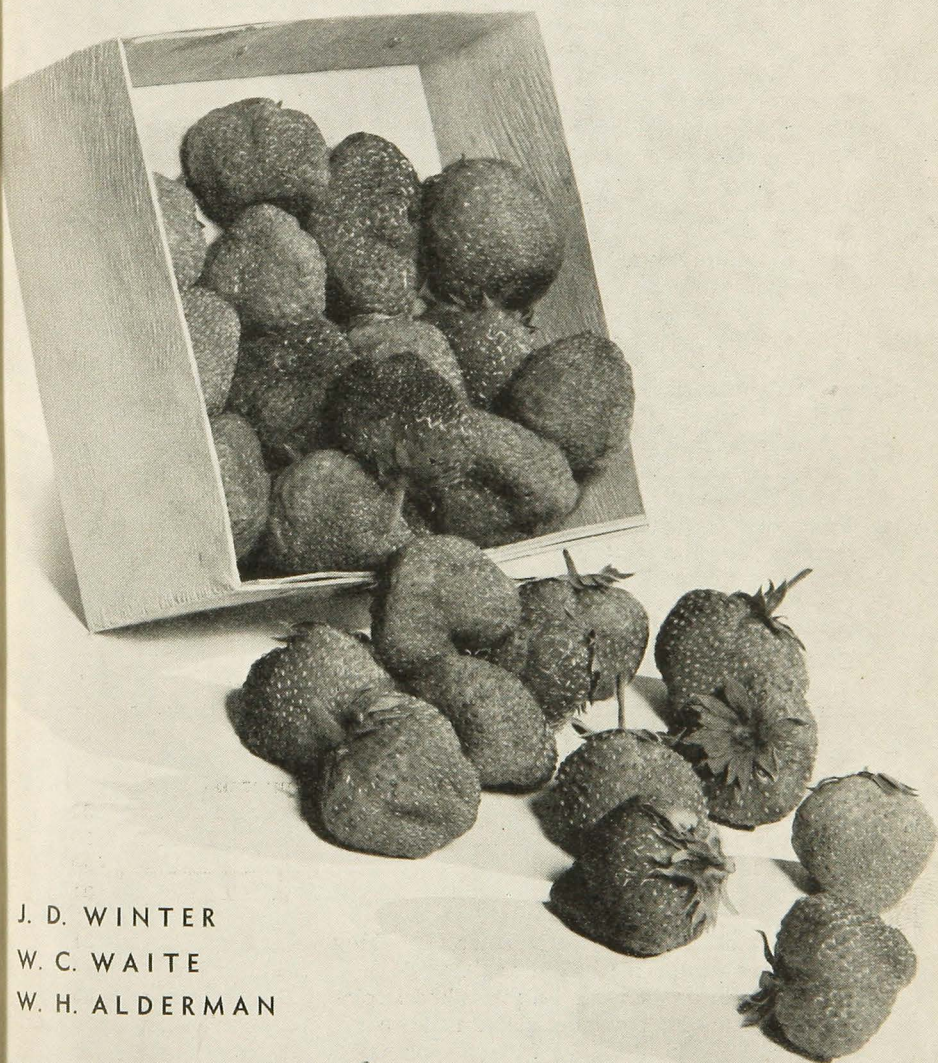


MARKET OUTLETS FOR MINNESOTA FRUITS



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CONTENTS

	Page
Commercial production of raspberries and strawberries.....	3
Established grades and legal measures for Minnesota fruits.....	4
U. S. standards for raspberries.....	5
U. S. standards for strawberries.....	5
Grades used by co-operative associations.....	6
State and federal legal measures for fruits.....	7
The fresh fruit market for raspberries and strawberries.....	7
Channels of distribution.....	8
Transportation problems.....	10
Shipping weights.....	12
Express rates to consuming markets.....	13
Freezing raspberries and strawberries for commercial use.....	18
Storage costs.....	18
Storage temperature.....	18
Containers.....	19
Packing methods.....	19
Varieties for freezing storage.....	20
Commercial utilization of raspberries and strawberries.....	21
Frozen berries for retail distribution.....	21
Commercial manufacture of jams, preserves, and jellies.....	23
Use of Minnesota raspberries by preserving factories.....	24
Use of Minnesota strawberries by preserving factories.....	24
Prospects for market in preserving industry.....	25
Berries used for ice cream manufacture.....	25
Prospects for market in ice cream industry.....	26
Crushed fruits for soda fountain trade.....	27
Berries used in the baking industry.....	28
Commercial canning.....	28
Summarized statement of quantity of berries used for commercial manufacture in Minnesota.....	28
Use of Minnesota apples, plums, and grapes for commercial manufacture.....	30
Apples and crabs.....	30
Plums.....	30
Grapes.....	31
Value of Minnesota apples for commercial baking.....	31
Requirements for the baked apple trade.....	31
Tests of Minnesota varieties for baked apples.....	33
Requirements for commercial pie making.....	34
Tests of Minnesota apples for pie making.....	35

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THIS PUBLICATION presents a preliminary study of the marketing problems of Minnesota-grown fruits with special reference to the possible utilization of these fruits in commercial manufacture. During the last decade improved methods of packing and shipping perishable fruits from other regions have placed competing fruits on the local markets far in advance of the local crop season. Early pickings of local berries, for example, no longer bring the high prices that were received formerly for the early local crop. Moreover, there is some tendency toward increased local production. For these reasons it is increasingly important for local growers to endeavor to secure an adequate distribution for their crop especially during the peak of production, if they are to receive a fair average price for the season.

If growers endeavor to extend their markets by the shipment of berries, attention must be given to the legal requirements for shipment and transportation rates. The federal requirements governing shipments outside the state and the state regulations governing shipments within the state, in consequence, have been discussed. There is also a study of the transportation rates on fresh strawberries and raspberries between 20 Minnesota and Wisconsin shipping points and 30 consuming markets.

