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The Colorado Raspberry Industry

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A good type of Cuthbert raspberry bush.

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# THE COLORADO RASPBERRY INDUSTRY

By R. S. HERRICK AND E. R. BENNETT.

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The raspberry is one of the best known small fruits. In its wild state it has been used as food since the beginning of history. This fruit belongs to the family of brambles of which there are many hundred species. The raspberries of commerce are mostly included in three species. These three species are divided between two quite distinct types, the reds and blacks.

The European red raspberry, *Rubus Idaeus*, is little grown in this country. The fruit is similar to the American red raspberry in appearance, of better quality, but the plants are less hardy. The early attempts at red raspberry culture in this country were largely confined to the development of this species but these have never succeeded because the species is not adapted to our climatic conditions.

The American red raspberry, *Rubus strigosus*, is of comparatively recent domestication. In the wild state it is found more or less over the northern and eastern United States. One variety of this species is native in the higher altitudes of the Rocky Mountains. This wild raspberry of the mountains is far superior in quality to the domesticated berry or to the wild berry of the East. Up to the present time however nothing has been done to improve or acclimate the berry to cultivated conditions.

The black raspberry, *Rubus occidentalis*, is also native to the northern and eastern United States. The black raspberry of commerce is practically the same as the wild berries of the fields. This species is commercially the most important of the raspberries.

Another species, *Rubus neglectus*, is a hybrid of the American red and black raspberry. This species is relatively unimportant. It is represented by what is known as the purple cane berries.

The raspberry has reached its greatest commercial importance in the northeastern states. This is because the fruit demands a cool climate and a loose, moist soil with an abundance of humus. In a wild state both the red and black varieties are found at their best on newly cleared timber lands of the eastern and central states. Land from which timber has been removed in the East is nearly always first occupied by the raspberry brambles. After the surface humus becomes more or less exhausted these bushes disappear.

The great drawback to raspberry growing either in a wild or cultivated state is the droughts that are apt to occur at time of ripening. For this reason the culture of this fruit has been to a great extent confined to those regions of sheltered timber lands and plenti-

ful rainfall. The red raspberry seems to be as much at home in the burned over timber lands of the high altitudes of Colorado as in Michigan; consequently we may conclude that the soils of Colorado are as well adapted as in the eastern states.

Comparatively few diseases attack the raspberry in the dry climate of Colorado. The yield and quality of fruit is equal or superior to that of the East.

Raspberry growing has become one of the important industries in several districts of Colorado and it gives promise of proving even more valuable in the future because the conditions for the best development of fruit may be more readily met on the irrigated lands of Colorado than in the uncertain climatic conditions of other parts of the country.

### REQUIREMENTS.

Although the raspberry is one of our fruits that can be raised in most any section of the state up to an altitude of ten thousand feet and in various kinds of soil, there are certain requirements that, if followed, will insure its success.

*Soils.*—The native raspberry of the state is found on mountain sides where there is a good supply of humus. The cultivated plant is grown in soils ranging from a light sandy loam to a heavy clay. On investigation it has been found that the earlier fruit is on the sandier soils, but the better production comes from those plants growing in a heavier soil such as a clay loam. The sub-soil is an important matter as regards drainage. The best subsoil would be that of gravel or sand. With less impermeable sub-soils the site requires more slope to insure proper drainage. The depth of soil that is the best for raspberries is more or less an open question. Perhaps six or eight inches of good surface soil is deep enough for a short lived plantation. There is no doubt but that a soil two or more feet in depth is better for raspberries than a shallower one. The more humus that the soil contains at the time of planting the better will be the result in growth.

*Climate.*—The different climatic conditions which exist in the state necessitates two distinct methods of handling raspberries. In those sections where the temperature falls to several degrees below zero and remains there for any length of time it is necessary to cover for winter protection. In those sections where the temperature never falls to but around zero it is not necessary to cover either the red or black varieties. Then there are other sections where the red varieties have to be covered and the black do not need winter protection. As far as climate is concerned raspberries will stand the most rigorous

climatic conditions of any of our fruits, if covered for winter protection.

