Oregon State College Publications
Relating to Snap Beans


2. Cost of Producing Pole Beans in the Willamette Valley, Oregon—Oregon State College Station Bulletin 452.


5. X-disease and Other Forms of Yellow Bean Mosaic in Western Oregon—Oregon State College Station Circular of Information 379.

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Growing Snap Beans

for Market and for Manufacture

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The word “snap” as applied to beans is based on the development of the pods in that they will snap or break readily when harvested. There are commonly three stages of development in the bean—snap, green shell, and dry. The word “string,” sometimes used to indicate the snap stage of a bean pod, is a misnomer as it should rightly be called “stringless.”

This circular considers only beans grown for the snap stage of harvesting.

Importance of the Crop

Snap beans are widely grown for city markets and for manufacture. Ordinarily about 175,000 to 180,000 acres of snap beans are grown for the fresh market, whereas the acreage for processing commonly runs between 120,000 and 130,000 acres.

The acreage of beans grown in the United States for shipment in 1949 was slightly less than the ten-year average of 1938 to 1947 and the acreage of snap beans for manufacturing in 1949 was about equal to that for the same ten-year period.

In Oregon beans are quite widely grown for canning and freezing. In 1934, only 900 acres of snap beans were grown for processing, with an estimated evaluation of $202,000. In 1949, approximately 6,600 acres of land were planted to this crop for manufacture, with an estimated tonnage of 54,100. Growers were paid a seasonal average price of $125.25 per ton and a total evaluation of almost six and three-quarter million dollars.

Oregon packed a little over two million cases of canned snap beans in 1943 and 2,357,265 cases in 1948. In addition, 8,176,943 pounds of snap beans were packed by freezing in the Northwest in 1943 and 13,993,000 pounds in 1948. These figures of the frozen pack are for the combined states of Oregon and Washington as there is no segregation of data for each of these two states.

While the acreage of beans grown for manufacture in Oregon is comparatively small compared with that in some other states,

*This bulletin supersedes Oregon State College Extension Circular 434, a mimeographed circular on snap beans by the same author.
nevertheless for the past twenty years or so Oregon has led all states in tonnage per acre. The United States Department of Agriculture statistics show that while the average yield of beans for the United States in 1949 was 2.15 tons per acre, Oregon is credited with 8.2 tons, which is higher than the 1938-1947 estimate of 5.9 tons for the state.

The Willamette Valley produces approximately 90 per cent of the Oregon snap bean crop, the acreage being found in Marion, Lane, Linn, Washington, Multnomah, Yamhill, Polk, and Benton counties.

**Varieties**

A variety of beans suitable for the open market and for manufacture should have certain definite characters: first, it should be prolific in yield so as to make it profitable for the grower in tonnage; second, it should be of the correct shape, color, and length in order to satisfy the trade; third, it should have good quality and flavor; and fourth, it should be as nearly stringless as possible.

Of the tall-growing or pole varieties used for canning and freezing, Blue Lake is the most widely produced. There are several strains and derivatives of the original Blue Lake varying in season, plant characters, yield, and degree of stringlessness. In general this variety is characterized by having straight pods which are 6½ to 7 inches long, round, fleshy in character, dark green, and stringless.

Other valuable pole bean varieties, mainly used for the open market, include Kentucky Wonder, Oregon Giant, and Delicious Giant.

Some wax-podded varieties of bush form are being grown for canning and freezing, notably Round Pod Kidney Wax. Useful bush varieties which have green pods include Stringless Refugee, Stringless Green Pod, Tendergreen, Bountiful, Full Measure, Black Valentine, Keystonian, and a recent introduction, Topcrop, which is a promising new variety for processing.

**Soils for Beans**

Land for growing snap beans should be well drained, relatively easy to work, fertile, and suitable for irrigation. Any friable land of good tilth that is naturally fertile or that has been built up to a good state of fertility will grow good yields of beans. Sandy loam and silt loam soils are preferred. Beans are produced to a large extent on river bottom soils and almost always under irrigation. A major exception to the river bottom soils is the Stayton area in
southern Marion County. Here the soils consist of the gravelly phases of Clackamas, Salem, and related soil series. Occasionally bean yards are to be found on Willamette soil and some of these have been known to produce good yields. Soils that have been used for bean growing for a number of years may not continue to bear heavy yields unless the organic content of the soil is maintained and ample fertilizer applied. Impoverished soil can be detected by the meager growth of vines, the dropping of blossoms and the small yield of pods.

Beans are not usually planted in soil where beets were grown the year before because of possible toxicity of the boron applied to beet land for control of canker.