The possibilities of a greater utilization of Minnesota-grown fruits for commercial manufacture, particularly during the peak of production, are of considerable importance.

COMMERCIAL PRODUCTION OF RASPBERRIES AND STRAWBERRIES

No statistics are available showing the total volume of raspberries and strawberries produced commercially in Minnesota. Records of the sales of berry boxes to Minnesota growers by eight factories in Minnesota, Wisconsin, and Iowa have been secured, however. The eight factories that co-operated are believed to supply almost all the berry containers used by commercial growers in Minnesota. These factories made available their records of shipments and sales for 1935 and in some instances also similar records for previous years. Some additional data were secured from other sources where factory records were incomplete.

Though a survey of production made on this basis cannot be wholly accurate, it probably affords a more reliable index of commercial production than can be secured in any way other than a farm-to-farm census. Sales of berry boxes during 1935 in Minnesota, according to these records, totaled

¹ Completion of certain parts of this project was made possible by workers on Official Project No. 65-1-71-140, Minnesota Work Projects Administration. Sponsor: University of Minnesota.

1,816,146 pints and 2,312,139 quarts. These records do not include any corrections for berry boxes held over by growers from the previous year, or for boxes purchased in 1935 but not used. It is probable that relatively few crates were carried over from 1935 to 1936, and in 1935 growers did not have many strawberry crates held over from the previous year. However, there was a considerable carry-over of raspberry crates in 1935 from the previous year, so that with proper allowance made for this factor the total for raspberries in 1935 would be approximately 2,000,000 pints. For the purpose of this survey, it is assumed that all pint boxes were used for raspberries and all quart boxes for strawberries, although some ever-bearing strawberries are marketed in pint boxes and some use is made of quart boxes for other fruits. Most of the factory records made it possible to separate boxes sold for blueberries, but this could not be done in all instances. Obviously, these records fail to include any production sold direct to consumers who pick the berries into containers other than regular berry boxes.

An examination of the shipping records of berry marketing associations and of box manufacturers indicated that the 1935 strawberry production in Minnesota represented an average production for the period 1929-1935, excluding the severely reduced crop of 1934. The production per acre in 1935 was unusually heavy, but reduced acreage due to drouth conditions in 1933 and 1934 held the total volume to approximately that of an average crop for the state.

