

Oregon Agricultural College

EXPERIMENT STATION

DIVISION OF HORTICULTURE

LOGANBERRY BY-PRODUCTS

BY

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Corvallis, Oregon

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*Resigned March 31, 1914. †Elected Director of the Experiment Station and Dean of the School of Agriculture, April 8, 1914.

LOGANBERRY BY-PRODUCTS

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C. I. LEWIS and F. R. BROWN

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LOGANBERRY BY-PRODUCTS

INTRODUCTION.

From a commercial point of view, the Loganberry is relatively a new fruit. Only during the past six years has it assumed commercial importance. The output up to the present time has been somewhat limited, owing to the small acreage now in bearing; but there is a good opportunity greatly to increase the output, since the Pacific Northwest not only has large areas of suitable soil, but a climate that will produce this berry profitably.

Another factor which emphasizes the possibilities of this berry, is its adaptability to various commercial uses. As a canning berry it is very satisfactory, and as a pie fruit it is believed to be one of the very best that we produce, being superior even to that queen of pie fruits, the blackberry. In addition to its adaptability to canning, the berry can be easily evaporated, and in this condition sent all over the world. It makes rich jams and beautiful jells, having a bright red live color which adds attractiveness to a fruit product. One of its greatest uses, however, is in the manufacture of juice, vinegars, and wines. The juice of the Loganberry, in fact, is pronounced by many people to be superior to that of the grape.

This bulletin is merely a preliminary report, containing for the most part the results of only one year's investigations. We are simply giving at this time a few facts that we believe will be of assistance to those who, being engaged in growing Loganberries, are naturally very much interested in the possibilities of disposing of the crop. Though we have secured other results of practical importance, we do not feel justified in publishing them at this time, since the work is of such a nature that it requires several years' investigations before our findings can with confidence be given to the public. We wish to thank Miss Ava B. Milam of the Domestic Science department for special recipes for the use of the Loganberry in the home, and Mr. O. G. Simpson, of the Dairy Husbandry department for his cooperation in the manufacture of ice creams and sherbets. We feel especially indebted to Mr. J. J. McDonald, of Salem, and his two sons, Lyman and Glen, who not only furnished us with an evaporator and with fruit, but who rendered us much valuable aid in carrying on our investigations.

MARKETING THE LOGANBERRY.

The production of the Loganberry is relatively easy. The cultural methods which are successful with other cane fruits, such as the blackberry or raspberry, are likewise applicable to the Loganberry. The marketing problem, however, is somewhat more difficult. This is especially true because of the fact that this is a new product, that it is relatively unknown, and that it therefore needs extensive advertising and careful distribution. There is always great danger in attempting to introduce a new product, for unless the first reception by the American public is favorable, years of hard work are required to overcome early prejudice. The Loganberry is a very tart fruit. When put up in the right way, it will meet with a very hearty reception, but when poorly handled it will soon cease to meet with a strong demand in any market. In the past, undoubtedly some of the canned goods that have been sent out have been unsatisfactory. The cannery man fills the cans full of a fruit which is rather solid, and which when shaken down, leaves few air spaces. Consequently, when the syrup is poured into the cans, there is very little room left for it around the berries. As a result, the product is too tart. In order to put a sweeter product on the market, either less berries should be put in the can, or else a heavier syrup should be used. It is very gratifying to note that the Northwest Cannery Association is taking steps immediately to correct this difficulty, and to this end has established three standards for canned Loganberries. All of the berries which will be shipped out during the coming season by this association are to be inspected and stamped according to grade, and provisions are to be made to keep off the market berries which are unsuitable for consumption. Some of the evaporated product which has gone from the state in previous years has been very unsatisfactory. Many of the berries have been picked too green. Many, in drying, have been scorched, and blackened, and handled in such a way that they have been rendered very unattractive. We cannot hope to build up a permanent trade with such fruit. Then, again, we have to meet the danger of a substitute. Already in some Eastern markets blackberries, canned and labeled as Loganberries, have been sold as such on the market.

A few juices are being put on the market; some of these are very good indeed, but, unfortunately, some are of a very inferior grade. Acquaintance with such goods makes it very evident, in the first place, that standardization is necessary with the Loganberry; and, in the second place, that to bring about a standardization which will meet the market require-

ments and carry weight with the growers themselves, it will be necessary to cooperate. With this purpose in view a new association has been organized in the state known as the Oregon Loganberry Association. This association should meet with the hearty support of every Loganberry grower in the state of Oregon. In forming this association, the objects were stated as follows: "The objects of this Association shall be to perfect a state-wide organization of Loganberry growers of the State of Oregon; to promote the industry by rendering assistance in standardizing, advertising and distributing Loganberries and their products; to maintain a bureau of statistics; and to render any assistance to growers which may seem helpful in the production of the crop; and to procure a market at an adequate price." Thus we can see that if this association is successful, if it has the support it merits, many of the problems of marketing will be greatly simplified.

As to just what standards can be established, it is somewhat difficult to state at this time. It would seem that the canned goods can be standardized by determining the strength of syrup necessary to give the proper blend. The evaporated products, first grade, should consist of berries which are of a good color, of pleasant flavor, and not too tart. The juices should be clear, have a good aroma, pleasant flavor, and should be free from all foreign taints. The juice will probably go through the same evolution as has the grape juice. Hundreds of people have tried to put on the market grape juice that they claimed to be superior to the brands that are well established. Invariably, however, these juices are inferior. Should we be so fortunate as to be able to put a high grade Loganberry juice on the market, the demand will be almost unlimited.

Advertising is one of the principal problems for us to consider. Before we spend much money on advertising, however, we must have a very large production and know absolutely how much fruit we can depend on. We can begin very nicely by advertising at home, by having the people of the state send to their eastern friends presents of dried Loganberries. These, put up in cartons, would make very acceptable presents. We can undoubtedly do splendid work at the Panama Exposition by maintaining a booth at which the various Loganberry products can be demonstrated.

LOGANBERRY EVAPORATION.

In considering the question of evaporation of the Loganberry, we can divide the subject into two natural heads. First, that which deals with the harvesting and preparation of the berries for evaporation. Second, that which deals with the

handling of the berries in the evaporator. We wish first to take up the work in the field, namely, the harvesting and preparation.

Harvesting and Preparation. An investigation will show that many of the inferior evaporated Loganberries are due to one or all of three causes: poor selection of the fruit and careless harvesting methods; rough handling in removing the fruit from the field to the evaporator; and unskillful methods employed in evaporation. Too much stress cannot be placed on the question of harvesting. Early in our investigations we soon determined that harvesting alone was responsible for many of the poor berries that were being evaporated. It is only by very careful handling and correct knowledge of the proper berries to pick, that one can deliver to the evaporator a product that is desirable for evaporating. In addition to careless handling in the field, many berries are ruined in being transported from the field to the evaporator.

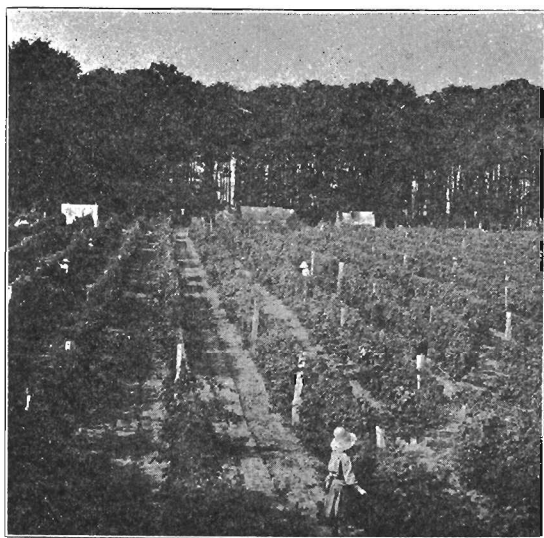


Fig. 1—METHOD OF TRAINING THE LOGANBERRY

Types of Berries Desired. The best berries to select for evaporating purposes are firm, ripe berries. Care should be taken, however, not to pick these too soon. If they are light colored, or very bright colored and hard, they do not make a very satisfactory product. True, a very pretty product can be manufactured, one which is very attractive, but the fruit is too tart, and it also loses too much weight. During the early part of the season, growers need to be unusually cautious

not to pick the berries too green. The berries are apt to ripen slowly, while a grower has a tendency to become anxious to remove the fruit and to start the evaporator. The presence of large amounts of this unripe fruit is probably partly responsible for the greater loss in weight through the evaporation process during the early part of the season than is experienced during the latter part; though possibly the fact that there is apt to be a little less moisture in the ground at the end of the season, may be responsible for some of the difference in moisture content of the fruit. Berries which are over-ripe should not be used for evaporating purposes. Such berries can be utilized for juices, syrups, jams and jells.