**Fertilizers**

Manure or cover crops are the best materials for adding organic matter and fertility to bean soils. Where manure cannot be obtained in sufficient quantities there is usually a definite program of building up the organic matter by means of cover crops such as vetch, winter oats, Abruzzi rye, and barley. Bean growers producing high yields of beans consider the green manure program a necessary factor in maintaining good yields. In Extension Bulletin 612, directions are given regarding the type of cover crops that are grown and the number of pounds of seed to be planted. Bean vines are usually plowed down in the fall preparatory to planting the seed of the cover crop and adding organic matter thereby.

Beans do not respond to liming unless the soil is fairly acid. They grow well in a soil reaction ranging from pH 5.8 to 6.5.

Commercial fertilizers are commonly used to supplement plant nutrients contained in manure or cover crops. It is important to consider the relative proportion of units of nitrogen, phosphoric acid and potash as well as the materials that are put into the fertilizer, the total amount of each applied per acre, and the important matter of placement.

There are wide variations both in the analyses of fertilizers used and in the matter of application. Not infrequently a complete fertilizer, such as of a 1-3-1 or 1-4-2 ratio, is applied two inches or so from the seed row at time of planting, using about 250 to 300 pounds of fertilizer. Some growers broadcast 250 to 500 pounds of 16-20 Ammo-phos prior to planting and any basic soil fertilization is followed with applications of water-soluble nitrogen fertilizers applied through the irrigation lines after the establishment of the
plants and the appearance of the first pods. Successive applications by the same method are made as deemed advisable. One of the larger processors in the Willamette Valley reports that their growers use approximately 90 pounds of nitrogen, 180 pounds of phosphoric acid, and 60 pounds of potash per acre. Yields from such a fertilizer program have been very good. In this particular program granular cyanamid is applied to the cover crop when diskimg under, phosphoric acid and potash are applied just before planting, 16-20 Ammo-phos is side-dressed when beans are about 4 inches high, and water-soluble nitrogen is used through irrigation pipe as needed.

**Seed and Seeding**

The yield and market quality of any variety of beans are very largely dependent upon the particular strain of seed of the variety. The seed should come from a field that has been thoroughly rogued for plants and pods of an undesirable type. Flat pods are particularly distasteful to the processor. It is especially important, too, that the seed be resistant to common mosaic and other seed-borne diseases. From the standpoint of canning and freezing, white seed is preferable.

Bush beans are grown in continuous rows and the field is seeded, using approximately 60 pounds per acre. The distance between rows is usually 28 to 30 inches. The seed should not be sown too thickly as the plants will produce more and better pods if they stand a few inches apart.

If bean seeds are treated before planting, Spergon at the rate of 50 ounces per 100 pounds of seed or Arasan, 3 ounces per 100 pounds, seem to be the preferred materials for protecting the seed from rotting. Spergon is preferred if bacterial inoculation is to be used.

Pole beans are grown with the rows usually 4½ to 5 feet apart and for this method of seeding about 18 pounds per acre are sufficient. Quite commonly a combination fertilizer distributor and bean planter is used. The planting of seed of pole beans varies from the latter part of April to the first part of June, depending upon the time when it is desirable to have the beans come to a stage of development for harvesting. Ordinarily a period of 70 days elapses between seeding and the first harvesting, but this varies according to weather conditions and varieties or strains used. For the home or market garden, plantings of bean seed may be made up to the middle of July to provide a fall crop. Bush beans are useful in this respect.
Bean pods having constrictions in one portion of the pod or another have few seeds due to insufficient fertilization and nutrition of the pods. Well formed pods (lower right) have seeds throughout.

**Supporting and Training**

Pole beans are supported and trained by means of row posts, support posts, wire, and string. A bean yard may have temporary, semipermanent, or permanent equipment. Generally speaking, the temporary yards are used in the overflow and river-bottom areas, in which case the majority of growers remove the support posts in the rows and many of the posts supporting the cross wires. The top wires remain in the field as do the end posts. The field has a
few posts left to hold up the cross wires, which in turn have the row wires attached to them. These fields remain this way until after the soil is all prepared and ready for seeding. All or part of the equipment in permanent yards remains in the field the year around. In the stake yards stakes are used for the actual support of the bean plants. In the other kind of temporary yard, posts are placed at intervals down the bean row. These posts are connected by two wires, one at the top, No. 12 galvanized, and one at the bottom, No. 14 galvanized, of the posts. No. 8 galvanized crosswire is usually placed every 30 feet for additional support. The bean plant then climbs a string between the two wires. In some cases the support string is tied to the upper wire and at the bottom to the bean plant itself.