On the other hand, these same records indicated that the 1935 raspberry crop was considerably below the aver-

age for the period 1929-1935. In 1929, a year of heavy production, one box factory alone sold more pint raspberry boxes than the total quantity sold by eight factories in 1935. It is probable that the 1935 raspberry production in Minnesota did not exceed 50 per cent of a normal crop.

A similar survey of berry-box sales in Minnesota was made in 1936, except that records were not obtained for each county. According to records secured in this survey, sales in Minnesota totaled 2,200,000 pints and 2,700,000 quarts, indicating a slight increase in the commercial crop of raspberries over 1935 and an increase of 15 per cent in strawberries.

By 1940 it became evident that there was a considerable increase in acreage over the 1935-36 period, especially with strawberries. Favorable weather prevailed for the 1939 and 1940 crops. Shipping association records indicated a yield of strawberries estimated at 4,000,000 quarts in 1939 and 6,000,000 quarts in 1940. The raspberry crop in 1939 was also considerably above recent levels and is estimated at 5,500,000 pints.

ESTABLISHED GRADES AND LEGAL MEASURES FOR MINNESOTA FRUITS

The proper grading of fruit is so closely identified with marketing problems that it is important for the grower to have a clear understanding of grade requirements. The grade refers to the character or the quality of the fruit. The legal measures refer to the size of containers for the fruit or the weights of the fruit contained therein. Grading is permissive; that is, the grower

may grade his fruit if he desires, but the use of the legal measure is mandatory. Each grower, in consequence, should be familiar with the state and federal legal measures for the fruit that he places on the market. He should also consider the advantages that might be secured in grading his own fruit and be well informed regarding the customary grading of fruit that comes into direct competition with his own.

The standards recommended by the United States Department of Agriculture are the official grades in Minnesota for both raspberries and strawberries. If berries are graded according to these standards, the proper grade designations may be used. These standards are given below.

U. S. Standards for Raspberries

The United States Department of Agriculture recommends the following standards for use in grading raspberries:

U. S. No. 1 shall consist of raspberries of one variety that are well colored, well developed, and not soft, overripe or broken; that are free from cores, sunscald, mold and decay, and from damage caused by dirt or other foreign matter, shriveling, moisture, disease, insects, mechanical, or other means.

In order to allow for variations incident to proper grading and handling, not more than 10 per cent, by volume, of the raspberries in any container² may be below the requirements of this grade, but not to exceed one half of this tolerance, or 5 per cent, shall be allowed for defects causing serious damage, and not more than one fifth

of this amount, or 1 per cent, may be affected by mold or decay.

U. S. No. 2 shall consist of raspberries of one variety which are not graded in conformity with the foregoing grade and which do not contain more than 10 per cent, by volume, of raspberries that have been seriously damaged from any cause, but not more than one fifth of this amount, or 2 per cent, may be affected by mold or decay.

Unclassified shall consist of raspberries which are not graded in conformity with either of the foregoing grades.

The terms used in these grades are defined as follows: "Well colored" means that the whole surface of the berry shows a color characteristic of a mature berry. "Well developed" means that the berries shall not be misshapen owing to anthracnose injury, frost injury, lack of pollination, insect injury, or other causes. "Overripe" means dead ripe or soft, necessitating immediate consumption. "Damage" means any injury or defect that materially affects the appearance, or edible or shipping quality. "Serious damage" means berries that are badly deformed, crushed, leaky, moldy, decayed, or otherwise seriously injured. Berries that have poor color characteristic of immature berries or berries from which the core has not been removed shall be considered as seriously damaged.

