Growing

Strawberries

in Washington
Strawberries are Washington's most important berry crop. Over the past 10 years an average of 16,000 tons of strawberries have been harvested from close to 8,000 acres annually. Returns to growers have averaged $5\frac{1}{4}$ million dollars. Washington ranks seventh among the 49 states in strawberry acreage and fourth in total production. Only one state, California, has a higher production per acre.

Most of the commercial strawberry production in Washington is west of the Cascade Mountains. Strawberries are grown commercially in three-fourths of the counties of the state.

Eighty-five per cent of the strawberries produced in the state are sold to processors who freeze them. The frozen berries are used as dessert fruit and to make ice cream, shortcake and ice cream topping, jams and preserves, and other products. The high quality and excellent flavor of Washington-grown strawberries make them ideal for freezing and for fresh market.
SOIL TYPES

Strawberries, like most other crops, do their best in deep, well drained, loamy soils. Light soils, with a high proportion of sand, are better suited to strawberries than heavy clay soils. With sandy soils special care must be taken to keep up the organic matter, provide adequate plant food and maintain enough moisture for good growth and production. A clay layer or hardpan near the soil surface restricts root growth or shuts off the drainage of water in the soil. There should be at least 18 inches of good soil over clay subsoils or hardpan. Highly organic soils such as peat or muck are poorly adapted to strawberry production.

Strawberry plantings on heavy clay soil are likely to be shortlived due to red stele disease and root rots unless resistant varieties are used. Clay soils should be avoided if possible. They can be improved by the addition of organic matter and by surface or subsurface drainage.

SITE LOCATION

Some surface slope is desirable, particularly with the heavier soils. Slopes so steep that they cause erosion or make the use of machinery difficult are poor sites for strawberry plantings.

Spring frosts can, and sometimes do, cut yields by killing blossoms and newly formed fruits. Spring frosts occur most often in low spots, near the bottom of long slopes or on slopes where air drainage may be blocked by trees. Open prairies are also subject to spring frosts. Open slopes where there is free movement of air over and on down below the level of the field are the most frost free.

Strawberries planted on south slopes may get caught by spring frosts because they start growth and produce blooms earlier. South slopes dry out in the summer more quickly than those facing in other directions.

MARKETS AND LABOR SUPPLY

Anyone planning to grow strawberries must consider possible market outlets and a supply of labor for picking. The larger the planting, the greater the consideration that must be given to these problems. Be sure there is a processing plant or an assured fresh market outlet within reasonable hauling distance. Be sure, too, that there are enough pickers available to get your crop harvested on time.

STRAWBERRY VARIETIES

Varieties of strawberries selected for planting should be productive and not seriously susceptible to disease. They should be easily and rapidly picked, and should be especially well adapted to the purpose for which they are grown, either processing or fresh market. In areas of low winter temperatures, hardiness is also important. Where late spring frosts occur, late blooming varieties may escape frost damage.

Most of the varieties that do well and are popular in other sections of the United States have not done well in Washington. They have been lack-
ing in yield, flavor or disease resistance when tested here. Our experiment stations have a constant variety testing program going on to find varieties which are best adapted.

The varieties listed here are grown commercially or have qualities that make them promising as commercial varieties in this state. Other varieties may have merit for a special growing situation or marketing purpose.

**NORTHWEST**

The leading variety in Washington. Grown throughout the state. Excellent for freezing or fresh market, good for canning. Fruit medium large, conic, bright glossy red, firm and well flavored when sugared. Plants vigorous and very productive under best conditions for the variety. Somewhat resistant to virus, but should be dusted for aphids to prevent spread of virus. Susceptible to cyclamen mites, red stele and root rots. Does best on medium-light, well drained, irrigated soils. Blooms and ripens five to six days after Marshall. Escapes frost some years when Marshall doesn’t.

**MARSHALL**

The long-time favorite in Washington, and still an important variety, particularly popular with commercial preserve makers. Grown throughout the state. Fruit large, blunt conic, deep crimson, slightly soft, richly flavored. Plants moderate in vigor and yield, resistant to cyclamen mite, very susceptible to virus, must be dusted for aphid control. Adapted to fairly wide range of soils. Bloom and ripens five to six days after Marshall. Escapes frost some years when Marshall doesn’t.