The trellis yards are similar to hop yards. The wires are raised to an overhead position in order to permit machine work in the field. Ordinarily fewer but heavier posts and heavier wire are used than for the other bean yards. The posts in semipermanent yards remain in the ground all year, but the wire is removed after the crop is harvested.

The difference in the cost per acre between these different yards is small. Those of the trellis type are the most expensive, having a relatively high investment and depreciation cost per acre, but they also have the lowest labor cost of any type yard. The stake yards have a low investment per acre but obviously require more labor since the stakes are entirely removed and then returned each spring. It would appear that yields are little affected by the type of yard used.

**Maintenance of the Bean Area**

Four important things in caring for an area of land planted to snap beans include (1) cultivation for weed control, (2) irrigation, (3) insect and disease control, (4) supplementary soil fertilization.

**Cultivation**

No more cultivation or soil stirring between the rows should be done than to control weeds and keep the soil in proper tilth during the growing season. In Oregon State College Station Bulletin 452, Cost of Producing Pole Beans in the Willamette Valley, hand and machine cultivation totaled 4.3 per cent of the total cost of producing pole beans.

Bean plants are unusually sensitive to applications of 2,4-D. Mild to severe injuries to beans have been reported where fields adjacent to the bean plantings were treated with 2,4-D.
Irrigation

Irrigation of a bean field is necessary for the production of a high yield and good quality. Growers use the rotary sprinkling method for an approximate period of 60 days during which the plants are watered. Some fields are irrigated by the gravity system, but this is only true where the contour of the land permits this method. From 12 to 15 inches or equivalent rainfall are usually provided an acre of beans during the watering season. The plants may receive two inches every two weeks until the beans hit the top wire, then $1\frac{1}{2}$ inches every week later and $\frac{3}{4}$ to 1 inch after each picking, which is generally every third day or so.

The usual equipment for rotary sprinkling consists of a river, creek, or well as the source of water, an electric motor, a centrifugal pump, four-inch pipe for main lines and two-inch pipe for laterals. In the Willamette Valley the cost of sprinkler irrigation is stated to be about $7 per ton of beans grown.

Irrigation is important in providing not only a uniform degree of water throughout the growing season but also in carrying water-soluble fertilizer into the ground for the benefit of the continued production of pods.

Insect control

There are several insects which do considerable damage to snap beans. The 11-spotted beetle is liable to do some early injuries by chewing the tender leaves of the young plants soon after they come through the ground. Later on this insect eats the leaves and pods. The pod injury is sometimes quite serious as there may be a heavy percentage of them with small holes eaten in them, thus rendering them unfit for open marketing or for manufacture. Experimental trials have indicated that 5 per cent methoxychlor, 20 to 25 pounds per acre, and piperonyl cyclone formulations have been effective in control of this beetle.

Black aphids are sometimes very injurious, particularly to pole beans. They congregate on the undersides of the leaves and on the pods, and dust must be applied directly. Dusting with 40 pounds of 4 per cent nicotine dust per acre has been effective. One to four applications may be required to eliminate loss due to aphids. Corrective measures should be taken as soon as black aphids are detected in a field, for there is a rapid build-up to the point that the processor will not receive beans from the infested fields.

Red spider mites are sometimes present in injurious quantities in bean fields. The bindweed is a source of infection and it should be eliminated where adjacent to a bean field.
The larvae of thrips have been found to be injurious in curling the base of the young pods. Nicotine dusts have been recommended for control.

If seed is saved from snap beans it should be fumigated immediately after harvest with carbon bisulphide to control the bean weevil.

Symphylids are small, white, centipede-like animals which are more or less widely distributed through certain bean-growing areas. They have caused considerable damage in the past and seem to be increasing in number and in the scope of land affected. Their underground habits make them extremely difficult to control. Observations over a 3-year period have indicated that continuous rotary tillage has contributed to definite declines in symphylid population, which demonstrates the necessity of a good seedbed in heavily infected soil.

The application of chlorinated propane-propylene—a soil fumigant—toward the late summer or early fall has resulted in a material reduction in population of symphylids. Details concerning the use of this material are available from the Department of Entomology, Oregon State College.

Ethylene dibromide at the rate of 2 gallons (actual material) per acre has been recommended for control of wireworms.