U. S. Standards for Strawberries

The following standards are recommended by the United States Department of Agriculture for use in grading strawberries:

U. S. No. 1 shall consist of strawberries of one variety, with the cap (calyx) attached, which are firm, not overripe, underripe, or undeveloped, and which are free from mold or decay

² The tolerances specified for the various grades are placed on a container basis. However, any lot of raspberries shall be considered as meeting the requirements of a specified grade, if upon inspection no sample from the containers in any lot is found to exceed the tolerances specified by more than one half the amount allowed, provided that the entire lot shall average within the tolerances specified.

and from damage caused by dirt, moisture, foreign matter, disease, insects, or mechanical or other means. *Unless otherwise specified*, the minimum size shall be not less than three quarters of an inch in diameter.

To allow for variations other than size incident to proper grading and handling, not more than 10 per cent, by volume, of the strawberries in any lot may be below the requirements of this grade, but not to exceed one half of this tolerance, or 5 per cent, shall be allowed for defects causing serious damage, and not more than one fifth of this amount, or 1 per cent, shall be allowed for decay.

In addition, not more than 5 per cent, by volume, of the strawberries in any lot may be below the specified minimum size.

U. S. No. 2 shall consist of strawberries which are free from decay and from serious damage caused by disease, insects, mechanical, or other means. *Unless otherwise specified*, the minimum size shall be not less than five eighths of an inch in diameter.

To allow for variations other than size incident to proper grading and handling, not more than a total of 10 per cent, by volume, of the strawberries in any lot shall be allowed for defects causing serious damage, but not to exceed three tenths of this amount, or 3 per cent, shall be allowed for strawberries affected by decay.

In addition, not more than 5 per cent, by volume, of the strawberries in any lot may be below the specified minimum size.

Unclassified shall consist of strawberries which are not graded in conformity with either of the foregoing grades.

The terms used in these grades are defined as follows: "Overripe" means dead ripe, becoming soft, a condition unfit for shipment and necessitating immediate consumption. "Underripe" means so immature that less than two thirds of the surface of the berry is of a pink or red color. "Undeveloped" means not having attained a normal shape and development owing to frost

injury, lack of pollination, insect injury, or other causes. "Button" berries are the most common type of this condition. "Damage" means any injury from the causes mentioned which materially affects the appearance or edible or shipping quality. "Serious damage" means that the strawberries are soft, badly deformed, badly bruised, leaky, or otherwise seriously injured. Strawberries which are caked with dirt or which show no pink or red color shall be considered seriously damaged. "Diameter" means the greatest dimension at right angles to a straight line running from the stem to the apex.

Grades Used by Co-operative Associations

In 1934 a survey was conducted among the principal berry shipping associations in the United States to determine what grades were being used. Data were secured from 30 of these associations, and a tabulation is shown in table 1 which indicates that more than half of the associations are using the U. S. grades or their equivalent.

The co-operative shipping associations in Minnesota commonly use two grades which are designated as (1) fancy and (2) commercial. These two grades correspond in general with U. S. No. 1 and U. S. No. 2. In 1935 one of these associations reported an average price for the fancy grade of raspberries which was 23 per cent above

Table 1. Grades Used by 30 Co-operative Shipping Associations for Raspberries and Strawberries, 1934

Using the U. S. grades.....	16
Using two grades (approximately same as U. S. Grades)	3
Using two grades (different from U. S. Grades)	4
Using one grade only (different from U. S. Grades)	7
Total	30

the average price for the commercial grade. The fancy grade of strawberries brought 24 per cent above the average price for the commercial grade, thus demonstrating the importance of producing fruit of the best market grade.

State and Federal Legal Measures for Fruits

Regulations of the Minnesota State Department of Agriculture require that each crate of raspberries and strawberries offered for sale in Minnesota shall be marked with the name and place of business of the grower or distributor together with the size and number of containers inside the crate. Similar regulations of the Federal Food and Drug Act apply to interstate shipments. The state regulations also provide that each crate must bear the date of packing, but this requirement is not generally observed.

Only new containers may legally be used, and these must conform to the provisions of the United States Standard Container Act which requires that berry boxes and other containers for small fruits shall be of the following capacities: dry $\frac{1}{2}$ pint, dry 1 pint, dry 1 quart, or multiples of the dry 1 quart. It further provides that the standard dry pint shall contain 33.6 cubic inches and that the standard dry quart shall contain 67.2 cubic inches.