**PREMIER**

Grown for fresh market in eastern Washington. Plants very hardy, vigorous, fairly productive. Early fruit is large but fruit at the end of season becomes quite small. Berries will be light in color unless allowed to develop full color before picking. Early. Prolific plant maker, grown in matted row.

**PUGET BEAUTY**

(For trial throughout the state.) Excellent for fresh use and preserve making. Fruit medium large to large, mostly long conic and slightly necked, easily picked, medium red, glossy, fairly firm but becomes soft after freezing and thawing. Sweet and aromatic as a fresh berry. Carries flavor over into preserves well. Plants fairly vigorous, productive, fairly resistant to viruses. Resistant to red stele and root rots in some situations, not in others. Adapted to moderately heavy soils with or without irrigation. Blooms after Marshall but ripens at practically the same time.

**SILETZ**

(For trial throughout the state in situations where red stele is severe.) Acceptable as a processing or market berry. Fruit medium to large, blunt, medium red, glossy, Easily picked, core pulls with cap. Plants very vigorous and productive under good conditions. Somewhat resistant to virus. Very resistant to red stele. Suggested for trial where red stele is a problem.

**EARLI DAWN**

(For trial in eastern Washington.) Plants hardy, vigorous, very productive. Fruit large, bright red, short conic, uniform, firm. Flavor tart but good if well ripened. Early—just ahead of Premier, about a week ahead of Pocahontas and Dixieland. Harvest period is short, usually two to three weeks. Requires fertile soil for matted row.
**DIXIELAND**
(For trial in eastern Washington.)
Excellent for fresh market. Plants vigorous, productive. Fruit very firm, large, long conic, light, bright red, attractive. Medium early.

**POCAHONTAS**
(For trial in eastern Washington.)
Excellent for fresh market. Fruit firm, medium to large, bright red, attractive. Plants very vigorous, productive. Prolific plant maker, grown in matted row.

**EVERBEARING STRAWBERRIES**
Everbearing varieties are not commercially important in Washington. Several varieties are grown for home use and to a very limited extent for local markets. They are Red Rich, Rockhill, Gem, Streamliner, Superfection, Twentieth Century and Utah Centennial. Breeding and selection work is in progress to produce a productive variety of good flavor and handling quality.

**PREPARING FIELDS FOR PLANTING**
build up the soil and cut weed control costs

A soil improvement program on land to be planted to strawberries will pay out in the long run. Little can be done during the life of a strawberry planting to build up the soil. You may have soil that is in unusually good condition from having been in pasture, hay or other soil improving crops. If not, it should be built up by applications of manure or by growing green manure crops. In many instances it will be worthwhile to devote a full year or more to building up the soil. Suggestions as to crops and their management are given in the section on rebuilding strawberry soils beginning on page 17.

**PREVENT WEEDS, DISEASES**
Noxious weeds such as quack grass, Canada thistle or sheep sorrel should be eliminated before planting strawberries. There are no known chemicals that will kill these weeds in strawberries without injuring the strawberry plants. Strawberries should not be planted on ground that has had tomatoes or potatoes on it the previous year because the soil may have been infected with Verticilium wilt by these crops.

**PREPARE SOIL CAREFULLY**
Soil for strawberries should be given the same careful preparation that would be given it for any other row crop. If a high percentage of the plants are to survive and grow well, the soil must be well worked, firm and moist when the plants are set. If the planting is to be done by machine, a smooth, even surface is essential in order to get all of the plants set at the right depth. This is particularly true when the planter is mounted on the tractor with a rigid hitch.

Ground that has been in sod should be cultivated or cropped at least one season in order to break down the sod and kill out the grass completely before planting to strawberries. A soil insecticide such as aldrin, heptachlor or chlordane should be worked into the top 6 inches of soil before planting. This will protect the planting for three or four years against most species of strawberry root weevils, wireworms and other soil insects but will not control the raspberry bud weevil (*Nemocesthes* sp.). Ask your county agent for details on materials and rates.
Both matted row and single hill plantings are used successfully in Washington. The matted row is by far the more common at present.

**MATTED ROW SYSTEM**

Plants are usually set 30 to 36 inches apart in rows 42 inches apart for the matted row system in western Washington. In eastern Washington plants are set 24 to 36 inches apart in rows 36 inches apart. Runner plants are encouraged to fill in the spaces to make a row 12 to 14 inches wide.