Handling the Pickers. The picking is done mostly by women, girls and schoolboys, the average price being one cent per pound. Some growers practice giving five-sixths of a cent early in the season, and pay about one and one-fourth cents when the picking becomes poor in the latter part of the season. It is hard at times to get really first class work done by the people who present themselves to our growers. The system of paying by the piece encourages the pickers to be very careless, and if this system is maintained it is absolutely necessary that careful supervision be employed. A check system of such a nature that the grower can check up on his pickers would be very advisable, whether they pick by the piece or by the day. This is the only way he can keep out of his product undesirable fruit, stems, leaves, etc.

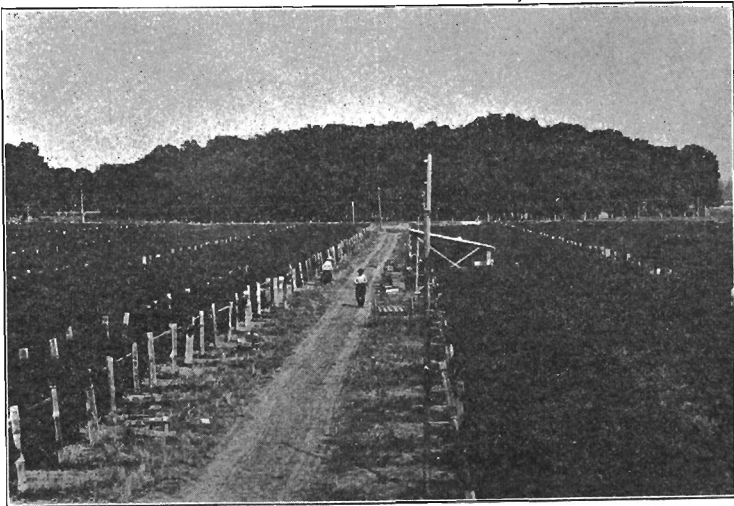


Fig. 2—A LOGANBERRY FIELD, PUSH CART IN FOREGROUND

Up to the present time, the growers have had very little difficulty in securing pickers. When good camping facilities are furnished, whole families will move to the Loganberry district, and while enjoying an outing, give the young people a chance to earn money for school books and other necessities. Owners of isolated patches, small in area, may have some trouble in securing proper help for picking.

The method used in handling pickers by one of the most successful Loganberry growers in the state may be of interest to our readers. This man has 85 acres and estimates that it is necessary to have 400 to 500 pickers to handle the crop. He is putting in a model camp ground, with electric lights and sanitary surroundings. He also provides a watchman both night and day. Under his present arrangement he is able to secure more pickers than he can use.

He requires pickers to sign a written contract that they will stay with him throughout the season and will work eight hours a day if required. He pays the pickers one cent a hallock, but at the end of the season gives a bonus of one-fourth cent a hallock to all those who have done first class work.

He keeps field inspectors, whom he pays \$2.00 a day. It is the duty of these inspectors to see that the work is carefully done. He also keeps check of the men and the amount of fruit which each picker handles. If it is necessary for an inspector to speak more than three times to any picker because of carelessness or unsatisfactory work, the picker is discharged. Each picker has a small book in which he keeps account of the number of hallocks picked. This is checked on a tally sheet kept by the owner. The daily balance is drawn each night. By such a system it is possible to pay off the 400 or 500 pickers within two hours.

This grower provides canvas rest rooms. Canvas is stretched so as to provide shade. This is very necessary for the women pickers, and where whole families come, there is a place for the children to play. He sees to it that storekeepers in the vicinity charge no extra prices to pickers for goods. The same is true of milk or any food product the campers need.

The fruit is picked for canning purposes and shipped in cattle cars, the shipping being done at night. The fruit then arrives next morning at Portland in very good condition. It is necessary, of course, that the cattle cars be very thoroughly cleaned before loading, but these cars afford ventilation that it is impossible to secure with ordinary cars.

How to Pick. There are two points which should be observed by the pickers. The first is, that the berry is not pulled straight out from the stem, but is picked with a slight

twist of the wrist, which pulls the berry to one side. In doing this, less pressure is used and there is less tendency to break off stems and leaves with the fruit. The second is, that many pickers have a tendency to hold too many berries in the hand at one time. The berry will soften and melt down very rapidly when held in the warm hand. Again, the berries are so soft that where a number are held together in the hand they bruise easily and the juice begins to leak. These bruised berries are very unattractive, giving the carrier a mussy appearance.

The time of picking is a very important factor; the best berries which arrive at the evaporators are picked in the cool of the day. It is the general practice of the larger growers to pick a part of their field every day, working until noon, while in some cases they continue to work until four in the afternoon. Others pick every third day, but work all day. The time and amount of picking is controlled to a certain degree by the capacity of the evaporator. Berries picked early in the morning will not only evaporate heavier than those picked at noon or late in the afternoon, but they also retain their form better. This latter fact is perhaps more important than the gain in weight, the loss of form and melting down of the berries being responsible for much of the drip which takes place. The berries become warm in the afternoon, and when placed on the trays begin to drip badly. This drip consists of a heavy syrup, rich in sugar, and its loss is very serious. It is responsible not only for a loss in weight, but since the drip tends to caramelize and char on the trays, it is responsible also for much of the unattractive burnt fruit which is found on the market. We would urge the growers to pick the fruit by ten in the morning, if possible, and under no circumstances to pick in the warm hours of the afternoon.

Receptacles. There are two types of baskets or boxes used at the present time, neither of which is ideal. The Michigan hallock, a square box with a false bottom, is considered the better. These hallocks cannot be piled closely, however, and therefore dry out readily. The tin topped basket, which is the second receptacle used, is very undesirable. The tin rusts badly, and the baskets, which have sloping sides, when empty are piled together in stacks, while still moist. In this condition mold rapidly develops. A light basket that could be dipped in boiling water each time it is emptied, would lessen the growth of the mold very materially. Possibly a small wire mesh basket, made of galvanized iron wire would prove to be very satisfactory for handling Loganberries. One should also avoid the use of large utensils, such as pails and pans. Even though the berries are not piled very high in such recep-

tacles, there is very little circulation of air and the berries very soon become soft and mushy. The ideal receptacle should be small, well ventilated, and easy to cleanse.

Wagons. The wagon in which the hauling is done should be provided with good bolster springs. Care should be taken, however, to see that these springs are not too stiff, for if they are, they will jar the berries about as badly as though there were no springs at all. With a wagon properly balanced and with good springs, it has been found possible to haul the berries six or eight miles with very little injury. Coverings should be provided, so that the road dust can be kept from the fruit.