When such containers are level full they contain the legal measure of fruit. There is no legal weight established for small fruits but persons who offer for sale containers which are not level full are subject to prosecution under the provisions of Chapter 66, Section 1, Minnesota Laws 1913. This law is administered by the Minnesota Railroad and Warehouse Commission. It

is not legal to sell berries "by the box" unless the box and its contents conform to the legal requirements stated above. These regulations apply to all small fruits such as blueberries, currants, gooseberries, raspberries, and strawberries.

The legal weight in Minnesota for pears is 45 pounds, but there is no legal weight for apples and plums. The Minnesota law with reference to apples states that "the term 'bushel' shall mean 2150.42 cubic inches with a permitted tolerance of 50 cubic inches." As this measure conforms with the provisions of the United States Standard Container Act under which the capacity of bushel baskets is determined, it means that a standard bushel basket when level full contains a legal bushel of apples. There is no similar provision with respect to plums.

Regulations of the Minnesota State Department of Agriculture prohibit the repacking of the original pack for the purpose of increasing the number of cups or crates.

Labels used by fruit growers to identify their product may be registered at the office of the Secretary of State at St. Paul. A number of individual growers and certain co-operative associations in Minnesota are using special labels on their product.

THE FRESH FRUIT MARKET FOR RASPBERRIES AND STRAWBERRIES

The fresh fruit market normally is the best outlet for Minnesota-grown raspberries and strawberries and almost the entire crop is sold for table use or for home preserving or canning. Since 1938 increasing quantities of

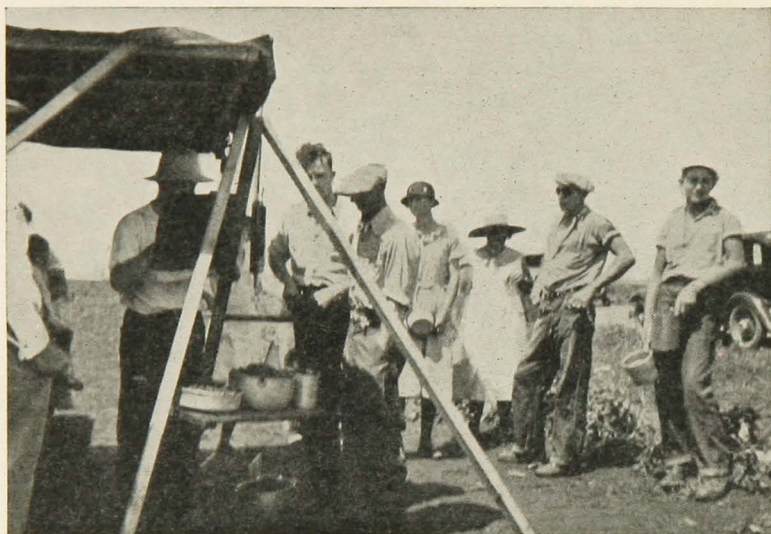


FIG. 1. WEIGHING BERRIES THAT ARE SOLD BY THE POUND TO CUSTOMERS WHO PICK THEIR OWN FRUIT

these fruits are being placed in refrigerated lockers by the consumer. The first of these locker plants was established in Minnesota in 1935 and the number now exceeds 300.

Channels of Distribution

Marketing of the berry crop is conducted through four different channels: (1) direct to consumer, (2) to retail distributor, (3) through wholesale buyers in terminal markets, and (4) through co-operative marketing associations.

The grower employs several methods in selling fruit direct to the consumer, among which are sales made at the farm, owner-operated roadside markets, city markets, and house-to-house peddling by truck. A recent innovation is the plan by which the fruit is advertised for sale on the bush or plant. The purchaser comes to the

farm and picks the fruit at a stipulated price, furnishing his own containers. This plan has met with considerable success, but it must be supplemented by other methods of marketing to dispose of surplus fruit, because the grower must try to maintain a reserve supply of fruit to accommodate a fluctuating demand. In recent years growers have received from 8 to 12 cents a pound for raspberries and 4 to 8 cents a pound for strawberries, without any expense for picking or for containers.