**HILL SYSTEM**

For the hill system, plants are usually set 18 to 24 inches apart in rows 36 inches apart. No additional plants are allowed to grow. Runners are cut several times each summer, usually with sharp hoes. On some of the larger plantings mechanical runner cutters are now being used.

In some instances plants for the single hill system are planted 3 feet apart in the row. One or two runner plants are allowed to develop and are set by hand in the row between the original plants.

Some variations of the hill system are being tried. Using a larger number of plants per acre has increased yields substantially in some situations, particularly in the first year of harvest. One way to increase the number of plants per acre is to set them closer together in single rows. Distances as close as 12 or even 9 inches are being tried. Another variation of the hill system being tried is the use of double rows with plants alternated as illustrated below.

This system has 48 inches between the centers of double rows, 18 to 24 inches between hills in each row. The double rows are 9 to 12 inches apart. It requires from 11,000 to 14,500 plants per acre.
Matted row planting. Left, plants set in the spring and photographed in August. Right, how a two-year-old planting has filled in from the runners.

More research and experience is needed to show what number of plants per acre and which plant spacings will be most productive and economical. County agents will have this information as soon as it is available.

**PLANTS NEEDED PER ACRE**

You can figure the number of plants per acre for any spacing by dividing 43,560 by the number of square feet for each plant. Be sure to allow space for roadways, packing or loading platforms, ditches, and room to turn machinery at the ends of the rows. Here are the number of plants required per acre for the spacings most commonly used:

- **36 inches between rows**
  - 18 inches between plants, 9680 plants per acre
  - 24 inches between plants, 7591 plants per acre
  - 36 inches between plants, 4840 plants per acre

- **42 inches between rows**
  - 30 inches between plants, 4986 plants per acre
  - 36 inches between plants, 4149 plants per acre

**SELECTION OF PLANTS . . .**

certified plants are disease free

Strawberry plantings are usually expected to last through three or four years of harvest. The better the plants you use, and the better the care you give them, the longer the planting will last and the more productive it will be. Buying certified plants is the best assurance you can have that they are free from any serious disease or insect damage. In order to be certified, the fields from which plants are taken must have been inspected several times during the growing season by representatives of the State Department of Agriculture. The plants are also inspected at the time they are dug and prepared for storage or delivery.

Most of the strawberry plants grown for sale in Washington are dug in late winter, before growth starts. They are usually sorted, trimmed, packed in bundles of 25 plants each, placed in cartons of 1000 plants and kept in cold storage until planting time. They make excellent planting stock if they go into storage in good condition, are stored at constant temperatures near freezing, and are kept from drying out.
Plants can be dug and replanted immediately. If you have a source of good, disease- and insect-free plants that can be purchased on this basis, they will start quickly and grow well. Select well-rooted plants from last year's runners. Trim the roots to 4 or 5 inches.

There is some danger from shipping in plants from other states. Unless you can be sure they were grown under the supervision of a sound certification program, you may introduce viruses or other diseases that will become seriously troublesome.

CARE OF PLANTS . . .

keep them cool and moist

Planting should be done just as soon as possible after the plants come out of cold storage. A delay of more than a day may weaken the plants unless you make special effort to keep them cool and prevent them from drying out.

Don't leave strawberry plants packed in boxes or crates without refrigeration for more than one day. They may heat, mold or rot.

If you can't plant your strawberry plants immediately, heel them in where they will be out of the way and can be kept moist. Break the bundles of plants and spread the roots out enough in the row so that soil moisture can get to all of them. Cover the roots well and press the soil down against them. Don't leave any roots exposed to the air. Water them if necessary.

When you take your plants to the field keep them in the shade and out of the wind. Sprinkle water on them if there are any signs of drying.

SETTING THE PLANTS IN THE FIELD . . .

soil just over top roots

Set the plants in the ground so that the soil just covers the tops of the roots. Spread the roots out so that soil comes in contact with as many roots as possible. Be sure that the soil is pressed down firmly around the roots. Watering the newly set plants will pay dividends any time the soil is dry enough to work well.

TIME OF PLANTING

Spring planting is the general practice among commercial strawberry growers in Washington. Good plants are seldom available in large quantities in the fall. In western Washington, weed control through the first fall, winter and early spring would be an added expense. In the colder areas of eastern Washington, alternate freezing and thawing may damage newly set plants by heaving during the winter.