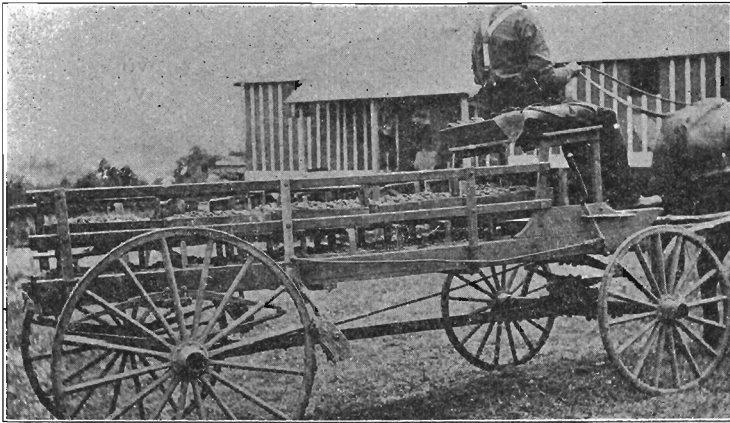


Fig. 3—A LIGHT WAGON FOR SHORT HAULS, SHOWING THE CARRIERS FILLED WITH BERRIES

Some of the larger growers use push carts to very good advantage. These have wheels spaced so that the cart can be pushed down between the rows of Loganberries. The wheels are surmounted by a rather broad platform upon which can easily be placed the carriers of berries. These carts may be used for delivering the berries to the end of the row, where they are placed in larger wagons. Such push carts could probably be bought in the open market, as they are quite similar to wagons used by grape growers in the East, or almost any blacksmith could make them very easily.

Evaporation. The evaporation of Loganberries is in its infancy. Two of the men who were among the pioneers in the evaporation of the Loganberry, were Mr. W. H. Claypool, of Salem, who used a stack evaporator, and Mr. E. W. Powers, also of Salem, who used a tunnel evaporator. These men both started work in 1908, at a time when the production of the

fresh berries had reached a point where the market was becoming overstocked. Canning, up to that time, had not been successful commercially, owing to the fact that plain tin rather than enameled cans had been employed, whereas the latter are necessary with this fruit. Evaporating and juice manufacture had not been tried. This, coupled with the poor shipping quality of the berries, made it necessary to sell all of the fresh fruit in the local market. It was very easy, in the face of such a handicap, to overstock the market. Most of the growers at that time became discouraged and ripped out their berries, much to their regret in later years. The following years the prices were so satisfactory that the Loganberry has been one of the most profitable crops we have grown in the state.

Mr. E. W. Powers shipped the first evaporated Loganberries from the state. These were sold in Aberdeen, South Dakota, for 22½ cents per pound. For the first few years nearly all the evaporated berries were sold in the North Central states, one car being sold for \$12,148.00, a price thought by some to be the highest ever received for a car of fruit from the Pacific Coast. During the past season large shipments of evaporated berries were made to Chicago and other Eastern markets. These sold on an average for 23½ cents per pound f. o. b. The demand for evaporated Loganberries became so great this past year that for the first time the buyers came to the associations, and even to the growers, endeavoring to secure enough berries to fill their orders.

Kind of Evaporators to Use. Prune evaporators are commonly used for the evaporation of the Loganberry. Both tunnel and stack types have been used, but at the present time most of the men who have used both types prefer the tunnel. The length of the tunnel varies with each evaporator, and ranges from 20 feet to 34 feet.

The tunnel evaporator may be described as a group of long, nearly horizontal wooden tunnels, arranged side by side over a fire pit. The slope varies from one to two and one-half inches per foot. Each tunnel may be complete in itself, or the walls between the tunnels may be partly open. Along the walls are nailed cleats or rollers to support the trays of fruit and serve as a track along which they are pushed. The fruit is introduced fresh at the upper end and taken out evaporated at the lower end. As a tray is removed at the lower end, a fresh tray is placed in at the upper end, and the whole row pushed down one notch.

The tendency in building new evaporators has been to increase the length of the tunnels, the owner believing that by so doing he was increasing the capacity of the evaporator.

Instead, the circulation of air has been impeded, and as a result, the capacity has been actually decreased. The air, in passing through long tunnels over moist fruit, soon becomes saturated, and as a consequence is ineffective; rapidly moving, dry air is the most efficient. Consequently, it would be much better to increase the number of tunnels and at the same time reduce their length.

The heating pit is directly below the tunnels; sometimes it extends their full length, but more often only the lower part of the tunnel is above the pit. The heating is done by brick arch furnaces or by stoves of iron or steel. The "hop stove," 2x2x5 feet, is the most common device used in the newer evaporators; one of these stoves is sufficient to heat three tunnels. Often the floor of the tunnel is removed for the full width of the furnace pit, but a better control of the heat may be had if an opening of only two feet is left at the lower end of the tunnels. When more than three tunnels are desired, the furnace pit may be extended to include two stoves, and another three tunnels added; or, a better way would be to keep the arrangement of the furnace pit the same, and for each three tunnels additional add another section to the pit. Such an arrangement would permit the use of only a part of the evaporator without the expense of heating all the tunnels.

The principles involved are much the same for evaporating both prunes and Loganberries, but climatic conditions are very different during the two seasons. It will not always follow, therefore, that because an evaporator works successfully for prunes it will work equally well for Loganberries. A study of conditions affecting the evaporation of fruits must necessarily be carried on for several seasons to be conclusive; one season's work has shown, however, that a better circulation of air is necessary for the evaporation of Loganberries than for prunes. The moisture-carrying power of heated air depends largely on the difference in temperature between the air inside the tunnels and that on the outside of the evaporator; hence, during the Loganberry season, when the temperature of the outside air is high, a greater amount of air will have to pass over a certain amount of fruit to remove its moisture than would be necessary later in the year, when the maximum daily temperature is lower.

Plenty of room should be provided near the upper end of the tunnels for storing the crates of berries as they come in from the field. They should be piled so that the air may circulate freely about them, and should not be allowed to stand more than 24 hours after picking. As a rule, the sooner they are trayed, the better it will be for them. The traying table must be convenient to the crates of berries and to

the upper end of the tunnels where the drying process begins. Plenty of ventilation is desirable for this part of the evaporator, but windows and doors should be protected so that the direct rays of the sun can be kept out. In fact, every effort should be put forth to keep the berries as cool as possible until they are placed in the tunnels.

Methods of Evaporation. Loganberries should be spread on the trays evenly and rapidly, with a quick twist of the wrist. They should not be moved when once on the tray, and any attempt to pick out stems, flower parts and broken leaves at this time will result in the fruit becoming more or less crushed. If the trays are filled too full, or the berries spread unevenly, some will dry quickly, while others which are more deeply piled become mushy and dry slowly. Fourteen boxes, or about 16 pounds, are sufficient for an ordinary tray. One man should be able to fill from 150 to 200 trays per day.

After the berries have been trayed, they are placed in the upper end of the tunnel, where the temperature is usually about 100° F.; the trays are then gradually pushed along until they reach the lower end of the tunnel, where the temperature is kept at about 160° F. The common fault with this system is that during the first few hours there is very little loss of moisture, and the low temperature only causes the berries to flatten out, run together and melt, causing dripping.

After observing the effect of a low temperature at the start, experiments were carried out to determine the effect of a higher temperature at the beginning of the evaporation process. A series of trays was prepared and started at 140° F., gradually increasing this to 150° F. at the finish. The results of this test were so marked that other series were tried in the same way during the following two weeks. A much improved product, which kept its form better, had better color, and gave better all around results, was produced. Higher heat at the start seems to sear over the berries as hot water does a roast of beef. This searing prevents loss of certain juices which it is desirable to retain. Table I gives the results of experiments in evaporating.

The time required for evaporating each series, as given in the above table, is the average for the series. The first tray in each of the second, third, and fourth series was finished in 12½ hours. The gain in weight is no doubt greater than will be obtained where less careful methods are used. Added to the gain in weight and the saving in time, is the fact that where a higher temperature was used at the start, the berries retained their form better than where a lower temperature was used. However, there seems to be no way of evap-

TABLE I.—EFFECT OF HIGH TEMPERATURE AT COMMENCEMENT OF EVAPORATION.

