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PRODUCTION AND MARKETING OF ONIONS

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By A. G. B. Bouquet

November 1943

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## PRODUCTION AND MARKETING OF ONIONS by

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Onion growing is one of the oldest agricultural enterprises in the state of Oregon. According to authentic records the first crop was planted in 1847 in Washington county, so that crop production has now been carried on for over 95 years.

In the number of carloads grown, the onion is the State's leading vegetable crop, being particularly valuable because it can be stored during the fall and winter months and can thereby be sold by the grower according to favorable market conditions. Based on statistics given by the United States Department of Agriculture, there were approximately 3800 acres of onions in the state in 1942. For the ten-year period of 1931 to 1940 the average acreage was approximately 2380.

The extent of the industry and its increase in volume is indicated by the fact that shipments from the state in 1925 totaled 518 cars, which had increased to 1448 cars in 1934. In 1941, 2184 cars are reported to have been shipped and 1239 cars for 1942. Most of the acreage of Oregon onions is listed as "late" onions, while there is a small acreage of so-called "intermediates," mostly Bermudas, these terms referring to the time of maturity.

Climatic conditions. Onions can be grown in almost any part of the state where the growing season is long and warm enough for the bulbs to mature properly. If produced from seed it will ordinarily take about five months and sometimes slightly more until the crop is ready to be harvested. If onions are produced from onion sets or transplanted plants, the time will be shortened by one and a half to two months. This is true, for example, in the growing of Bermuda onions, in the production of which most of the crop is grown from transplanted plants. A dry fall season, particularly in September, is most desirable for proper curing. Rains during this period interfere with curing and may be largely responsible for onions going into storage in poor condition. Mildew, which is a disease that ordinarily occurs during late summer or early fall, has appeared in some seasons during the late spring and early summer, induced, no doubt, by rains in May and June. In irrigated areas dry summers are of no particular consequence but in unirrigated districts a long spell of drouth may be responsible for small-sized bulbs and serious attacks of plants by thrips.

In warmer areas of the state, such as in Jackson and Malheur counties, Sweet Spanish and Bermuda onions grow well, whereas most of the acreage of the Willamette valley which has milder temperatures is devoted to the growing of Danvers onions. Lack of sufficiently high temperatures

in some portions of the state during the late summer and fall may prevent maturity of the bulbs even though soil conditions are favorable. Onions are hardy enough to do well at a high altitude provided the growing season is not short enough to prohibit full maturity.

Varieties. The Yellow Danvers is most widely grown in western Oregon for commercial marketing. There are various strains of this variety which may differ in the shape, color and keeping quality of the bulbs. It is important in growing onions to plant seed of a strain which has been selected over a number of years for proper shape, good color and keeping qualities. Whether the onions will be uniform throughout the field and mature evenly and have good market characters will be dependent as much on the strain as on the variety itself. The Yellow Danvers onion, as grown in Oregon, has a copper-yellow color, with some strains having some Australian Brown characters in them.

The Australian Brown is a good variety for home use and may be more suitable than Danvers for certain parts of the state. It is a good keeper and is quite widely grown for brown sets.

A limited amount of Bermuda onions are grown, particularly of the Crystal Wax variety. This onion is grown for marketing before the season of the Yellow Danvers and is not suitable for storage. It is usually sold during the late summer and early fall months.

A considerable acreage of Valencia or Sweet Spanish onions is grown particularly well in the irrigated areas of eastern and southern Oregon. This is a large, oval-globe yellow or white onion, having a somewhat shorter season of storage than the Yellow Danvers.

Seed. Onion seed has been produced in Oregon for a number of years by onion growers and consequently most of the commercial crop is grown from state-grown seed which has been selected for good type, long-keeping qualities and productivity. Bulbs of the correct type which have shown the minimum tendency to sprout until well along in the spring have been saved each year and planted for the purpose of maturing seed in the fall. It is important to know the pedigree of the seed which is being planted, for upon the quality of the strain will depend the uniformity, character and grade of the crop.

