crops of peas or not. Inoculating material is inexpensive and the small investment is usually more than paid back by the advantages of better yields of higher quality peas. It is desirable to plant inoculated seed just as soon as possible after it has been treated. In growing peas on new land, the land is sometimes inoculated with soil that has previously grown crops of peas, soil from old pea land being spread over the new pea land.

Some dusts have been found to be beneficial in treating seed for prevention of rot, which may occur particularly during cool, wet spring months.
Oregon Experiment Station Circular of Information No. 334 recommends three materials in order of preference, Spergon, Semesan and Yellow Cuprocide. Spergon seems to be the only chemical that is consistently harmless to all varieties and may help all varieties of peas except Alaska under average conditions. Moreover, Spergon is the only protectant that can be used if the peas are inoculated with nitrifying bacteria. If inoculation with bacteria is considered more important than treating the seed with a protectant do not use any protectant. Pea varieties vary greatly in their tolerance of copper oxide, both red and yellow. Never use copper compounds on Alderman, Perfection and most other late varieties. However, the variety Thomas Laxton has responded well to copper oxide treatments in some counties.

The usual dosage of Spergon is one ounce to 40 pounds of seed—1\(\frac{1}{2}\) ounces per bushel, or one teaspoonful to four pounds of seed.

The amount of seed to be used per acre will be dependent very largely upon the method of growing the crop and the variety used. For market garden operations where dwarf peas are grown at a distance of 30 inches or so between the rows approximately 50-60 pounds of seed are used per acre. Plants produce more pods of better quality where there are not more than six to eight plants per linear foot of row. The size of pea seed varies with the varieties, but seed as a whole runs from 1300 to 1600 per pound.

Peas for manufacture are seeded by sowing the seed with a commercial drill with the rows approximately 6 to 7 inches apart, using from 2\(\frac{1}{2}\) to 4 bushels per acre. The amount of seed sown will vary from 135 pounds, a common amount sown east of the mountains, to as much as 280 pounds of seed sown west of the Cascades. These amounts vary according to the types of soils used and the extent of moisture available. Seed treatment may be a factor in reducing the amount of seed necessarily planted.

In growing market peas seed is usually sown just as early as the ground is ready for seeding. In certain parts of the State, such as the coastal counties, from which the market is to be supplied during the latter part of the summer and early fall, plantings are often delayed until May and sometimes into June. In planting seed of peas for canning and freezing the temperature of the soil should be at least 45°F. Sowing dates vary according to differences in elevation which permit a longer harvesting season where canning peas are grown. Most peas for processing in eastern Oregon are sown during March and April. Some years peas may be sown in western Oregon for freezing as early as February if soil and climatic conditions permit. The depth of planting seed varies from two to three inches depending upon the type of soil and the time of seeding. Earlier plantings are usually made at a lesser depth than those where seed is planted in drier soil and at later dates.

Insect Control. An important feature in the care of a pea-growing area is the control of two particular insects, weevils and aphids. Station Circular No. 126 discusses the control of the pea weevil by the use of three-quarters of one percent rotenone dust, and Station Circular No. 244 also deals with the control of the pea weevil.
The control of aphids is important, not alone because of their piercing the tissues of vine and pods and sucking the sap, but also because they spread mosaics. These diseases have done an increasing amount of damage to pea crops during the past few years. An early spraying or dusting with nicotine sulphate is necessary to control aphids. Extension Bulletin No. 551, "Vegetable Garden Insect Control," discusses measures of control.

**Disease Control.** Mosaics are virus diseases transmitted by aphids. When mosaic is present plants are dwarfed, leaves are mottled light and dark green, twisted and curled, and pods are malformed. If aphids are under control there is less danger of injury by mosaic. Early spraying or dusting is therefore necessary to control the lice.

Powdery mildew is a fungous disease causing a white, powdery-like dust coating on leaves, petioles, stems, and pods. The leaves are yellowed and malformed and there may be black spots and blight on the pods late in the season. Use of fine dusting sulfur will control this disease.

Downy mildew is a fungous disease which spoils the pods for market. Frequently, the large, ugly yellow spots on the pods constitute the only symptom observed. The disease begins on small plants, many of which die down and are not noticed. Sometimes the leaves are affected with spots which are yellow above and purple below. Spray and dust trials in this State and neighboring states have shown that control by chemicals is impractical. Downy mildew is a disease largely found prevalent in the coastal areas.

**Pod Proliferation.** In some pods of peas there is a white, cotton-like substance on the inside of the pod cavity. This is said to be a proliferation of the cells of the pod lining, which may fill the cavity but does not affect the seeds. It is presumed that this abnormal growth apparently arises due to fluctuation in climatic conditions. It may also be associated with downy mildew infection of the pods and mechanical injury to the pods.

Nightshade (Solanum nigrum) is an objectionable weed in pea fields and due to the size and color of the berries of the weed there may sometimes be contamination of pea packs, with necessary rejections being made. At the present time there is no known method of elimination of this problem in field or factory although laboratory procedures have been under trial which show promise of a possible solution of the problem.