No. of Series	Weight of Berries		Time of evaporating	No. lbs. of fresh fruit to make 1 lb. evaporated	Temperature		Humidity	
	Fresh	Evaporated			Start	Finish	Inside Evaporator %	Outside Evaporator %
1	852 oz.	162 oz.	23 hr., 35 m.	5.2 lbs.	140°	150°	54	63
2	908 oz.	188 oz.	14 hr., 22 m.	4.8 lbs.	130°	160°	42	44
3	1983 oz.	440 oz.	16 hr., 30 m.	4.5 lbs.	125°	160°	56	60
4	1417 oz.	361 oz.	16 hr., 00 m.	3.9 lbs.	130°	150°	53	51
Total.....	5160 oz.	1151 oz.						
Average.....			17 hr., 37 m.	4.6 lbs.	131°	155°	51	54
			Check					
5	272 oz.	49 oz.	38 hr., 25 m.	5.5 lbs.	100°	150°	51	64
6	726 oz.	128 oz.	31 hr., 55 m.	5.6 lbs.	90°	155°	47	58
7	2360 oz.	439 oz.	28 hr., 48 m.	5.3 lbs.	96°	150°	54	56
Total.....	3358 oz.	616 oz.						
Average.....			33 hr., 3 m.	5.5 lbs.	95.3°	151.6°	50.6	59.3

orating crushed berries which will prevent them from melting down. More fully to check on the above results, a set of trays was started at a temperature of 130° F. and finished at 160° F.; but the air circulation almost stopped. Thirty-seven hours and fifteen minutes were required for evaporating. Evaporated fruit was produced at the rate of one pound for every 6.5 pounds of fresh fruit. These berries did not melt down as badly, however, as when less heat was used at the start.

The best results were obtained when the temperature at the beginning of evaporating was kept at about 130° F., with a strong draft. In order to obtain such conditions, the tunnels will need to be shortened, or some system employed to force the air through the tunnels at a more rapid rate. The temperature at the finish need not be higher than 150° F., and with a strong draft even less, although the berries will stand a much greater heat. The maintenance of a fairly high temperature at the start, and a strong draft through the tunnels, are two important factors in the production of good evaporated Loganberries; and, in addition, these two factors will shorten the time of drying very materially.

Desirable to Remove Berries While Warm. The berries should be removed from the trays before they become cool, as otherwise they will stick to the trays. The berries should be left on the table only long enough to cool. This is especially important at night, for it is then that certain moths deposit their eggs. These eggs hatch in a short time, and the larvae feed on the evaporated fruit. As these moths fly only at night and work only on the fruit which is near a light, a little care will aid in preventing wormy fruit. From the cooling table the fruit is placed in sacks in which it may be stored, although a better way is to store in bulk in a clean, darkened room. If the berries are piled about 2½ feet deep, and allowed to go through the "sweat," the moisture content will be equalized; and if turned with a fork or shovel every few days, a very uniform product may be obtained.

TABLE II.—COST OF EVAPORATING LOGANBERRIES PER TON OF EVAPORATED FRUIT.

Wood	\$12.00
Labor	25.00
Interest on Evaporator	7.00
Insurance	1.80
Depreciation of Building	6.00
Total	\$51.80

The cost of evaporating any kind of fruit varies with the size of the evaporator, and especially with the management. The figures given in Table II are only an approximation of the ordinary costs. Wasteful and careless methods will in-

crease the cost very materially. The cost per pound of evaporated fruit is about $2\frac{1}{2}$ cents, based on a 30-day season, with an evaporator capable of turning out 700 pounds of fruit per 24 hours. If the same building is used for prunes, the interest charges and depreciation will be cut in half, and the final cost reduced to $2\frac{1}{4}$ cents per pound.

Packing and Shipping. For shipment, the berries are packed in 50-pound boxes without processing, though there is at least one company that turns live steam into the evaporated fruit for a short time. This has not been thoroughly tried out; consequently little is known of its ultimate effect on the keeping qualities of the product. Some of the Loganberries are sold in cartons; they are especially adapted, indeed, to that class of trade which prefers a high class article in sealed packages.

As the evaporated Loganberry is handled today, there is but one grade; no attempt is made to separate the different sizes. Good and bad are mixed and sold for the same price. While, at first glance, it would appear impracticable to attempt to form grades, nevertheless, if those berries which have melted and run together could be sorted out, it would improve the appearance of the product very materially. Since in most cases such berries stick together in solid masses, it would seem possible to separate them by passing them over a screen coarse enough to allow the single berries to pass through. By eliminating all scorched and burned berries, and by using care in harvesting, as already outlined, a fairly satisfactory standard can be established.

FRUIT JUICES AND SYRUPS.

We have already emphasized, under the chapter on evaporation of Loganberries, the importance of careful harvesting, and the relation of the type of berry to the product that is secured. We likewise find that there is a very close relation between the condition of the Loganberries harvested and the amount of juice, the flavor, aroma, and the sugar and acid content of the product.

For juice purposes the berries can be allowed to ripen more on the vine than is advisable with berries for evaporation. Since in the manufacture of juice the berries themselves would be crushed and destroyed, they can be allowed to become dead ripe. At this time it is found that the berries contain the maximum amount of sugar and the least amount of acid. This is a very desirable characteristic. Not only that, but we have often found that where the ripe berries can be stored in a suitable room, the flavor and aroma are influenced, and it is possible to get a greater amount of juice

than can be secured if the berries are pressed as soon as they are harvested.

The following table furnished by Professor H. V. Tartar, of the Chemistry department, shows the relationship of sugar and acidity to the juice content of the berries:

TABLE III.—COMPOSITION OF LOGANBERRY JUICE.

Juice obtained from	Specific Gravity	Acidity (calculated as Sulphuric acid)	Total Sugar (calculated as Dextrose)
No. 1 Green Berries	1.032	2.06%	3.50%
No. 2 Medium Ripe Berries.....	1.0395	2.10%	4.91%
No. 3 Full Ripe Berries.....	1.045	1.88%	6.40%
No. 4 Over Ripe Berries.....	1.040	1.78%	6.46%

The effect of ripeness of the berries on the quantity of juice and its general quality, is very strikingly brought out in the following table:

TABLE IV.—EFFECT OF RIPENESS OF BERRIES ON THE QUANTITY OF JUICE.

Number of sample	Kind of Berries used	Per cent. of Juice	Rank according to quality
No. 1.....	Green	59.3%	4th
No. 2.....	Medium	71.8%	3rd
No. 3.....	Ripe	71.8%	1st
No. 4.....	Over Ripe	78.1%	2nd

Juice made from very ripe fruit retained a more distinct flavor and had a higher quality than was obtained from berries at other stages of ripeness. If more than a very small per cent of green berries is used, the juice is apt to have a very astringent flavor and to be undesirable. Berries which have become moldy but have not soured, should not be used for high grade juices and syrups, but can be used for the manufacture of vinegar or wine. Juices made from such berries will also make a syrup, which can be used in the manufacture of sherbets and ices, but does not make a suitable product for beverage purposes.

In addition to working with Loganberries, we worked with other berries to determine the amount of juice which one can secure. The following table shows the amount of juice we were able to secure from the various berries:

TABLE V.—PER CENT OF JUICE OBTAINED FROM VARIOUS SMALL FRUITS.

Kind of Fruit—	Per cent of Juice
Red Raspberry	68.0 per cent
Red Currant	75.6 per cent
Blackcap Raspberry	60.0 per cent
Phenomenal Berries	78.0 per cent
White Currants	56.2 per cent
Wild Blackberries	65.3 per cent
Loganberries	74.3 per cent

The amount of juice secured from the Phenomenal berries is somewhat misleading, since we had a rather small amount of this fruit and what we had was in the very best condition, being very ripe.

Extracting the Juice. In pressing out the juice we were obliged to use rather crude methods, since the equipment which we had was not very extensive. We used several types of presses. The small home "Yale" fruit press, shown in Figure 4, and a medium sized lattice cylinder press were the two which we used in our work. These presses are not nearly as efficient as some other forms of hand presses, such as the rack and cloth type, although we used the lattice cylinder press in such a way as to give us the same type as the rack and cloth press. This is easily done by removing the lattice cylinder and substituting racks. If hydraulic presses are used, one should be able to secure more juice and should also be able to extract it more rapidly and economically than would be possible with these hand presses.