From 2 to  $3\frac{1}{2}$  pounds of seed are usually planted per acre, the quantity depending upon the variety and the conditions under which onions are grown. Two to  $2\frac{1}{2}$  pounds are usually sown for Sweet Spanish, which, because of being larger, requires more space in the row.

High yields are not obtained from either light or heavy seedings. The grower aims to plant enough seed to have a good stand of plants without thinning, allowing possibly for some reduction of plants through possible attacks of cutworms or maggots. Too close a stand of plants in the row is responsible for small bulbs.

Location of onion lands and soil types. The onion industry had its beginning in the beaver-dam lands of Washington county. While there are comparatively few onions grown on the old beaver-dam lands at the present time yet there is considerable production on Lake Wapato. In more recent years the onion industry has developed largely in the Lake Labish area of Marion county where there are many acres of peat soil, high in organic matter. There have also been fairly recent developments in eastern and southern Oregon, the soils used for onions in these sections being largely of a sandy and silt loam nature.

Counties in western Oregon growing onions include Clackamas, Lane, Marion, Multnomah and Washington. Jackson county is the leading area in southern Oregon and Malheur county in eastern Oregon.

Soils for onions must be well drained, contain a fair to high amount of organic matter, be friable or easily pulverized, and should hold moisture well during the summer or else be of such a character as to be suitable for irrigation. They should also be reasonably fertile. The peat lands of western Oregon have all of these desirable characteristics, being especially high in organic matter, easily worked down to a fine seedbed and hold moisture unusually well during the dry period. Practically all of this type of land now used for commercial onion growing has been artificially drained in the earlier life of the soil with box drains and later on with tile.

Good yields of onions are also grown on sandy and silt loam soils that are moderately supplied with organic matter. In most cases these lands must be irrigated in order to produce a good crop.

Onions grow well at a soil reaction between pH 5.5 and 6.8.

While it may not be considered good practice in general farming for the same crop to be grown on the same land year after year, nevertheless it is true that onions have been successfully grown on the same land for many years. This would be inadvisable, of course, if the soil were infected with pink root.

Preparation of land. The soil should be put in fine condition before seeding in order that a smooth seedbed may be obtained. A relatively firm seedbed is desirable in order that moisture may be present for good seed germination and to assist in root development of the young plants. It is not possible to operate a hand or power seeding machine satisfactorily unless the soil has been worked over a number of times to make it smooth and level. Land must also be properly graded and smoothed for successful furrow irrigation. If possible, a new crop of weeds, just starting, should be killed before seeding.

Seed sowing. Onion seed is often treated before planting in order to check the onion maggot. (See Oregon Experiment Station Circular of Information 295.) In unirrigated sections in western Oregon the rows are usually spaced 14 inches apart. In irrigated areas the rows are spaced 20 inches or alternately 15 and 22 inches or so, the water being led down the wider space between the rows. The usual time of sowing seed is when the soil is in a fine friable condition about the latter part of March to the

second or third week in April, according to the earliness or lateness of the season. It is generally true that the earlier the seeding the better the growth obtained except during an extremely wet spring when the plants may be checked by cold weather and soil. Seeding in May is generally considered too late to mature bulbs properly.

Transplanting plants. Some crops of onions are grown by transplanting plants such as Bermudas. It is important to have clean plants instead of those that might be affected with pink root. In some cases southern-grown plants which have been shipped to Oregon have been affected with pink root, which may seriously endanger the value of onion ground because the pink root disease is more or less of a permanent soil disease. The growing of Bermuda onions is discussed in Oregon Experiment Station Circular of Information No. 93, and the growing of early onion plants is also discussed in Oregon Extension Circular 342.

Soil fertilization. During the older days of onion growing stable manure was plentifully available and was used quite abundantly. Of late years, however, due to the scarcity of manure, growers oftentimes have been forced to use it every second or third year. Even on land that is reasonably high in organic matter manure is desirable in maintaining the organic matter content and helping to increase bacterial count which comes from the breaking down of the manure in the soil.

Cover crops are used by onion growers to add organic matter when turned under in the spring, to prevent the erosion of land during the winter and the waste of leachable plant foods. What kind of cover crops shall be planted will be dependent largely on the type of soil as well as the area of the state where the crop is being grown.