*Moisture.*—The raspberry requires a medium amount of moisture for its best growth except during the fruiting stage, at which time it requires a maximum amount. For the most part it is not practicable to raise raspberries in Colorado without irrigation. It might be possible to grow them in certain sections where the rainfall is plentiful as compared to the state's average rainfall but it is doubtful whether or not in those sections there would be moisture enough to insure proper growth during the fruiting season.

If one intends to go into the raspberry business it would be well to select a location where a favorable market could be had quite near at hand. Careful selection of the site is necessary as regards climatic conditions, depth and kind of soil, amount of moisture to be had, etc. A southern slope may be warmer during the winter but it may also dry out quicker, and this is quite an important factor for all fruits.

#### PREPARATION OF THE FUTURE RASPBERRY PLANTATION.

When a fruit plantation of any kind is to be planted on new land it is well at first to get it into the best possible condition. In order to insure the best results it is important that the seed bed be properly made before setting out the plants. Not infrequently fruits of various kinds are set in raw land that has never been plowed except in the rows where the plants were set. In such cases the plants often grow in a stunted way and never acquire the vigor that they should attain.

One of the best crops for growing on raw land is alfalfa. If alfalfa has made a good growth it may be plowed under the second fall and if the soil is poor in humus it would be well to plow under the last cutting. This will do much in bettering the physical condition of raw soil.

It is well to follow the alfalfa with a hoed crop of some kind, such as potatoes, corn, etc. This will help to do away with the weeds and leave the soil in fine condition for planting.

Another reason why land should be cropped before setting out raspberries is that when raw land is first irrigated it most always settles more or less in spots. As irrigation is necessary year after year, it is important that the land has the right slope and has a comparatively smooth surface. The writer knows of no way by which this can be accomplished better than by cropping the land, for two and in some cases four years before setting out fruit of any kind.

Fall plowing is preferable to spring plowing especially when there is a green crop to be plowed under. Earlier spring planting can also be done when the plowing is done in the fall. Irrigation just

before the fall plowing will put the land in a better state of moisture at planting time in the spring.

Plenty of barnyard manure will take the place of a green crop. Perhaps barnyard manure does more good if applied after the plants are set than when used before.

#### DISCUSSION OF VARIETIES.

Although different varieties are more or less localized there are places in Colorado where it is thought that most any kind of raspberry could be grown. In the Loveland district the Marlboro is grown more than any other variety. This is a red raspberry and requires winter protection by covering. At Canon City the black-cap is raised quite extensively. Gregg is the variety most used. Each of these species, that is, the red and black-cap have their advantages. The red raspberry as a rule brings a better price on the market than the black. The black-cap varieties hold up perhaps a little longer in shipment and in many parts of the state do not need winter protection. On the western slope of Colorado the black-cap, red, and the purple cane varieties are found. In some places on the western slope none of these kinds are protected during the winter but it is thought that for the best growth and welfare of the plantation, the red varieties should be covered.

The best red variety for Colorado is undoubtedly the Marlboro on account of its good shipping qualities. The Cuthbert is also a very good variety for home use as it has a better quality and flavor than the Marlboro. Its chief objection is that it is a rather soft berry and will not stand shipment for any great distance. With careful picking and packing the Marlboro will stand up from thirty-six to forty-eight hours depending somewhat on the temperature, while most of the other red varieties go down in from twelve to twenty-four hours. For evaporating purposes the black-caps are better than the red varieties on account of their hardiness. When used for this purpose they can be picked by mechanical means thus doing away with hand picking. So far in Colorado there has been such a demand for raspberries to be used as dessert that it has not been necessary to resort to evaporating. In fact, during the last year there were not enough raspberries raised in Colorado to supply the local market. The following is a list of the different varieties of raspberries which are known to do well in Colorado. The purple cane varieties, as a rule, are the best for canning purposes.

**RED RASPBERRIES.**

Only very brief descriptions are given of the following varieties of raspberries on account of the lack of space; these are given in their order of importance.

**Marlboro.**—This variety is of only ordinary quality but noted for their firmness both on the bushes and hold up well in shipping.