A great deal of time will be saved in extracting the juice if proper attention is given to the method of filling the presses. With these small presses we found it necessary to use a cloth lining, otherwise the pulp was easily forced out with the juice. Cloth of the grade that is employed in the manufacture of sugar sacks was found to be very satisfactory for this purpose. The berries were first thoroughly macerated before being placed in the press. The berries were then put in the press in layers. In a small press, such as the Yale, these berries should not be more than from $1\frac{1}{2}$ to 2 inches deep before a layer of cloth is put in. These layer pieces that we used in the presses were made from cloth known as duck or canvas. By the use of these cloths the fruit pulp is kept from mixing with the juice, and more rapid and thorough drainage is obtained. In the rack press the layers of fruit may be about 3 inches deep, although thinner layers will give better results.

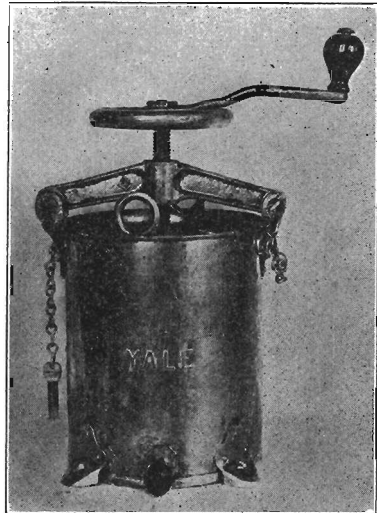


Fig. 4—"YALE" FRUIT PRESS

The time required for extracting the juice will depend largely on the quantity expressed at one time and upon the number of layer boards used. With a cider press, if half a crate was pressed at a time, one hour was necessary for draining out all the juice from a crate of berries. When a whole crate was pressed at one time, four hours were required. It was possible to reduce the time required for this work by using thinner layers of fruit and by employing more slats and cloths.

In addition to the grinding or macerating of the fruit before pressing, we found it to advantage to heat the fruit. This not only seems to facilitate the work, but it seems to increase the volume of juice that can be secured. If equipment can be secured which will grind the fruit rapidly, much less time will be required in extracting the juice. With good macerating, heating the berries will not be required.

It is interesting to note that in the handling of blackcap raspberries it was impossible to get much juice from them until they were heated to about 130° F.

From former work we had done with the juice, we were satisfied that by modifications in its preparation we could secure a juice which would be suitable for beverages, for flavorings, for ice creams and sherbets, for the manufacture of heavy syrups to be used with ice cream sundaes, for the manufacture of carbonated drinks, and as a flavoring or coloring product for jellies, puddings, etc.

Formulas for Preparing the Juice. The formulas which follow give the special preparation of the juice for these several purposes. During the season we tried many formulas for the preparation and preserving of the juice. Most of these gave very good results. A few, however, were clearly superior to the others. The results which we secured indicate that there are two ways by which the true flavor of the Loganberry can best be preserved. First, by the use of small amounts of sugar, and, in addition, heating the juice to a temperature of 200° to 212° F., but in no case allowing the juice to boil. Second, by using varying amounts of sugar, but employing no heat. In either case, four or five pounds of sugar per gallon of juice gave the best results where flavor and appearance only were considered.

In preparing the juice as a beverage, there are three formulas which gave excellent results. By using five pounds of sugar per gallon of juice and heating it to a temperature of 200° to 212° F., a very rich drink is obtained. The temperature should be raised quite rapidly, and the juice bottled as soon as the desired temperature is reached. Prepared in this way the juice retains a very distinct flavor and is very pleasant as a drink. This was especially desirable when carbonated.

Since none of the juice was filtered, there was a considerable amount of sediment, which settled to the bottom of the bottles.

If a very tart juice is desired, two pounds of sugar per gallon, or one measure of sugar for each three measures of juice, gives the best results. This should be heated to 212° F., and bottled as soon as that temperature is reached. It is especially desirable for use in water ices.

The use of five pounds of sugar per gallon of juice without heating resulted in a product which had not only a very desirable flavor, but also was entirely free from sediment. This gave a clear, bright red juice which was very attractive to the eye. While the flavor of this juice was not so distinct as when heat was used, it ranked with those few which were distinctly superior in flavor and quality. Great care is necessary in bottling the juice when not heated. Berries that are free from mold should be used. All utensils, the press, and the bottles must be carefully sterilized. The work should be done quickly and with the juice exposed to the air as little as is possible. The sugar should be stirred in carefully to insure a uniform mixture.

These juices are too concentrated for drinking as manufactured, and make a more pleasant beverage when diluted with from one to three parts water, according to personal preference.

In making a heavy syrup for soda fountain trade, sugar was used in equal parts by weight, by measure, and at the rate of 10 pounds per gallon of juice. Any of these makes a very desirable syrup. If this syrup is heated it becomes undesirable as a beverage. The flavor of the berry is modified, leaving a very sweet juice. On the other hand, the use of large amounts of sugar without heating results in a juice suited for use as a beverage, as well as for other purposes. In the latter case, a clear, bright red syrup without sediment is obtained. These heavy syrups are well adapted for use in soda fountain trade, since they will keep indefinitely after being opened.

As a crushed fruit the Loganberry has two serious faults—the numerous large seeds and the hard core. The latter is of less importance, since, if carefully macerated, it is no more objectionable than the pulp of the strawberry. When the berries were run through a colander and the seeds and cores removed, a very fine product was obtained. This, when sweetened with sugar in amounts ranging from two to ten pounds per gallon of juice, made a syrup especially desirable for ice cream sundaes and for flavorings for ice cream.

Bottling the Juice. Loganberry juices put up for beverage purposes should be bottled, but the heavy syrups tend to

jell and solidify, and for that reason it is better to use larger containers, such as fruit jars. Where the juice is to be put up on a small scale, the bottles or jars may be easily sterilized by keeping them in boiling water. They should be left in this water 15 or 20 minutes. As soon as they are taken from the boiling water they should be filled and quickly corked. It is also well to have the corks thoroughly sterilized. Care should be used not to allow the hand to pass over the mouth of the bottle, and in handling the cork, the lower end which is to go into the bottle, should not be touched by the hand. The cork should be forced down into the mouth of the bottle so that it is at least one-fourth inch below the top of the neck. This space which is left should be filled with hot paraffin or parowax. In fact, it is well after the wax has hardened, to pour over additional wax, so as to be sure that the bottles are thoroughly sealed. We found that after sealing the bottles in this way there was no difficulty in keeping the juice. The Loganberry juice is the easiest to make and keep of any that we experimented with. There is no deterioration. We found it difficult with some of the raspberry and blackberry juices to keep them from spoiling when the same methods were used as were employed in making Loganberry juice. We find this to be true, that whenever the Loganberry juice is uncorked it seems to have just as good an aroma and flavor as when first put up, but many of the other berry juices, even though they keep well, seem to deteriorate in quality.

COMMERCIAL MANUFACTURE OF LOGANBERRY JUICES.

The work which we did in the manufacture of Loganberry juice last year was principally along the line of working out definite principles, which could be applied locally for home purposes on the one hand, or in the large manufacturing plant for the world's trade on the other.

The special application, however, of these principles for commercial uses will still have to be worked out. Nevertheless, we have some suggestions which we should like to make to those communities who are interested in the establishment of Loganberry juice factories.

Building. We suggest, first, that the building which is to be used for the manufacture of such juices should be light and clean, and be so constructed that it can be cleansed very easily. It is very important in the juice manufacture that the building be cleansed daily either by hot water or live steam, or the use of some disinfectant. The most satisfactory building will be provided with an abundance of hot water and steam.