Take advantage of early spring moisture and coolness to get your strawberry plants well established before warm, dry weather comes. March and April in western Washington, and April in eastern Washington, are the best times to plant. Pick a period of cool, cloudy weather to do your planting if you can, rather than planting on bright, warm or windy days.
PLANTING SUCCESS
The success of your strawberry planting operation depends primarily on five things.
1. Well prepared soil.
2. Plants that are in good condition.
3. Setting plants at the right depth.
4. Moist soil, well firmed around the roots.
5. Planting early enough to get the plants established before warm, dry weather. The earlier or quicker your plants get started, and the faster they grow the first season, the heavier the production.

Plants must be set at the correct depth. The plant at the left is too shallow. The center plant is set at the right depth. The plant at the right is too deep. The soil should just cover the tops of the roots.

THE PLANTING OPERATION . . .
by hand or machine

MACHINE PLANTING
Machine planting of strawberry plants has become common on acreages large enough to justify purchasing or renting machines. The planting machine must be pulled slowly enough for the workers on the machine to set the plants in the right position in the planting mechanism. Having the planter adjusted so that the plants are set at the right depth is also important.

The field should be well leveled for machine planting. If the planter is mounted on the tractor with a rigid hitch the planter will be forced deeper or shallower each time the front wheels start up or down a hump or dip. Most of the newer machines have a flexible hitch. Straight, even rows are essential for cultivating, fertilizing, dusting and other tractor-powered jobs.

The soil should be loose enough for the planter to operate at an even depth, getting the roots well down into the soil. It should not be too loose or fluffy. The packer wheels on the planter must firm the soil down well against the roots, firmly enough so that the plants cannot be easily pulled from the soil by hand. It is a good idea to have one or two workers follow the planter to see that there are no skips and that all of the plants are properly and firmly set.

Most planters are equipped with tanks and measuring devices to water each plant as it is set in the ground. If you are not going to irrigate immediately after the planting, water the plants as they are set.

In western Washington some growers use a starter solution made by adding 1 quart of 52 per cent phosphoric acid to each 25 gallons of water. It is applied at the rate of 1 cup per plant.

PLANTING BY HAND
For hand setting, the field should be marked off in both directions. This will make it possible to line the plants up for cultivation either way.
The fastest and best method of setting plants by hand is with a spade. Two people are required to do the job. One handles the spade. The other carries and sets the plants. The worker handling the spade shoves it into the ground about 6 inches and pushes it back and forth to open a hole. The plant setter slips his hand into the hole with the roots of the plant spread fan-like across his fingers, pushing the roots well down into the hole. The plant setter then lifts the crown to the right level and removes his hand. The worker handling the spade lifts out the spade without disturbing the roots; then, with a couple of short strokes with the spade, he works soil over against the roots and presses the dirt down firmly with the toe of his shoe.

If the plants are to be watered, a third person can be added to the planting crew. He should pour about a cupful of water around the roots of each plant as it is brought into final position by the plant setter.

Care and time to do a good job of planting is less expensive than having to go over the field to replace plants.
SUMMER CARE OF YOUNG PLANTINGS . . .

help plants build up reserves early

As soon as the plants have become established they should be fertilized. Kinds and amounts of fertilizer are discussed on page 15.

One of the most important jobs the first year is to keep the planting free of weeds. Cultivation and hoeing should be shallow so as not to disturb strawberry plant roots. Chemical weed control can do much to eliminate the cost of hand work. Get information on materials, timing and rates from your county agent.

Strawberry plants should not be allowed to set fruit the first season. Much more will be gained by directing the vigor of the plant into growth than by producing a few fruits. Remove the blossom clusters as soon as they appear. This can usually be done as the plants are given their first hoeing.

TRAINING THE PLANTS

If the strawberry planting is to be handled as a matted row, the runners should be trained into the row. This is done with cultivators for the most part. It is best if the cultivators can be run along each row in the same direction at each cultivation after the runners get started. This will avoid dragging the runners back and forth. The runner plants should be encouraged to root just as early as possible. Those that root the earliest will produce the biggest crop the following year.