Retail distributors handle a large volume of the crop. These consist of retail merchants, operators of roadside markets, and truck peddlers. Under the Perishable Agricultural Commodities Act any person buying for resale 2,000 pounds or more of fruit or other produce in interstate or foreign commerce is a "dealer" and is required to be licensed by the Secretary of Agri-

culture. Truckers who purchase fruit to be sold in other states must, in certain instances, obtain a special license. Iowa now requires a license as an itinerant merchant to be secured from the motor vehicle department of that state.

A trucker operating within the state who buys fruit for resale to retail merchants or to others handling fruit for resale is required to obtain a Minnesota wholesale dealers license regardless of the amount of fruit sold, but no state license is required when sales are made direct to consumers. However, many local communities require a so-called peddlers license when fruit is purchased for resale to consumers.

There are six active co-operative berry marketing associations in Minnesota. These are the Afton Fruit Growers Association at Afton, the Cuyuna Range Fruit Growers Association (1936), the Excelsior Fruit Growers Association at Excelsior, the Head-of-the-Lakes Fruit Growers Association at Duluth, the Howard Lake Fruit Growers Association at Howard Lake, and the Minnetonka Co-operative Fruit Growers Association at Maple Plain. The total quantity of raspberries handled by the five associations in 1935 was 21,489 24-pint crates. The total quantity of strawberries handled by the same associations in 1935 was 758 16-quart crates and 19,823 24-quart crates. It should be taken into consid-

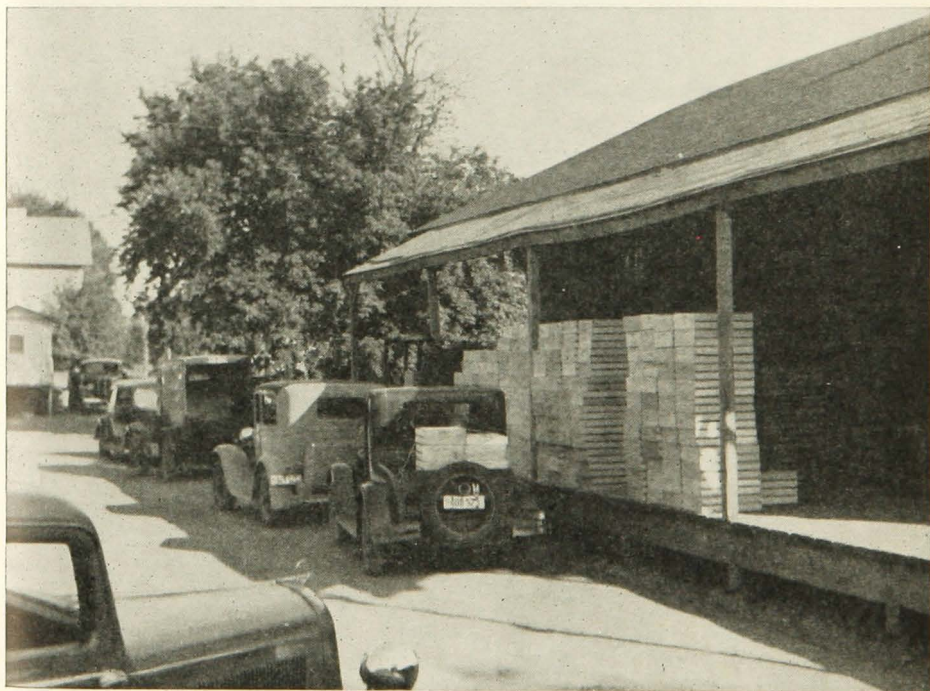


FIG. 2. BERRIES ARRIVING AT THE SHIPPING PLATFORM OF A CO-OPERATIVE MARKETING ASSOCIATION: NOTE THAT VENTILATED CRATES ARE BEING USED