It would be well to have a fairly large receiving room, a manufacturing room sufficiently large to permit work around the machinery to advantage, and a storage room where the product can be stored until shipped. In fact, if a cool basement can be used for such purposes, it is a distinct advantage.

Equipment. As regards the equipment, the presses should be of the hydraulic type, and in addition it may be found to advantage to use some form of macerator or crusher. Probably some large kettles or retorts will be needed for heating the juices. Large open tanks should be employed for the temporary storage of juice until it can be racked off into barrels or filtered.

While the uncooked juice normally needs little filtering before bottling, it is preferable to filter all cooked juice. This will mean that large filters should be employed for this purpose. Many people will also prefer the juice carbonated. This will mean the employment of an additional machine for such purposes.

For beverage purposes, and for selling in grocery stores, drug stores, etc., the juice should be bottled. The crown cork type of bottle, while a little more expensive, is on the whole the most satisfactory. Machinery can be employed for the bottling.

Capital Required. The amount of capital which will be needed will vary with the capacity of the plant, but outside of the building and boilers and piping for hot water and steam purposes, probably \$1,200.00 to \$1,500.00 would buy the machinery which would be needed in a small factory. We would suggest that communities that are interested in the commercial manufacture of such juices start in a small, conservative way, and enlarge the equipment and plant as the future may demand. Those communities that are interested in starting this business may correspond with us regarding the equipment that will be used and where such equipment can be secured. We shall always be pleased to tell people where they can secure catalogs from supply houses handling the type of machinery which would be desirable in the manufacture of the juice.

FROZEN PRODUCTS.

The preliminary work with Loganberry juice as a flavoring for frozen products was very encouraging. These frozen products were manufactured from juices and syrups furnished by the Horticultural department to Mr. O. G. Simpson, of the Dairy Husbandry department. Two classes of juices were used, cooked and uncooked. There were two grades of the cooked juice; both gave good results without the use of lemon, but were improved by the use of small amounts of

lemon juice. The uncooked juices were heavy, sweet syrups, and needed the addition of lemon juice to bring out the natural Loganberry flavor.

The natural Loganberry flavor is produced with smaller amounts of the syrup by the addition of lemon juice. When some of the heavy syrups were used alone, the "mix" was too sweet after enough juice had been added to produce the desired flavor. The Loganberry juices which were used imparted the natural flavor characteristic of the fresh Loganberry better than any preserved berry juice commonly used for flavorings.

Loganberry juice alone, when added to "mix" flavored with vanilla, did not "kill" the vanilla or blend with it. As to lemon juice, it will be necessary to determine the amount that should be used with the Loganberry to obtain the best results. This is an important point in commercial work, as nearly all ice cream manufacturers make up, in good sized quantities, the "mix" that is to be frozen into ice cream, and flavor it with vanilla. If orders are received for flavors other than vanilla, the desired flavor is added to the vanilla "mix." Vanilla is a light flavor and is "killed" by the stronger flavor or "blends" with it. When Loganberry and vanilla are combined, the two flavors are distinct, a condition which is not usually desired.

Water Ices. The Loganberry juice is very well adapted for making water ices. It produces a rich, attractive color, is very sour, and the natural flavor of the berry is brought out very well by the addition of lemon juice. If the red color of the Loganberry is desired with other flavors, enough juice to produce the color may be used without "killing" the stronger flavors.

Using Loganberry juice containing two pounds of sugar per gallon, or at the rate of one measure of sugar for each three measures of juice, the following formula gives good results:

Formula 1. For one gallon of sherbet.

Four cups water.

Two cups sugar.

Two cups Loganberry juice.

Two tablespoons lemon juice.

Make a syrup by boiling the water and sugar for 20 minutes; cool, add juice, strain, and freeze.

Sherbets. The products obtained by using Loganberry juices for both water and milk sherbets were very pleasing in color, flavor, and quality. The ease with which they are made up, the color obtained, and the way the natural flavor is brought out, show great possibilities in the use of the Loganberry for flavoring this class of frozen products.

Loganberry juice containing equal parts by measure of sugar and juice, and bottled without heat, was used. The natural Loganberry flavor was low. This is not a serious fault, for some prefer the milder to the more pronounced Loganberry flavor. The color was excellent.

Formula 2. For one gallon of sherbet.

One-half gallon of water.

Whites of two eggs.

Two and one-quarter pounds of sugar.

Four fluid ounces of Loganberry juice.

Three fluid ounces of lemon juice.

Using Loganberry juice containing 10 pounds of sugar per gallon (very similar to that used in Formula 2), a sherbet having a strong Loganberry flavor was obtained.

Formula 3. For one gallon of sherbet.

One-half gallon of water.

Whites of two eggs.

Two and one-quarter pounds of sugar.

Six fluid ounces of Loganberry juice.

Four fluid ounces of lemon juice.

Loganberry juice containing ten pounds of sugar per gallon and heated to 212° F. when bottled, was used in Formula 4. The color was good, and an excellent flavor was obtained without the use of lemon juice.

Formula 4. For one gallon of milk sherbet.

Forty-five one-hundredths gallon milk.

One and one-fifth pounds sugar.

Whites of two eggs.

Six fluid ounces of Loganberry juice.

The results obtained in Formulas 2 and 3 show that the use of lemon juice is necessary to bring out the natural flavor of the Loganberry in the water sherbets. This is especially true if the uncooked juices are used. For a milk sherbet, lemon juice is not necessary, if cooked juice is used. In all the trials, less Loganberry juice was used when lemon was added.

Ice Cream. The use of Loganberry juice as a flavoring for ice cream was found to be a more difficult problem than its use in water ices and sherbets. While only two trials were entirely successful, the results obtained in the others would compare favorably with much of the ice cream made on a commercial scale from other fruit juices and crushed fruits. The juice was added to the "mix" before freezing, and the acidity did not cause coagulation of the cream.

Loganberry juice containing ten pounds of sugar per gallon and bottled without heat, was used in Formula 5. The flavor and color obtained in this trial were good.

Formula 5. For one gallon of ice-cream.

One-half gallon cream.

Ten ounces sugar.

Six fluid ounces of Loganberry juice.

Three fluid ounces of lemon juice.

If a light Loganberry syrup is used without lemon juice, a large amount is required to bring out the flavor. In Formula 6, Loganberry

juice containing two pounds of sugar per gallon or one measure of sugar for each three of juice, was used. The color and flavor were excellent.

Formula 6. For one gallon of ice-cream.

One-half gallon of cream.

Thirteen ounces of sugar.

Twenty-eight fluid ounces of Loganberry juice.

By using a heavy Loganberry syrup containing 10 pounds of sugar per gallon and heated to 212° F. before bottling, a very pleasing product was obtained without the use of lemon juice.

Formula 7. For one gallon of ice-cream.

One-half gallon cream.

Thirteen ounces of sugar.

Eight fluid ounces of Loganberry juice.

HOUSEHOLD RECIPES

The following Loganberry recipes were furnished to the Horticultural department by Miss Ava B. Milam, of the Domestic Science department.

GELATINE DESSERTS.

Loganberry Bavarian Cream.

One tablespoon granulated gelatine.

One-fourth cup cold water.

One-half cup powdered sugar.

Whip from three and one-half cups cream.

Berries to line mold.

One-third cup scalded cream.

Line a mold with large, fresh Loganberries and fill with the following mixture:

Soak gelatine in cold water; dissolve in scalded cream; strain into a bowl, and add sugar. Set bowl in pan of ice-water and stir constantly until it begins to thicken; then fold in whip from cream, adding one-third at a time. Turn in mixture and chill.

Loganberry Trifle.

Two tablespoons granulated gelatine.

One-half cup cold water.

One-half cup boiling water.

Whip from three and one-half cups cream.

One cup sugar.

One cup Loganberry juice.

One tablespoon lemon juice.

Make same as Loganberry Bavarian Cream and mold.

Loganberry Sponge.

One and one-third tablespoons granulated gelatine.

One-third cup cold water.