**Cuthbert.**—A good berry for home use, having fine quality but generally too soft for shipping long distances.

**Loudon.**—Canes vigorous, quite hardy, and productive. A good berry for local market or home use.

**Turner.**—This variety is very hardy and vigorous. Fruit, sweet and of excellent flavor.

**Golden Queen.**—In all characteristics this is a Cuthbert except that it bears yellow fruit. A few for home use are desirable.

**BLACK-CAP VARIETIES.**

**Gregg.**—Best known late variety. Very good shipper and an excellent variety for evaporating when picked by hand.

**Kansas.**—Fruit similar to Gregg ripening a week earlier, juicy, of excellent flavor and firm enough to ship well.

**Ohio.**—The great evaporating raspberry of the present day. Quality poor as it is very seedy but yields more pounds of evaporated fruit per bushel than any other sorts.

**PURPLE CANE VARIETIES.**

**Shaffer.**—An excellent canning variety.

**Philadelphia.**—This represents the red raspberry more closely than some of the other purple cane varieties. Propagated by suckers, yields but sparingly.

**Columbian.**—This is of the Shaffer type and ripens a little later.

**PROPAGATION.**

Propagation of the raspberry varies according to which species it belongs. The red raspberries are propagated from the suckers which come up from the parent root. As a rule most of the red varieties throw up enough suckers to insure plenty of young plants. For this reason careful cultivation has to be resorted to in order to avoid injuring the root system of the old plant. For when it is injured it acts only as a stimulant to throw more shoots and often requires a severe pruning to keep them down. The old plant can be separated by division thus obtaining extra plants for planting purposes, but as a rule this is not as good a plan as to use the young shoots with the roots attached.

The black raspberry is propagated by tip layerage. This is done by covering the tips along the latter part of July or the first of August. They take root at this point and generally establish themselves well enough so that the next spring they can be separated from the parent stock by cutting the cane off near the ground.

The purple cane varieties vary somewhat in their mode of propagation according to the variety. The most of them however resemble the black-cap in this respect and are propagated by tip layerage.

## SETTING PLANTS.

It is a good plan to grow the variety which has done the best in that locality. It is better to secure home grown plants when such are available rather than to use plants brought from a distance.

*Age of Plants.*—It is believed that yearling plants are the most desirable for the new plantation. By this we mean those plants which have grown one full season and not those that were started the summer before. In some cases it is perhaps possible to get good stocky plants which were started the summer before but generally these are small and spindling and have a poor root system.

*Time of Setting.*—In Colorado the best time to set raspberry plants is in the spring. This should be done just as early as is possible to avoid any damage from severe frosts. As a rule, the middle of April is a good time. For this reason it is well to have the land plowed the fall before.

*Distances.*—The distances that raspberry growers use in setting out new plantations vary somewhat according to variety and locality. In those localities where the winters are not severe enough to require laying down it is not necessary to plant the rows as far apart as where protection from the winter is required. Where protection is necessary the distance for the red raspberry between the rows is seven feet apart and in the row two feet and eight inches. The distance in the row can be greater than this providing the pin system of laying down is not used. This distance varies from that mentioned up to three and a half feet. In those localities where laying down is not required for winter protection, the distance of five to six feet for the rows and from three to five feet in the rows is used. This enables cultivation to take place both ways. It requires 2333 plants per acre when set two feet eight inches in the row and rows seven feet apart.

The black-cap varieties in those localities where winter protection is not used, should be planted with rows the same distance apart as for the red, that is, about seven feet and about five feet in the row. Where covering of the black-cap is necessary it is better to have them a little closer than this, from three and a half to four feet. This latter distance will require severe pruning of the plants to keep them from forming a hedge row. The purple cane varieties can be the same distances as the black-cap which in habit they so closely resemble.

*Method of Setting.*—A good method of planting is to have the rows staked off the desired distance from each other and plow a deep furrow where the rows are to be set. Set the plants by hand the de-



sired distance in the row from each other and place some dirt around the roots of each to keep them from drying out. The rest of the dirt can be plowed back with one horse. Irrigation should follow as soon as the plants are set in order to keep them from drying out. If cultivation is to be done both ways it would be well to set the plants in check rows. This would lighten the expense of cultivation especially for large areas.