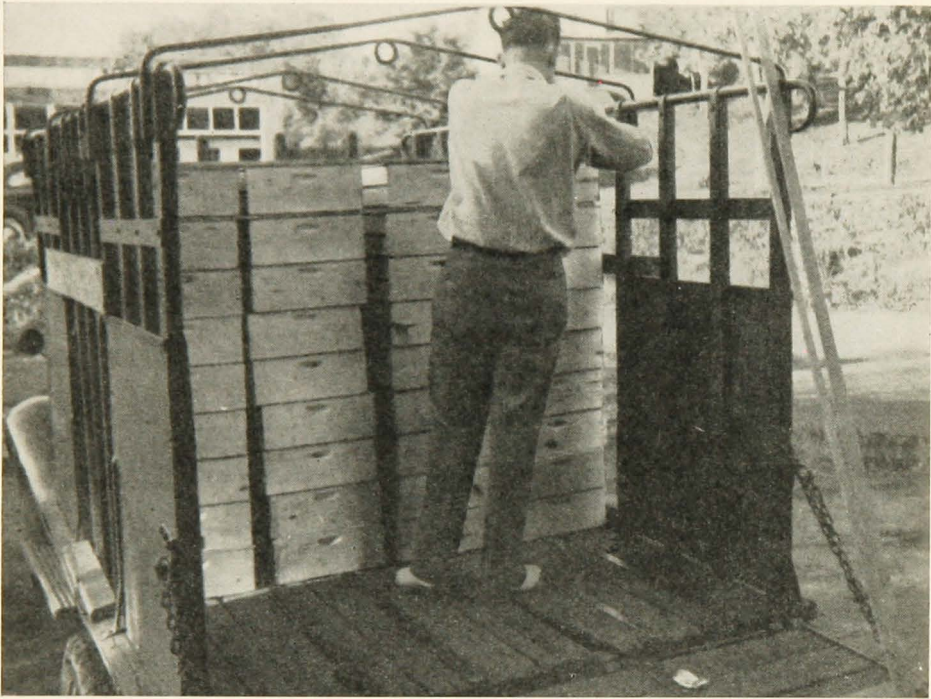


FIG. 3. LOADING BERRIES FOR SHIPMENT BY TRUCK INTO WESTERN MINNESOTA; LATHS ARE BEING NAILED TO THE TWO TOP TIERS OF CRATES

eration that production of raspberries was decidedly below normal in 1935. These associations handle only a part of the total commercial crop in Minnesota.

The expense of marketing through a co-operative association usually averages about 10 per cent of the gross receipts. Receipts for each day are pooled and each grower receives the average price for his grade less expenses which are pro-rated.

Transportation Problems

A steadily increasing proportion of the Minnesota berry crop is being shipped to market by truck. Successful handling of berries by truck requires

careful attention to loading and driving. A light load of berries in a truck of large capacity with heavy springs usually results in much damage in transit. The fruit will travel best in a truck loaded to its rated capacity, provided the tiers of crates are not piled too high. Raspberry crates stacked 14 tiers high have been known to break and cause serious damage to the fruit in transit.

Trucks usually travel at night and a good circulation of air is of the utmost importance in a non-refrigerated body. Crates should be loaded with the longest dimension from front to rear and a space two to three inches wide is left between each row, this space running lengthwise of the truck from front

to rear. Laths are placed between each tier or alternate tier of crates, these laths extending to the sides of the truck for bracing to prevent side motion. The laths may be nailed to the end of each crate although sometimes it is necessary to nail only the two top tiers to hold the load in position. For nailing, a 4 d. box nail is used. The crates at the rear must be well braced to prevent lengthwise motion. Figure 3 shows a trucker nailing laths in place on the top tier. Note the metal support for a canvas that will cover the fruit when loading is completed.

Adequate ventilation should be provided from front to rear on trucks with closed bodies. Since the introduction of the ventilated crates for both raspberries and strawberries, truckers are

showing a marked preference for fruit packed in this type of container. If market deliveries will permit, each half cover of each crate should be slit down the center before loading and about one third of the cover removed to permit better ventilation, unless three piece divided covers or two inch slat covers are used. Three piece divided covers provide better ventilation for the top layer of fruit than the standard two piece covers.