One-third cup boiling water.

Whip from three cups cream.

One cup sugar.

One tablespoon lemon juice.

One cup Loganberry juice.

Whites of three eggs.

Soak gelatine in cold water; dissolve in boiling water; strain and add sugar, lemon juice, and Loganberry juice. Chill in pan of ice-water; when quite thick, beat with wire spoon or Dover beater until frothy; then add whites of eggs beaten stiff, and fold in cream.

Line a mold with Loganberries, turn in mixture, and chill.

PUDDINGS.

Snow-Balls.

One-half cup butter.

One cup sugar.

One-half cup milk.

Whites of four eggs.

Two and one-fourth cups flour.

Three and one-half teaspoons baking powder.

Cream the butter, add sugar gradually, milk and flour mixed and sifted with baking powder; then add the whites of eggs beaten stiff. Steam 35 minutes in buttered cups, serve with preserved fruit, quince marmalade, or strawberry or Loganberry sauce.

Loganberry Sauce.

One-third cup butter.

Two-thirds cup Loganberries.

One and one-half cups powdered sugar.

White of one egg.

Cream the butter, add sugar gradually, egg beaten until stiff and Loganberries. Beat until fruit is mashed.

PIES.

Loganberry Pie, No. 1.

One cup sugar.

One cup hot Loganberry juice.

Two tablespoons corn starch.

Two egg yolks.

One teaspoon butter.

Two tablespoons flour.

Mix corn starch, flour and sugar, add hot juice, stirring constantly. Cook two minutes. Add butter and egg yolks and cook until thickened. Line bottom of pie plate with paste and bake. When browned, remove from oven and place inside of plate. Fill with the mixture which has been cooled, and cover with meringue, and brown.

MERINGUE

Whites of two eggs. Two tablespoons sugar. Beat whites until stiff; add sugar gradually, and continue beating. Place on top of pie.

PLAIN PASTRY

One cup of flour. Three tablespoons of butter or lard. One-fourth teaspoon of salt; cold water to moisten, about one and one-half tablespoons. Add salt to flour and cut fat into mixture. Use just enough water to make particles adhere together. Roll very thin, handling as little as possible.

Loganberry Pie, No. 2.

Line plate with paste rolled until thin. Fill with berries which have been picked over and washed, or with canned berries. Add sugar. (The amount needed will depend upon the size of pie, ripeness and acidity of the berries, so this must be determined by tasting.) Arrange six strips of pastry across the top, cut same width as rim; put on upper rim. Bake 30 minutes in a moderate oven.

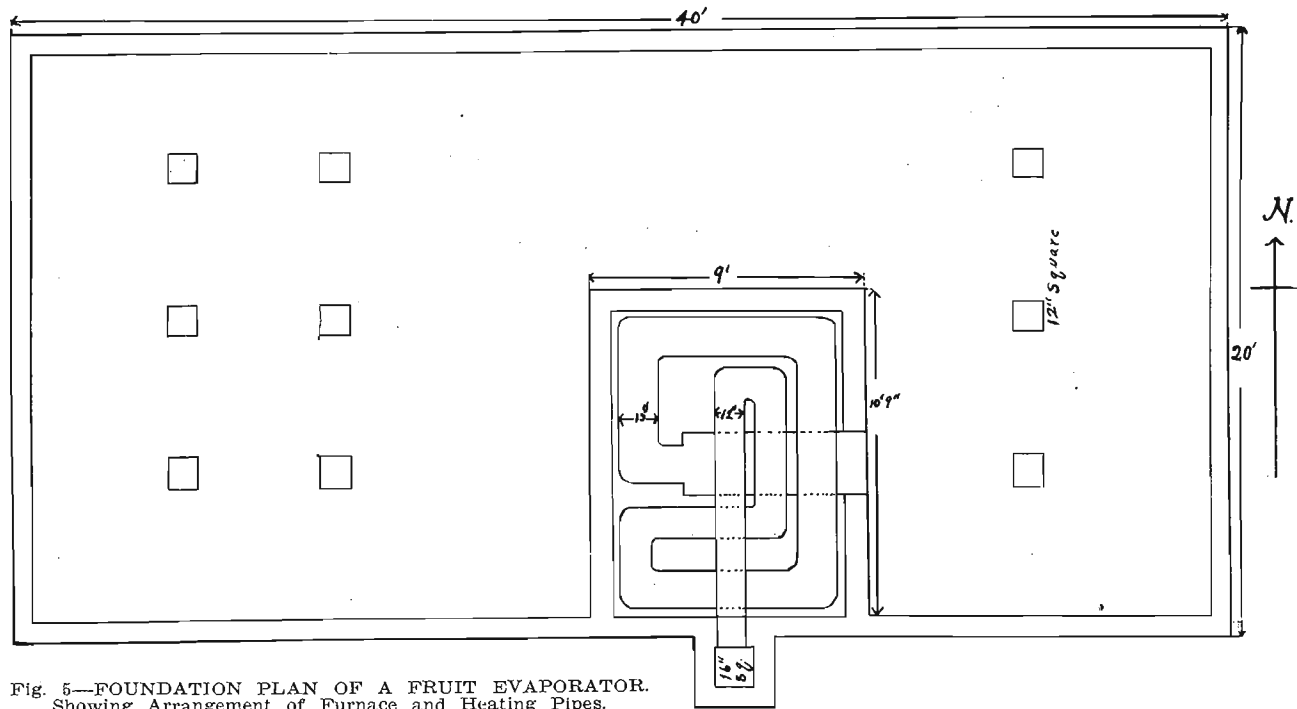


Fig. 5—FOUNDATION PLAN OF A FRUIT EVAPORATOR.
Showing Arrangement of Furnace and Heating Pipes.