### CULTIVATION AND IRRIGATION.

In those localities where covering is necessary for winter protection there is less need perhaps for an annual plowing as this is done in the fall when covering and in the spring when uncovering. This keeps the soil from forming a hard pan four or five inches below the surface as is often found when only clean cultivation is used. A good rule to follow during the summer is to cultivate after each irrigation except during the fruiting season. This will not only prevent the ground from baking but will often take the place of irrigation. During the fruiting season it is necessary to irrigate some soils almost every other day; for others twice a week is plenty. It is probable that if careful irrigation and cultivation were used during the growing season, it would not be necessary to irrigate so often during the fruiting season. Over irrigation has a tendency to soften the fruit. In running the water between the rows it is not a good plan to have the irrigation furrows too near the plants, as it is hard to cultivate the furrows in when they are too close.

There is a dispute as to whether the plantation should be irrigated and cultivated up to the last of the growing season or whether it is better to allow irrigation and cultivation to cease about the first of August, thus giving the plants a chance to ripen. It is thought that this latter practice is the better. Irrigation can be done the latter part of October or the first part of November. This will enable the plantation to be more easily covered with soil. This late irrigation is also beneficial in keeping the soil moist during the winter.

Cultivation is quite necessary during the growing season to keep down weeds and perhaps more important to keep down suckers in those varieties that are inclined to throw up a great many shoots. Square teeth are used on the cultivator in the place of the round ones in order to cut the shoots off just below the ground. These square teeth can be made by any blacksmith and are one of the best implements to use to keep down suckers. It cannot be emphasized too much that irrigation cannot take the place of cultivation. But on the other hand, it is often possible for cultivation to take the place of irrigation with good results. Frequent hoeing during the season up to the fruiting period is necessary especially where the plants are

not check rowed in order to keep weeds and raspberry shoots from growing in between the hills. It is always better to keep thrifty hills in the row rather than to let them grow together and form a matted row.

### WINTER PROTECTION.

As has been stated before it depends largely upon variety and locality whether or not it is necessary to lay the plants down for winter protection. In the Loveland district all varieties are laid down. In the Canon City district and most places on the Western slope the black-caps are hardy and do not need winter protection, while the red raspberries as a rule are covered.

*Methods of Protection.*—There are two principal methods used by which raspberries can be protected from the winter freezing, namely, that of covering with straw, leaves, etc. and that of covering with earth. As a rule in Colorado the earth covering is the more practical as straw and other material is sometimes scarce.

Raspberries are laid down from the middle of October to the middle of November, depending somewhat on the weather conditions. There are two principal systems used in laying down the plants, namely, first that of pinning, and second that of bending over and throwing dirt on the tips, thus holding them down. The pinning system is done by commencing at the end of the row and pulling the first two hills down so that the tops of each are at the side of the base of the other. They are held in place by pieces of old canes which are broken to about six inches in length and so placed as to hold the canes in a firm position on the right hand side of the base of the plant. In order to do this pinning properly it is necessary to either have canes long enough to overlap when they are laid down or have the hills close enough together. It is always well to have the tops of one plant at the right of the base of the next and to keep this up throughout covering. If this is done uncovering in the spring can be aided by using a right hand plow, to plow at least one furrow away from each row. Another form of holding the plants down until some earth can be placed upon them is that of using a six tined pitch fork and holding the tops in place until earth can be shoveled onto them. By using either the pinning or fork system of holding plants in place, one man can very easily cover his own canes. Placing soil upon the canes to hold them down takes from two to three men. One man bends the canes down and the other two shovel soil upon them. In pulling the canes down into place it is necessary that they lay quite flat on the ground in order to be properly covered, otherwise they are apt to loop in the center causing an air space and the likelihood of their becoming uncovered before spring. See Fig. 1.



Figure 1. Raspberries not properly laid down and covered.

One of the vital phases in the protection of raspberries is that of uncovering in the spring. If uncovered too early they may be caught by late spring frosts and on the other hand, if uncovered late, the buds shoot out into white tender growth which may be killed by hot winds. A good plan would be to commence uncovering to within about one-half an inch of the canes, about the middle of April and to keep this up gradually for some time until the work was completed. This would give a chance for the young growth to harden off so as to resist the change of climatic conditions.