Varieties that are prolific runner makers may make too dense a mat of plants if all runners are pulled into a narrow row. This can be avoided to some extent by letting the late runners set over a wider row width and narrowing the row down at the end of the growing season.

If the planting is to be handled as single hills, the runners should be cut several times during the season. Cut them off before multiple leaves, crowns and roots develop at the ends of the runners. Sharp hoes are usually used when runners are cut by hand. Mechanical runner cutters are being used satisfactorily by some growers.

HARVESTING THE CROP . . .

pick according to market needs

For highest quality, strawberries for processing must be picked as they ripen and reach the peak of their flavor. For fresh market they are picked just ahead of full-ripe. They are then firm enough to stand the handling and not overripe when they reach the consumer.

HOW TO PICK

For processing, the berries are picked with the hulls or caps off. To do this, hold the stem and hull with the fingertips of one hand. Grasp the berry lightly with the fingers of the other hand and pull free with a slight twist.

For fresh market strawberries are picked with the hulls or caps on. Hold the stem with one hand. Put the other hand over the berry and grasp the stem next to the cap. Break the stem as close to the cap as possible, catching the berry in the palm of the hand.
To pick berries for processing, slip off the hull.

Most berry fields should be picked every two to three days in warm weather and at least every four to five days in cool weather. Eight to ten good pickers per acre may be needed to keep the field picked in warm weather. In cool weather, four to six pickers may keep your field clean. Picking the berries early in the day helps keep them firm and reduces damage. It also gets them to the packer in plenty of time to be processed during each day’s run.

**HAVE ENOUGH PICKERS**

For a successful berry harvest it is important that you have enough pickers, give them the training and supervision they need, and provide them with cool, clean drinking water and adequate toilet facilities. Having a shady area near the field where pickers can eat lunch and rest if they tire out quickly is a decided advantage.

Growers that have large acreages must devote some time to recruiting pickers. This can be done, in part, through ads in local papers or over radio and TV or through local labor offices. Many growers keep names and addresses of prospective pickers and send out cards or letters ahead of harvest each year. The use of buses or trucks to take pickers to and from the fields is a common practice. It is a necessity if pickers are to come from considerable distances.

It is important that each picker know what is expected of him—what he is to do and how to do it. What degree of ripeness, how full to fill the
boxes, what to do with rotten fruits or small berries must be explained. Be sure that your pickers know how to move along the row, work over the plants and hold the berries to get them picked with the most speed and the least damage to berries and plants. Having someone to help each new picker get started will pay dividends by the end of the season.

**SUMMER CARE OF BEARING PLANTINGS . . .**

What happens to your strawberry planting after harvest has a lot to do with the following year’s crop. Summer and fall is the time when the plants build up food reserves and form the fruit buds for next year’s crop. The single crop varieties which make up the commercial plantings in Washington tend to go into a semidormant or rest period following harvest. The quicker you can get them into renewed activity and growth, the better will be the following year’s crop.

**CLEAN UP AFTER HARVEST**

Where irrigation is available, or where there is enough moisture for plant growth, the strawberry planting should be cleared of weeds, fertilized and irrigated as soon after harvest as these operations can be carried out. Matted rows should be cut down to 10 or 12 inch widths before fertilizing and irrigating.

If you don’t have irrigation, and the soil in your berry planting is too dry for plant growth, more time can be taken to carry out the clean-up and fertilizing operations. Be sure that you get them taken care of in time to take advantage of late summer and fall rains. Give your plants every possible advantage so that they will make every bit of growth possible through the summer and fall.

Some growers mow and rake off the tops of the strawberry plants and weeds at the end of harvest. If the strawberry leaves are browned and have little life, mowing should not damage the plant. Where the leaves are fresh, green and active, the plants will be set back.

Matted rows are usually narrowed down by a rotary-type cultivator or sharp disk attachment on the tractor that cuts the plants from both edges of the row, leaving the centers intact. Care should be taken to move the soil back against the shoulder of the row.

**IRRIGATION . . .**

Irrigation is a necessity in most parts of eastern Washington if good yields of strawberries are to be produced. In western Washington, irrigation will increase size and yields of strawberries materially most years.

No specific guide can be set up to go by in determining how often or how much to irrigate strawberries. Light, sandy soils may hold less than an inch of usable water per foot of soil depth. Medium-textured soils may
hold 2 inches and heavy soils as much as 3 inches of usable water per foot of soil depth. Light, shallow soils must be irrigated more often and with smaller amounts of water because the soil water is depleted more quickly. Highest yields are produced if the moisture in the root zone is not allowed to become less than half of what the soil will hold.