Diseases

Bean mosaics involve a complicated situation. One of these is seed-borne; the other is introduced from infected clovers, alfalfa, and gladiolus by aphids. Resistant varieties may be resistant to one but not to the other. Disease-free seed is essential for the control of the seed-borne mosaic. Avoid planting near old clover sod. Do not locate bean plantings near field peas or fields of commercial gladiolus. For complete details consult Oregon State College Station Circular of Information 379.

Bean rust is common in bean-growing areas when weather conditions are favorable for the development of the disease. It is a fungus disease which is liable to affect different varieties of the common bean. While some varieties have proved somewhat resistant to this disease, many of the popular varieties of beans, grown commercially, are seriously affected.

Control of bean rust in commercial acreages will depend on: (1) cutting down and diskimg vines as soon as last picking is made to prevent formation of overwintering stage; (2) treating stakes and other equipment with dormant lime sulphur to kill any overwintering spores on them; (3) dusting with sulphur dust at weekly intervals.
if rust was serious the year before, or if considerable rust appears on the new foliage before any bean pods begin to form.

The white mold (Sclerotinia) is probably the worst disease affecting beans grown in the Willamette Valley. The stems, branches, leaves, and pods are attacked by the causal organism. In the field the plants are affected by an abundance of white, mold-like growth which grows from the soil into the plants and hence from one plant to another through the leaves and stems which come into contact with each other. The disease is also readily recognized by the large black fungus masses on the surface of the dead stems and decaying parts. There is no positive means of control yet recommended.

**Blossom drop and malformed pods**

It is generally recognized that pollination of beans may be seriously affected by high temperatures. Bean blossoms drop off because of imperfect pollination due to the influence of warm weather on the germination of the pollen. If the plants have a good reserve of moisture and leaf growth they seem to show a smaller percentage of blossom drop than otherwise.

Some snap bean pods are "polliwog" shaped instead of being straight, well-filled, and uniformly shaped from stem to point. In most pods of this kind, therefore, half or one-third of the pod is filled with seed instead of having the normal number of 5 or 6 seeds per pod. Improper or insufficient fertilization of the bean flower is a vital cause of malformed pods.

Where summer temperatures are high it was found that pods with one bean or two in them resulted from flowers pollinated by pollen grains containing few starch grains. This pollen has a high degree of sterility.

Where there is ample nutrition provided for the bean field by sufficient soil fertilization and water the plants are vigorous and grow well and there is less flower drop and fewer malformed pods.

**Harvesting and Yields**

The quality and market value of snap beans are very largely dependent upon the time of picking and the development of the pods. It is important to pick beans before they become too large or the seed has started to swell inside the pod. Some varieties remain longer on the vines without deteriorating than others. However, varieties such as Blue Lake must be watched closely in order to have them harvested at the proper time. It is necessary to pick bean pods carefully and discriminately so as to pick those that have reached suf-
sufficient development but to leave on the vines those pods which are not yet large enough to be harvested. In this way the percentage of lower grades of beans may be reduced to a minimum. In instructing pickers, emphasis is always placed on careful and clean picking to insure high quality and a better grade. It is customary for one picker to pick one side of the row rather than attempt to pick two sides at one time, for in this manner the beans can be picked more thoroughly and there is less pulling of the vines to find the pods.

Studies in bean harvestings would indicate the average adult’s picking to be about 200 pounds per day, with some pickers more than doubling and sometimes trebling that amount.

The following are the bean pod dimensions of the field grades: No. 1 grade, 14\(\frac{1}{64}\) to 21/64; No. 2 grade, 21, 22, 23/64; No. 3 grade, 24, 25, 26/64, and No. 4 grade 27/64 or more. The percentages of grades in a field will vary considerably with the season, variety, soil fertility, moisture conditions, and the ability of the grower to obtain sufficient labor to harvest the crop.

Yields of beans vary largely according to the variety and productiveness of the land. In the survey of costs of producing pole beans (Blue Lake) in the Willamette Valley, yields per acre vary from under four tons to over 12 tons per acre, the majority of growers being within the 8- to 12-ton range. Bush varieties generally yield less than the tall ones. Some varieties such as Topcrop have registered yields almost equal to some of the pole varieties.

Generally the higher the yield obtained the lower the cost per ton.

**Cost Items**

On the basis of the studies stated in Oregon Experiment Station Bulletin 452, the average cost of producing and harvesting an acre of beans was $822.90. The average cost of production and harvesting for all the growers interviewed was $104.60 per ton.

**Prices**

In 1934 the seasonal average price of beans for processing was approximately $47 per ton, in 1942 the seasonal average was $93.20, in 1943 approximately $104.10, in 1946 about $112, in 1948, $123.30. These are average prices for the three grades of beans.