The majority of onion growers are in the habit of using commercial fertilizers to supplement applications of stable manure or cover crops. In order to produce onions economically and with a good yield, it is important to apply fertilizer of a desired analysis and to make the best use of it by proper placement.

Onion bulbs of a 300-sack yield are stated to remove 79 pounds of nitrogen, 31 pounds of phosphoric acid and 75 pounds of potash.

Most of the peat soil is deficient in phosphoric acid and potash, and therefore these elements are given first consideration in determining what fertilizer analysis shall be applied. Analyses of fertilizers used on peat land include 0-10-10, 0-12-18, 2-8-10, 3-10-10, 3-10-20 or a fertilizer in which the ratio of nitrogen to phosphoric acid and potash would be approximately 1-4-6. Of these various analyses probably a 3-10-10 is generally satisfactory for peat land. On some organic soils it is desirable to have some quickly available nitrogen in the fertilizer so that the young plants may be stimulated in growth during the early part of the season. This quantity of nitrogen, such as 2 or 3 percent in the analysis, should have a stimulating effect on the early growth of the plants and will in no way delay the maturity of the bulbs.

On soils with less organic matter but with a higher content of phosphorus and potash than the peat lands, a 1-2-2 or 1-3-3 ratio might be suitable. Phosphorus seems to be instrumental in increasing the earliness of maturity while potash may somewhat delay the maturity, but this may be counter-balanced to some extent by the phosphoric acid. A reasonable application should be 750 to 1000 pounds of complete fertilizer of any one of the analyses mentioned above if broadcast previous to seeding. Some growers have found it desirable to use some fertilizer as a side dressing to the rows after the appearance of the young plants in which case 300 pounds or so of fertilizer would be used per acre.

Weeding, cultivation and irrigation. Cultivation has for its main objective the elimination of weeds and stirring of the soil to keep it in good physical condition. The first crop of weeds is the most important one to be controlled. A thorough stirring of the soil before seeding will rid the soil of many weeds. As soon as the rows of plants can be observed cultivation should take place with a scuffle hoe, hand weeder, or power cultivator.

The roots of the onion plants develop at the base of the bulb and are not widely branched. The root system is neither widespread nor especially vigorous. In general, cultivation should cease when the tops interfere with operations and probably by that time the weeds will have been thoroughly controlled.

Irrigation of the lighter types of onion land is usually done each week or ten days, depending on the type of soil, the water being applied in the wider spacing between the rows. Some onion land is overhead watered but this may contribute to the development of mildew.

Thinning. This operation is seldom practiced for most onions are grown by having the correct amount of seed sown in order that thinning may be avoided. On the loose peat soils onion plants, even though they may be somewhat close together, will have a tendency to make good-sized bulbs by pushing out at the sides of the row.

Insects and diseases. In some cases yields and market quality of onions are considerably reduced by the attacks of such insects as maggots, cutworms, wireworms and thrips. Suggestions for the control of these insects are contained in Oregon Extension Bulletin 551.

Of these insects, the maggot is probably the most serious insect pest of onions in Oregon. It is present everywhere in the state where onions are grown and has caused serious losses in larger commercial plantings. Control of this pest by means of treating the seed with calomel is discussed in Station Circular of Information No. 295. Maggots are more troublesome in wet spring seasons than otherwise. By keeping cull onion piles cleaned up and eliminating such other breeding places, a good deal of injury from maggots can be avoided.

Thrips are usually not troublesome if there is a good stand of steadily growing onion plants with plenty of moisture in the soil so that the onions are not checked in their growth. However, in the early fall, following a long dry spell, thrips may become numerous and troublesome, and when onions are pulled the thrips migrate in large numbers to adjoining crops, oftentimes with serious injury as a consequence.

There are at least four important diseases which attack onions, including smut, mildew, yellow dwarf and pink root. Smut is satisfactorily controlled by applying formaldehyde to the soil at the time of seeding. The formaldehyde, used at the rate of about one gallon to 128 gallons of water, is carried in a tank, held on the frame of the seeder. In some fields there was a reduction in the stand of onions when the formaldehyde treatment for smut was used with calomel-treated seed. This loss was greatest where an excessive amount of formaldehyde was used or when the seed was deep-planted. Where necessary to control both smut and maggot seed should be planted shallow and the required amount of formaldehyde should be used.