**IN WESTERN WASHINGTON**

In western Washington, 2 acre inches of water or more are needed each month through the summer. This includes both rainfall and irrigation.

Good soil moisture is especially important just before and during harvest for producing a good crop of large berries. Many growers in western Washington hesitate to irrigate at this time because of the likelihood of increased rot or mold. If irrigation is necessary during the harvest period in western Washington, water should be applied as soon as the field has been gone over by the pickers, before the berries have ripened any more. This will probably mean irrigating at night and the plants may dry off early the next day. The use of fungicides during bloom and harvest will materially reduce the amount of rot most years.

**IN EASTERN WASHINGTON**

In eastern Washington, 2 to 5 inches per month are needed in April and May, 7 to 10 inches per month in June, July and August, and 2 to 4 inches in September. This includes both rainfall and irrigation.

During hot weather in eastern Washington, irrigation should be increased to avoid wilting of the plants. Otherwise good berry size cannot be maintained.

Soil moisture must be kept up through the summer and fall, after harvest, if the strawberry plants are to build up the strongest possible reserves and a heavy set of fruit buds for the following spring.

**FERTILIZING BEARING PLANTINGS . . .**

The high value of the crop harvested in relation to fertilizer costs makes it economical to fertilize strawberries liberally.

**METHODS OF APPLICATION**

Strawberry plants do not have large root systems. Biggest returns from fertilizer are obtained when the fertilizer is placed in the root area near the plants after the crop has been harvested. Put it in a furrow or band 3 to 4 inches deep and as close to the plants as possible in single hill plantings. With matted rows the fertilizer may be placed down each side or right down the middle of the row. If the matted rows are 10 inches wide or wider, half of the fertilizer can be put down the middle and a fourth down each side to advantage. Some plants will be killed or injured by drilling down the middle of matted rows. In heavily matted rows, killing some of the plants and reducing competition will be beneficial.

If equipment to put the fertilizer in the soil is not available, scatter the fertilizer on the soil near the plants in single hill plantings. Work it into the soil with a cultivator. With matted rows, scatter the fertilizer over the row if placement equipment is not available. Irrigate it in if you can.

Most western Washington soils tie up or fix phosphorus. This means you should band phosphorus because fer-
tilizer that is broadcast and mixed with a large quantity of soil is tied up much more rapidly than if it is concentrated in a band and exposed to a much smaller quantity of soil.

Fertilizers applied in the spring are of little value to strawberry plants that were able to build up reserves and fruit buds in the fall. Application of too much nitrogen in the spring is likely to produce heavy foliage, soft berries and increased rot. On some of the lighter, coarser soils, or in case of winter injury to the plants, light applications of not more than 20 pounds of actual nitrogen per acre in the spring might be beneficial.

**FERTILIZER NEEDS**

Soil tests are the best guides to strawberry fertilizer needs. They are particularly valuable in determining the fertilizer program for new plantings. Mailing boxes and instructions for taking soil samples to be tested at Washington State College are available at your county agent’s office. Without such tests it is not possible to make fertilizer recommendations that will be right for the wide variety of soils on which strawberries are grown in either western or eastern Washington. The following table will serve as a general guide to strawberry fertilizer needs per acre. Your soil may need more or less, or a different combination of fertilizer elements than suggested here.

Liquid and dry forms of fertilizers are just about equal in effect, pound for pound of plant food. Your choice between the two forms should be decided by the cost and convenience of getting a given quantity of plant food where your strawberry plants can use it to best advantage.

**BORON MAY BE NEEDED**

Especially south of the Lewis River, but also in some other areas of western Washington, the soil may lack boron. Yields and vigor are reduced by too little boron. In severe cases of boron deficiency some of the young leaves will be blackened across the tips. As these leaves grow, they become puckered because the cells at the edge of the blackened area don’t grow. Fruit may be rough and misshapen from boron deficiency.