The labor of covering the canes may be facilitated by plowing two furrows on each side of the row before using the shovel. It is a good plan to have a well rounded ridge with plenty of earth on either side to form rather wide bases. This will help to keep the earth from falling off from the top as would be the case with a narrow high ridge. Fig. 2. is an example of well covered rows.

In uncovering the plants in the spring never allow any soil to pile up in the hills or between them, for, if this is allowed it will not be



Figure 2. Raspberries well covered. Note the wide ridges which help to prevent the soil from rolling off of the sides and tops.

long before the rows will be growing on ridges. In order to keep this soil from forming into ridges it is necessary to remove it with a hand hoe from between the hills.

#### PRUNING.

Perhaps no one thing has as much to do with the life of the raspberry plantation as that of pruning.

*Pruning for Red Raspberry.*—It is a good plan to prune out all old canes just after the fruiting season and the following fall cut the main canes from three and one half to four feet in length and also remove any small inferior ones. It is, as a rule, better to leave more canes in the fall than you really need. The next spring when the canes are uncovered take out all canes that have been injured or broken and leave only the better ones in each hill. The number to leave depends on the vitality, etc. of the plants. This can best be determined by practice. As a rule, eight to fifteen canes are enough, when properly selected, for each hill. Where red raspberries go through the winter without covering they should be treated the same as black-caps. But it is thought for most districts of Colorado it would be better to

cover and prune as above stated. Mid-summer nipping of red raspberries causes laterals to be thrown out. As a rule this is not a good practice as these laterals are often broken in covering and uncovering. It is better for the fruiting cane to throw out its lateral in the early summer after it has been uncovered. The figure on the front page is a good type of pruning knife for cutting out the old canes.

*Pruning of the Black-Caps.*—Where the black-cap raspberry does not have to be covered for winter protection the following method should be followed. Cut out all old canes after the fruiting season and at the same time pinch back within three feet of the ground all new canes allowing these to throw out new laterals. In some cases it may be necessary to do this pinching back of new canes before the fruiting season. In this case another pruning is required. It is well to do this before the canes have grown too long. They should be pinched back to from eighteen to thirty-six inches from the ground. In the spring go over each hill cutting out all diseased or broken canes. Where black-caps have to be laid down for winter protection they can be treated the same as red raspberries as regards pruning.

The true purple cane varieties can be treated about the same as the black-caps which they more closely resemble in habit.

#### GENERAL MANAGEMENT.

The question is often asked, "Can raspberries be raised successfully in a young orchard?" This depends somewhat on kind of soil and method practiced. It is believed that with a rich, deep soil and with proper management two rows of raspberries, or in some cases three, depending upon the distance the trees are planted, can be raised in a young orchard for four or five years, or until the trees require a great amount of spraying, etc. Never plant raspberries in the tree row as is shown in Fig. 1. In raising anything in an orchard it must be remembered that the trees are primary and everything else secondary. Raspberries require more water than young fruit trees but it is thought that by keeping the water from the trees and watering the raspberries only for a few years, at least, no damage would result from this practice. Fig. 3. shows a raspberry plantation growing between old apple trees. It shows the stunted effect on the raspberries of over shade and crowding.

*Fertilizing.*—The best way to fertilize a raspberry plantation is to haul manure during the winter in between the covered rows. This manure can often be of a rough nature and in some cases it is thought to be better than when it is fine and well rotted. Perhaps the reason for this is that its physical nature is more valuable than fine manure. When this is placed in between the rows it is covered the next spring by uncovering the hills. In this condition it soon decays and becomes incorporated with the soil.



Figure 3. Raspberries growing in a fifteen year old apple orchard. Note stunted effect on the raspberries next to the trees.

*Life of Plantation.*—Eastern authorities claim that the best results are obtained when the plantation is not allowed to grow longer than six or seven years. In Colorado it is thought that with the proper management and care a raspberry plantation will last from twelve to fifteen years. There are in the Loveland district at the present time plantations twelve years old and these seem to be as thrifty as younger ones. It is hard to give the life of a plantation as this depends largely upon the care given it.