Onion mildew is usually not prevalent during dry summers but if the late spring and the latter part of the summer and the early part of the fall should be moist and warm, mildew is likely to develop. Suggestions for mildew control are contained in Oregon Experiment Station Circular of Information No. 276

Onion yellow dwarf is a serious virus disease first found in western Oregon fields during the summer of 1940 and is considered an important menace to onion production in western Oregon. A description of this disease, together with suggestions toward control, is discussed in Oregon Experiment Station Circular of Information No. 233.

Pink root has increased considerably the last few years as an onion disease in the state. It is a soil-borne disease and if it is once found in an area of ground, onions should not be grown thereon for some time. Pink root may be unknowingly introduced into the state on roots of plants that come in from other plant-growing regions, such as in the case of Bermuda onion plants. To eliminate this danger young onion plants for transplanting should be homegrown, if possible, in soil that has shown no signs of being affected with pink root.

Harvesting and curing. Onions are usually ready to be pulled during July for early varieties or in the case of bulbs grown from transplanted plants. Onions grown from seed are harvested the latter part of August through the first two weeks in September, depending upon the variety and district. The maturity of the bulbs can be determined by their development in which they seem to stand partly out of the ground and the tops begin to turn brown and fall over. Two to four rows of onions are pulled and laid in a windrow, all of the tops being placed one way so as to cover and protect the bulb from sunscald. The onions are left in this place for curing from two to two-and-a-half weeks, depending on the weather. Pulling the onions should be done if possible when the weather appears to be

consistently fine and dry. Satisfactory curing depends upon this type of weather. If rains occur during the curing season the onions must be turned over with a rake following the rain. No wet onions should be put into storage but the bulbs must be thoroughly cured in order to keep well. Well-cured onions will have dry necks and the bulbs will have a solid feeling. Onion sacks and crates are used as containers for taking the onions from the field to the storage house. In western Oregon operations either the tops are left on the onions or the bulbs are topped and put into mesh sacks. As the onions with tops on reach the storage house they are dumped on shelves or racks which are described below.

Storage of onions. Storage of onions lasts from mid-September to the last of April of the following year. Satisfactory keeping of onions is dependent on the variety grown, thoroughness of curing, freedom from mildew, and temperatures prevailing during the storage period.

Varieties of onions relate themselves differently in their suitability to storage. For example, according to Magruder and others, in U.S.D.A. Circular 618, the Bermuda variety is rated as poor, Sweet Spanish as fair, Yellow Danvers as good, and Australian Brown as very good.

Thoroughness of curing is dependent on good fall weather conditions and freedom from attacks of mildew in the field.

Both temperature and humidity prevailing inside the storage place have a direct influence on good keeping of onions. As temperatures increase, the earliness of sprouting is hastened but temperature has little effect on rooting. On the other hand, humidity has little influence on sprouting but does increase rooting. A temperature of 32° F. and a relative humidity of 64 percent are said to be most desirable for onion storage. However, in an air-cooled house such temperatures can seldom be consistently provided and oftentimes the humidity is above 65 percent.

Most onion growers in western Oregon have common air storage with houses having double walls for insulation. Onions in such houses are not immune from being frosted in case of cold weather but, if the bulbs are left untouched during such a spell, they will later thaw out, usually with but little, if any, injury. The average freezing point of onions of the globe or half globe type is about 30° F.

Ventilation and air circulation are provided by having intakes of cold air at the sides of the house with outlets at the roof. The best cured onions should go in a certain part of the storage place, as it is likely that they will be the last to come out in the spring. Those onions which are not so well cured should go in a place by themselves to be the first ones sold.