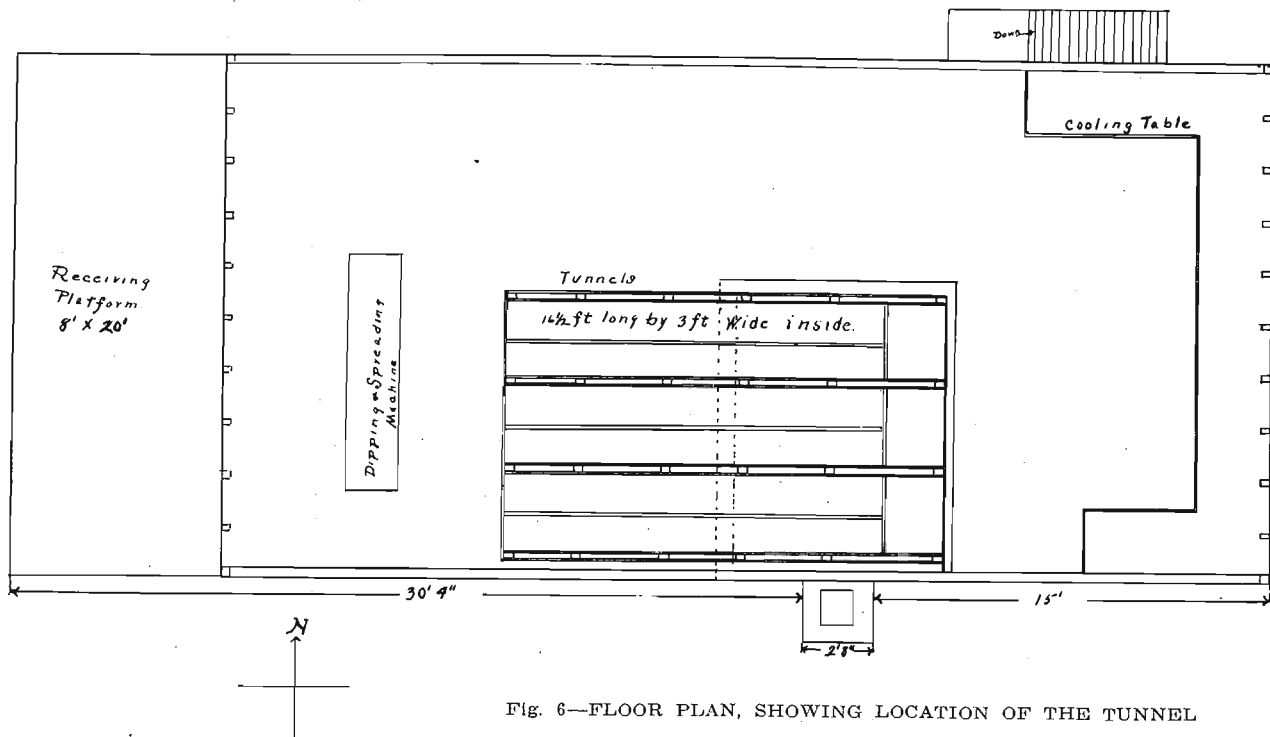
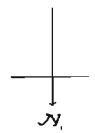
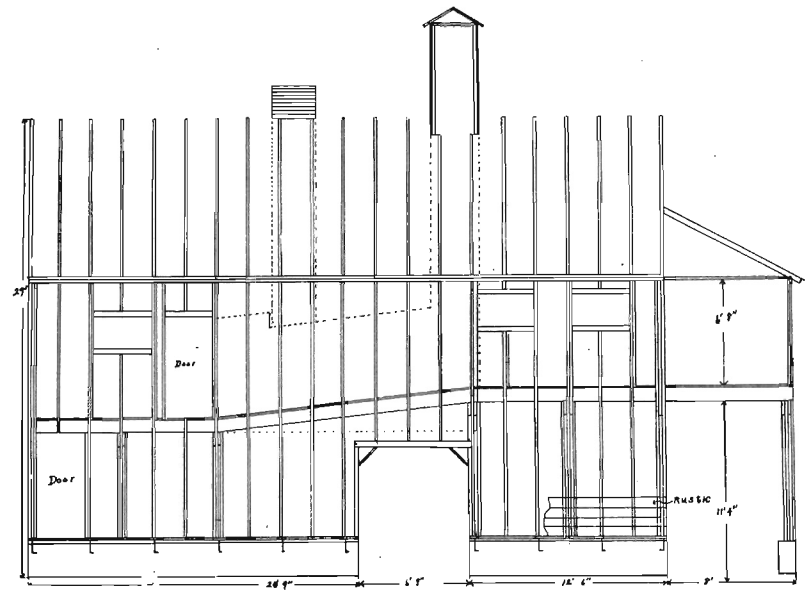


Fig. 6—FLOOR PLAN, SHOWING LOCATION OF THE TUNNEL

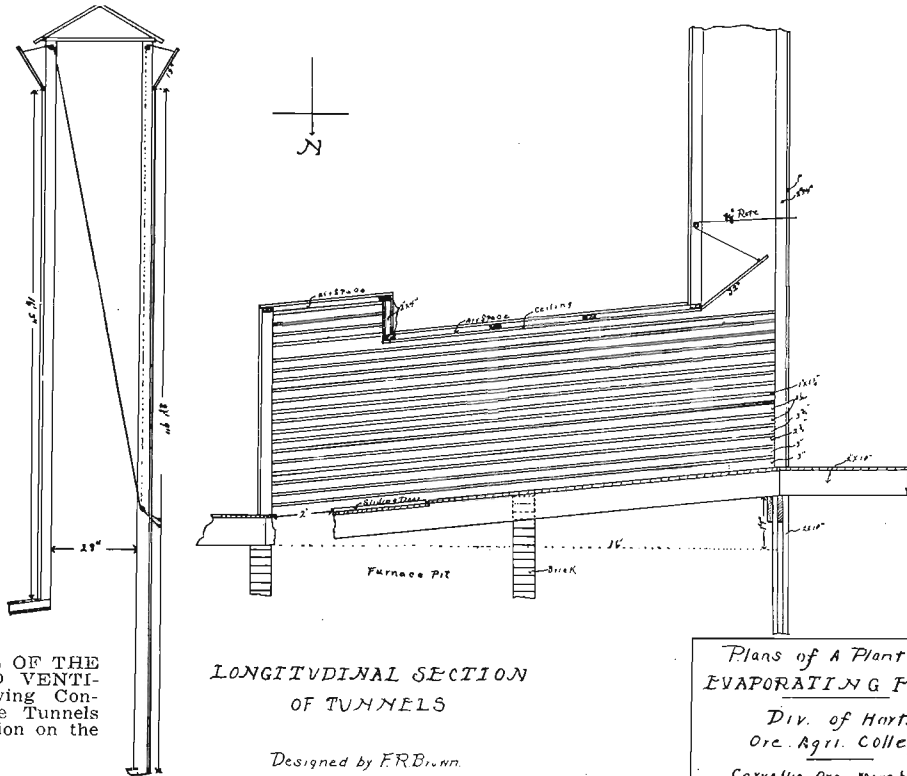


FRAMING ELEVATION
of
NORTH WALL

Designed by FR Brown

Plans of A Plant For
EVAPORATING FRUITS
Div. of Hort.
Ore. Agr. College.
Corvallis Ore. March 1914

Fig 7—NORTH WALL. NOTE THE SLOPE OF THE FLOOR WHICH CORRESPONDS TO THE SLOPE OF THE TUNNELS



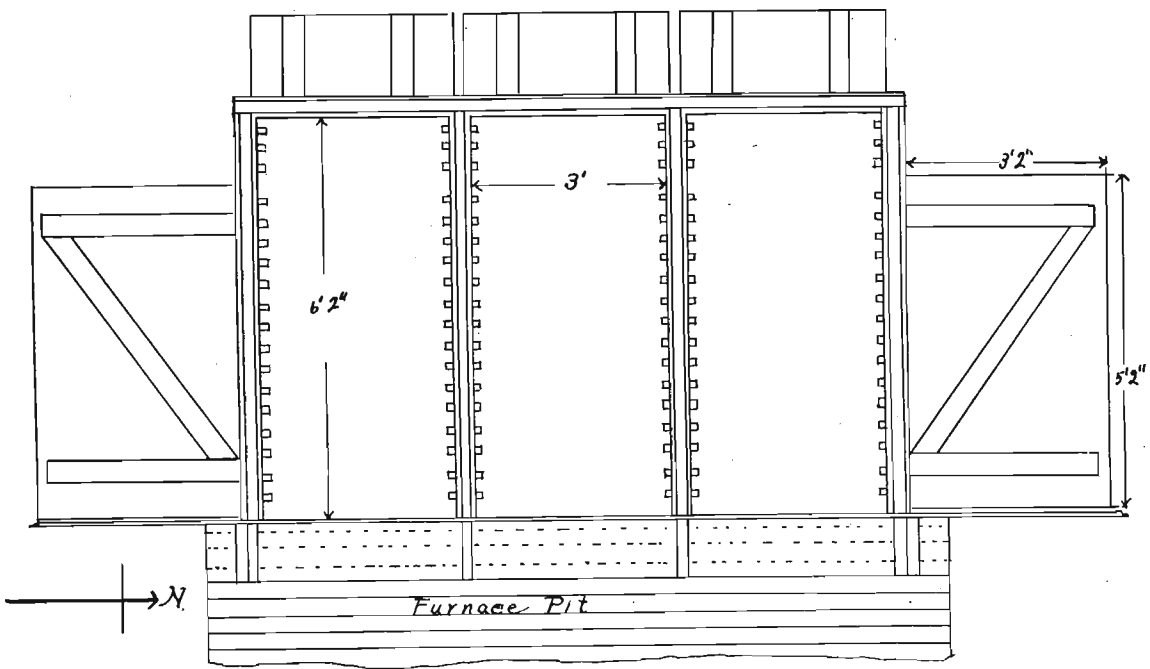


Fig. 9—DETAIL OF THE LOWER END OF THE TUNNELS, SHOWING ARRANGEMENT OF DOORS