Staking and Training. In the growing of tall varieties of peas in the market garden it is necessary to stake and train the vines. For this purpose stakes not larger than 1x2 inches and 7 to 8 feet long are set five feet apart in the row. From 1700 to 2300 stakes are usually put up per acre. Stakes are used to support twine, the first row of twine being put on when the peas are about eight inches above the ground or before they fall or bend over. Other strings, spaced six to seven inches from the lower ones, are added as the vines grow. It is important that the tying operation be done carefully or poor work may result in the vines going down. Pour to six-ply cotton twine may be used for this purpose and about six pounds of string is used per acre.
Harvesting. Because of the rapidity with which peas change from an immature to an overmature condition it is necessary to pay close attention to the development of the pods. Particularly is this true in periods of warm weather. Pods grown for the open market are picked by hand and therefore can readily be harvested at the most desirable stage of development. Canning and freezing peas, however, are harvested in the single operation of cutting the vines and threshing the peas, and the maturity determinations, therefore, must be very carefully made. The desire of the processor in harvesting peas is to obtain the greatest yield of the most acceptable quality. To determine the optimum time for harvesting such peas a tenderometer is often used, registering the resistance the peas offer to the delicate instrument.

Pollard and others, in presenting evidence on the influence of stage of maturity on the yield and quality of Perfection peas, showed that there was a close correlation between the increase in starch content and the increase indicated in the tenderometer readings. Increase in touchness was likewise associated with a loss in desirable flavor.

Observations by Nielsen (unpublished paper) indicate that, in general, tenderometer readings of 100 to 110 would be satisfactory for a desirable stage of cannery peas to obtain good yield and quality, with a reduction to a tenderometer reading of 90 for most varieties of peas for freezing.

Peas respire readily; if not removed to a cool place after being picked. The pods themselves carry considerable field heat if harvested during periods of warm weather, and this heat should be removed as quickly as possible by precooling. This may be done in various ways, such as putting the peas into a cool storage place or putting them into a car with fans operating over ice or reducing temperature of the car before loading.

In the matter of maintaining quality and reducing deterioration in peas for canning and freezing it is desirable to have no more than a few hours elapsing from the swath cut to the processing of the peas.

Nielsen showed in tests that when peas are held at an average temperature of 76°F. serious losses do not occur in four hours, but beginning at eight hours there is a rapid deterioration in sugar, vitamin C, flavor and texture. Peas delayed for 12 hours at 76°F. are unfit to pack. A reduction to 50°F. or lower is considered beneficial in checking growth of bacteria which, with natural respiration of the product, are responsible for loss of sugar and lack of fresh flavor.

Grades of Peas. Copies of Oregon standards for fresh peas are obtainable from the State Department of Agriculture, Salem, Oregon. These pertain to market peas. U. S. No. 1 grade requires peas to be fresh, tender, of uniform maturity, free from decay, mildew and insect or mechanical injury, with the customary 10 percent tolerance or 5 percent allowed for defects causing serious damage. Likewise there are standards for canned and frozen peas, copies of which can be obtained from the State Department of Agriculture or the United States Department of Agriculture at Washington, D. C.
Yields and Values. Yields of green peas vary greatly and are determined mainly by the variety grown, the vigor of the vines, prevalence of insects or disease, district where the crop is produced, and the seasonal conditions prevailing during the growth period and harvesting time. Dwarf varieties for the open market usually produce a smaller tonnage than the tall kinds. Yields vary from one to six tons per acre. One grower producing a crop of pole peas for the open market grew 400 hampers of 30 pounds apiece or six tons from seven-ninths of an acre. Twenty-eight pound tubs or 30-pound hampers constitute the leading shipping packages. Cars should be fully iced for the proper arrival of peas at destination, as peas heat readily.

While the U. S. average yield of peas for processing is about 1850 pounds of shelled peas per acre, the Northwest average is nearer 2000-2500 pounds. For 1943 the U.S.D.A. data indicate the mean yield of Oregon as 2600 and in 1942, when unusual precipitation of rain occurred, 3800 pounds.

Values of market peas range from 5 and 6 cents to 12 to 13 cents per pound according to the season of the year. Tubs were quoted at $3.00-$3.50 in September.

Values of peas for processing have varied considerably during the past few years. U.S.D.A. reports the mean value of all varieties and grades for 1944 as $77.60 with a total value of the crop as $3,628,000. 1944 support prices varied from $144.00 to $35.00 depending on sieve sizes and from $113.00 to $35.00, depending on tendometer tests, for frozen pack peas.

Utilization of Pea Waste. The most common use of pea waste has been as a fertilizer. Little time has been spent on the disposal problem other than to get the material out of the way—often returned to the field. For widespread use as animal feeds, all vegetable waste must be dried. One of the main problems in dehydrating the material even after cutting into small pieces is the difference in drying rate of the stems compared with the leaves. The latter contain the more food material, being high in protein, carotene and riboflavin.

Compared with alfalfa meal pea leaf meal is somewhat higher in protein, considerably higher in carotene and riboflavin and has less crude fiber.

In the vicinity of pea canneries pea vine silage has been a practical utilization of cull peas and vines but hauling any lengthy distance would have prohibitive costs.

Important food values in pea "waste" make it essential that efforts be expended to develop suitable products which will utilize the "waste" material to the fullest extent.

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