Soil analysis for boron is available through the soil testing laboratory at Washington State College. This test is the surest way of finding out whether or not your soil needs boron. If you want a boron test run, be sure

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### Strawberry Fertilizer Needs Per Acre

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<thead>
<tr>
<th>YEAR</th>
<th>WESTERN WASHINGTON</th>
<th>EASTERN WASHINGTON</th>
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<tbody>
<tr>
<td>Year plants are set</td>
<td>600 lbs. 5-15-10 as soon as plants start growth</td>
<td>100 lbs. ammonium nitrate, or its equivalent, as soon as plants are started</td>
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<tr>
<td>Year of first crop</td>
<td>Non-irrigated upland soils 500 lbs. 6-20-20 after harvest</td>
<td>200-400 lbs. 16-20-0 after harvest</td>
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<tr>
<td></td>
<td>Irrigated upland soils 600 lbs. 10-20-20 after harvest</td>
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<td></td>
<td>Bottom land soils 600 lbs. 5-15-10 after harvest</td>
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<tr>
<td>Year of second crop</td>
<td>Same as first crop year</td>
<td>400-800 lbs. 16-20-0 after harvest</td>
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<tr>
<td>Year of third crop</td>
<td>Same as first crop year</td>
<td>Same as second crop year</td>
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to make a special request for it when you send the soil sample to the Col-
lege.
If boron is needed, broadcast one of the boron-containing materials in the late winter or early spring at a rate that will provide 2 pounds of actual boron per acre. Liquid or sol-
uble forms that can be applied as a spray are available. It may be neces-
sary to apply boron each year where it is most severely lacking. Strawberry plants can be injured by too much boron. Don't exceed the rate of 2 pounds of actual boron per acre. Don't band boron fertilizers.

**WEED CONTROL . . .**

Hoeing and cultivation should be shal-
low to avoid damage to the roots of the strawberry plants. Hoe or cultivate only as often as needed to control weeds.

**GEESE AS WEEDERS**

Geese are used by some strawberry growers for the control of grasses, chickweed and sand rush. They will not keep strawberry plantings free of all weeds. Geese may do some dam-
age to young strawberry foliage, buds or small berries if they are fenced in with too little to eat. They must be removed from the strawberry field before the first berries start to ripen.

The number of geese used per acre varies, but is usually from two to four. They must be provided with drinking water and some feed, in addition to the weeds they eat. Young geese that are still growing are best.

**MULCHES . . .**

Hoeing and cultivation should be shal-
low to avoid damage to the roots of the strawberry plants. Hoe or cultivate only as often as needed to control weeds.

Mulches may be of considerable value in holding soil moisture and preventing the soil from packing. A wide variety of materials such as hay, straw, sawdust, shavings, wood chips, pea vines and strawy manure can be used. Two to three inches of the heavier materials like sawdust or chips or a little more of the lighter materials is suggested. If the mulch is to be kept for the life of the planting, additional materials should be added each year or two. A little extra nitrogen may be needed to offset the break-
down of some of the woody or strawy materials. Right after planting is a good time to apply the mulch.
PLASTIC FILM

Black film plastic is now being used to some extent as a mulch for strawberries grown in the hill system. It is effective in keeping down weeds in the row and conserving moisture. In some situations it helps to keep the berries clean and reduces rot or mold. Some scalding of berries on or close to the plastic occurs in bright, warm weather. The use of plastic mulch may cause earlier growth and expose blossoms to frosts when, without the plastic, bloom would be late enough to escape. When plastic is used it is laid down over newly set plants. Dirt is pulled over the edges of the plastic to hold it in place. Slits are cut with a razor blade or sharp knife and the tops of the plants are pulled through. Cost of the plastic is estimated at $150 to $175 per acre. Runners must be cut off the plants with knives or shears.

TO PROTECT FROM COLD

Mulches are not needed for protection from cold weather except in the coldest portions of the state. If mulch is needed for protection from cold, spread on enough to keep the soil from freezing or thawing quickly. Four to six inches of coarse hay or straw should be enough. Spread it over the field after the plants have become dormant in the fall, at the time the ground freezes. This is usually during November. The mulch should be taken off about the time growth starts in the spring. Some of the mulch may be left on to keep the berries clean or to conserve moisture. If very much of it is worked into the soil, extra nitrogen should be added to offset that taken from the soil to break down the much.

INSECTS AND DISEASES . . .

control is important

Strawberries are subject to the attack of several insects and diseases. Research is going on constantly at our experiment stations to find better, more economical methods of control. Your county agent has the most up-to-date information on materials, rates and timing.