A storage house 32 by 42 feet, having 10 shelves on either side, will have a capacity of about 2000 sacks of onions. A house 40 by 100 feet will have a probable capacity of 5400 sacks or 18 carloads. Some houses are built 36 feet wide with a 12-foot driveway in the center and 12-foot bins or shelves on either side of the driveway. The uprights



extending vertically from the floor to the ceiling are usually made of 4x4-inch material while 2x4's or 2x6's are used as supports for the boards which constitute the bottom of the shelves. On the outside of the shelves are 10 to 12-inch boards for holding in the onions which are piled about 12 to 18 inches high.

Cold storage with a temperature of 32° and a relative humidity of about 64 will keep onions satisfactorily over an extended period.

In saving onions for seed those bulbs which show the least tendency to sprout toward the end of the storage season and which have proper form and color make desirable mother bulbs for planting outside for seed purposes. In endeavoring to determine the best temperature for the storage of mother bulbs, Jones and Emsweller found that, in California, temperatures between 50° and 55° were most suitable. Plants from bulbs stored at this temperature bloomed and ripened their seed earlier and produced higher yields of seed than bulbs stored at higher or lower temperatures.

Topping and grading. Topping is done in the storage house any time during the season or whenever it is desirable to get out a certain amount of onions for the loading of a car. This work is done by a regular onion-topping machine capable of topping about 25 sacks per hour.

A copy of State of Oregon onion grades can be obtained from the State Department of Agriculture at Salem, Oregon. In order that growers may satisfy a critical trade, it is desirable that onions be closely graded and sold accordingly. In view of the variation in varieties and types of onions it would seem desirable to vary the specific grades according to the districts and variety of onions grown therein.

Practically all onions in the state are marketed in open mesh bags of various capacities, including 10, 25, 50 and 100-pound bags.

Yields and values. Onion growers aim to have their land producing a carload to the acre, 300 sacks, or more. Two hundred fifty sacks may be considered to be a fair yield for Danvers while a good yield may be 350 to 450 sacks. U.S.D.A. figures indicate that the average yield per acre of Oregon onions over a 10-year period, 1931-40, was 256 sacks. The 1941 yield was stated as 285 sacks and for 1942 250 sacks. In some cases, particularly with heavily yielding varieties such as the Sweet Spanish, from 400 to 800 sacks per acre may be obtained. Yields will depend very largely upon the variety grown, the stand of plants, freedom from insects and diseases, ability of the soil to produce a good-sized bulb, the amount of moisture available during the growing season and the ability to get the onions properly cured and stored. All of these factors combine to determine what will be the yield per acre.

The season of marketing Oregon onions extends from August the 10th to April 15th or May 1. The Oregon onion crop is marketed widely over various parts of the country, being sold mainly on the Pacific Coast, but also at times in the middlewest and east. 1942 shipments of cars were

made to California, Missouri, Pennsylvania, New York, Louisiana, Minnesota, Texas, Michigan, Colorado, Ohio, Illinois, Massachusetts, Maryland and District of Columbia. The extended distribution is largely determined by the size of the crop in other parts and by prices prevailing in the larger markets. Distribution of Oregon onions has also been made to the Hawaiian Islands, Alaska, Philippines and the Orient.

Large quantities of onions are now finding a market outlet in dehydration plants.

Onions vary greatly in value according to the season of the year, the size of the national crop, supply and demand, etc. During the season of 1942 to 1943 prices paid to growers in the northwestern Oregon onion-growing districts for U.S. No. 1 grade were in August, \$1.35 per hundred pounds; December, \$2.40 to \$2.50; in March, \$3.10 - according to U.S.D.A. figures.

#### Useful Publications on Onion Growing

Oregon Experiment Station Circular of Information No. 233, "Onion Yellow Dwarf."

Oregon Experiment Station Circular of Information No. 276, "Materials and Sprays Available for Onion Mildew Spraying."

Oregon Experiment Station Circular of Information No. 295, "The Onion Maggot."

Oregon State College Extension Service Bulletin 551, "Vegetable Garden Insect Pest Control."

U.S.D.A. Circular 415, "Some Influences of Freezing on Onions."

U.S.D.A. Technical Bulletin No. 475, "Influence of Storage Temperature and Humidity on Keeping Qualities of Onions and Onion Sets."

U.S.D.A. Circular No. 618, "Storage Quality of the Principal American Varieties of Onions."