#### YIELDS.

Yields for the raspberry plantation vary somewhat from year to year, it depends largely on the vigor and growth of the plant. An average yield for the black-cap raspberry is two hundred and seventy crates per acre; that of the red varieties is about three hundred seventy-five crates per acre. When we speak of crates we mean those which contain twenty-four pint boxes. In some cases the black raspberries are crated in quart boxes but unless for local market it is better to place them in pint boxes as the raspberries will hold up better. As a rule

the raspberry plantation will not come into bearing to any great extent until the third season.

### HARVESTING.

Unless raspberries are picked for evaporating purposes they are picked direct from the bushes into pint boxes; these are placed in a hand carrier which holds six boxes and carried direct to the packing house. It has been found that carriers holding not more than six boxes are better than those holding more on account of their not allowing the berries to remain in the sun for any length of time. After the berries are picked they should be kept as cool as possible until marketed.

*Markets.*—When a good price can be obtained it is better to sell at a local market than to ship. Good markets for the berries grown on the western slope are found in the nearby mountain towns. In fact during the past year there were not enough berries grown to supply many of the local markets of the western slope. The berries of the Loveland district are handled by an association which finds various markets of which Denver is the principal one. Some berries are shipped out of the state.

*Values.*—The amount received per crate varies somewhat according to amount grown and place of market. The average cost for the made up crate is about fifteen cents each. The cost for picking and carrying to packing house is about thirty cents a crate. The gross value received for an acre of red raspberries for the average year would run from four to six hundred dollars. The average expense, including cultivation, irrigation, pruning, covering, picking and packing is from one hundred twenty-five to one hundred fifty dollars per acre. This would leave a net gain of two hundred fifty to four hundred seventy-five dollars for red raspberries and two hundred to three hundred fifty for black-caps per acre.

### POSSIBILITIES OF THE INDUSTRY.

There is no doubt but that more raspberries could be grown in those localities where they are already growing and still have good markets. It is believed that there is a large field open for raspberries that can be evaporated. There is no doubt that raspberry growing properly managed can be made to be a paying proposition. There is no reason why every farm should not have a few well cared for bushes in its home garden. As has been stated before, raspberries will grow on a variety of soils and at various altitudes. Of course it might not be profitable to raise them on a large scale as above stated, but there is no reason why a few could not be raised for home use. With good railroad facilities and proper air cooled cars, raspberries can be shipped long distances. Properly air cooled cars are better for raspberries than ice cooled ones as raspberries when ice cooled soon go down when put on the market.

## DISEASES.\*

Raspberries in Colorado are not troubled with many fungus diseases, for the reason that the climate is too dry for the spread of such troubles as affect the canes above ground.

## ANTHRACNOSE.

This can be detected by gray discolored spots found on the canes above ground. When these spots become very numerous they may cause death or greatly weaken the plant. The disease is a surface one, namely, it lives on and in the bark.

*Treatment.*—Affected old wood should be removed and burned as soon as the fruiting season is over. In setting out new plantations careful inspection of the plants should be made to avoid any with diseased canes. Spraying may be done with one-half strength Bordeaux or self-boiled lime sulfur. In this case it must be remembered that the mycelium lives over winter in the canes, and that spraying can only prevent the germination of spores as they are produced. Black raspberries are perhaps more susceptible to the trouble than the red varieties.

## ORANGE RUST.

This disease is detected by the orange-red color on the under side of the leaves. This discoloration is due to the abundance of sori, which produce the orange-red spores by means of which the disease is spread from plant to plant. The mycelium of the fungus which corresponds to the roots of higher plants lives through the winter on the canes and roots of the raspberry. For this reason spraying is not very beneficial for its control. This disease is found more often on blackberries than on raspberries. Black raspberries are more susceptible to it than the red varieties.

*Treatment.*—All diseased plants as soon as discovered should be dug up and burned.

## CROWN GALL.

This disease, caused by bacteria, is characterized by a rough knotty growth around the base or on the roots of the plant.

The most satisfactory treatment for this trouble is to avoid planting any diseased stock. When found in the plantation take out diseased plants and destroy.

## CANE BLIGHT.

This disease has been thought for many years to have been winter injury. It is now thought to be a fungus trouble and is being worked on by Prof. W. G. Sackett of this station.

\*The accounts of these diseases are taken largely from Card's "Bush Fruits."