REBUILDING STRAWBERRY SOILS . . .

with winter cover and green manure crops

Three or four yearly crops of berries are harvested from most commercial plantings of strawberries. Unusually vigorous plantings that are free from disease may last longer.

When the crop has been harvested in the last year of production, the field should be plowed or disked out. If there is enough soil moisture, or if irrigation is available, a green manure crop can be planted immediately. Rye will make the most growth, but other grain crops can be used.

Winter cover or green manure crops should be started in September. If a summer crop has been grown it should be disked and turned down. Abruzzi rye grows better in the cool weather of fall and early spring than other varieties of rye or other grains.
In eastern Washington, hairy vetch should be used with the rye as a winter crop.

At least one full year should be taken to rebuild land taken out of strawberries. If it must be replanted to strawberries the following spring, the winter crop should be disked and plowed down as early in the spring as possible—not later than mid-April—and the ground prepared for the berry plants.

SECOND SEASON PROGRAM

If a second season can be taken to rebuild the soil, the additional crops grown and worked in the soil will add to its production through the life of the next planting. The second season's green manure crop can be one of the spring grains with Austrian winter peas, spring grains alone, or corn. Corn produces a large amount of organic material. Being a cultivated crop, there may be some advantage in the elimination of weeds.

The corn can be sweet corn for processing or fresh market. One of the silage corns would produce more organic material than sweet corn. That would be of greater benefit to the soil in the long run. Regardless of the kind of corn used, it should be disked and plowed down after it has reached full growth but before the stalks ripen or become tough and woody.

A second winter cover crop of Abruzzi rye (western Washington), or Abruzzi rye and vetch (eastern Washington), can be planted in September of the second fall to be turned under the spring before replanting to strawberries.

FERTILIZE GREEN MANURE CROPS

Fertilizing the green manure or winter cover crops will pay good dividends. Fertilizers will increase the volume of organic matter, will help break down the raw material and will add to the general soil fertility. Plant foods taken up by the cover or green manure crops are made available over a long period of time. They are not leached from the soil as rapidly as the more soluble materials in commercial fertilizers. Western Washington soils do not tie up or fix phosphorus from green manure crops as much as they fix the phosphorus from most commercial fertilizers.

Five hundred pounds per acre of 10-10-10 fertilizer should be applied, at seeding, to each planting of rye or grain used for a green manure or cover crop in western Washington. Two hundred fifty pounds of sulfate of ammonia per acre or its equivalent should be used with each cover or green manure crop of rye or other grain in eastern Washington.

Seeding Rates for Green Manure or Winter Cover Crops

<table>
<thead>
<tr>
<th>CROP</th>
<th>POUNDS PER ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye, wheat or oats, planted alone</td>
<td>100</td>
</tr>
<tr>
<td>Rye, wheat or oats, with vetch or peas</td>
<td>80</td>
</tr>
<tr>
<td>Hairy vetch, with rye</td>
<td>20</td>
</tr>
<tr>
<td>Austrian winter peas, with spring grain</td>
<td>70</td>
</tr>
<tr>
<td>Hairy vetch alone</td>
<td>35</td>
</tr>
</tbody>
</table>

THREE YEAR PROGRAM

If three years or more can be taken between strawberry plantings, perennial grasses and legumes can be grown to advantage. Roots of some of the perennial crops go much deeper and develop a longer lasting type of organic matter. The cost of repeated seeding and turning under is eliminated.
Growing Strawberries in Washington

Start with the best plants possible

Use certified plants. They are free from virus diseases that can cut yields and shorten the lives of strawberry plantings.

Keep your plants in good condition until you get them in the ground. Don’t let them dry out, mold or heat.

Get them off to a good start

Build up your soil with manures or cover crops. Do a good job of preparing it for setting the plants.

Set your plants at the right depth so that the crown is just above the soil surface. Press the dirt firmly against the roots. Water the plants right after setting.

Fertilize for fruit buds

Fruit buds are formed in the late summer and fall for the following year’s crop. Fertilize new plantings as soon as the plants start to grow. Fertilize old plantings soon after harvest.

Control pests and diseases

Get copies of the latest, most up-to-date information from your county agent on—

Insect control.
Disease control.
Weed control.