Trucks with refrigerated bodies must be used if berries are to be moved unusually long distances, and a constant circulation of air inside the truck should be provided. Figure 4 shows a truck of this type which moved raspberries successfully from Duluth to New York City in August, 1939. A

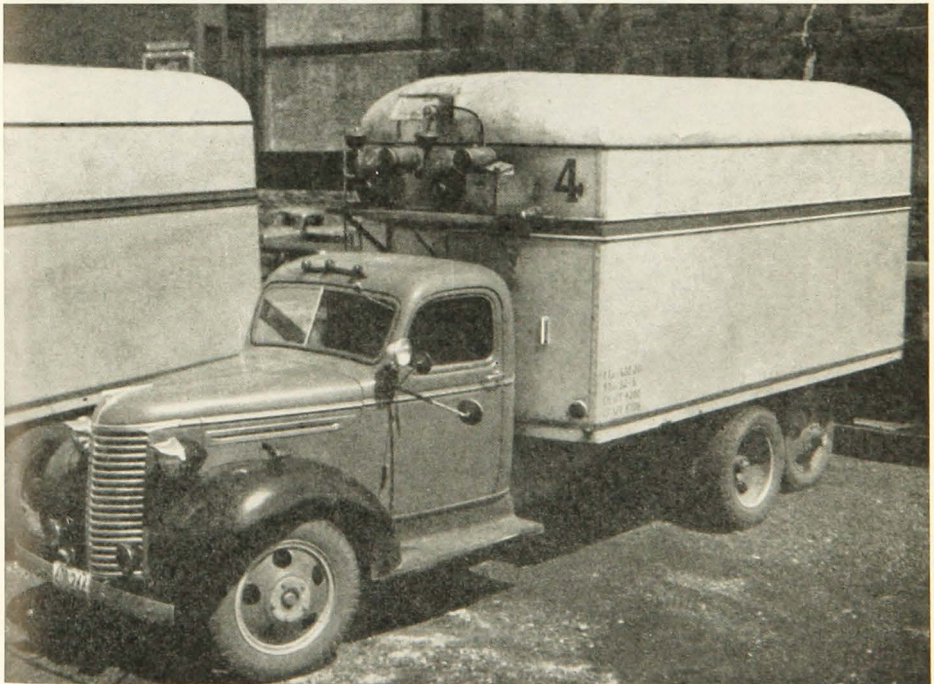


FIG. 4. A TRUCK EQUIPPED WITH A FAN AND ICE BUNKERS AT EACH END, CONSTRUCTED ESPECIALLY FOR HAULING BERRIES TO TERMINAL MARKETS

gasoline motor attached to the front of the truck body operates a fan inside and eight tires on the rear permit low tire pressure in transit.

The use of a conditioning room in which the fruit may be placed while awaiting shipment will assist in getting the berries to their destination in good market condition. The construction and operation of a room of this type is described in a mimeographed circular which may be obtained from the Division of Horticulture at University Farm, St. Paul. A number of such rooms are in operation in Minnesota and adjoining states.

When shipping fruit to a terminal market the time of arrival is of the greatest importance. Lower prices may be expected for berries that arrive in a large terminal market later than about 5 a.m. as compared to ber-

ries of the same quality that arrive earlier. Shipments by express should be checked to see that train schedules do not make it necessary to carry the shipment past the destination point and reload for a back haul, causing extra delay and handling. Berries picked after rains do not ship well and soft berries may be expected for two pickings following wet weather.

Shipping Weights

When shipping crates of berries in large quantities it has been customary to bill the crates at a uniform weight rather than attempt to weigh the crates individually or collectively. A 24-pint crate of raspberries usually is billed at 20 pounds, a 16-quart crate of strawberries at 25 pounds, and a 24-quart crate of strawberries at 35 pounds.

Table 2. Excess of L.C.L. Express Rates on Berries Over Express Rate from Market of Lowest Cost on Crates of 35 Pounds

Shipping point	Thirty markets	Dakotas markets	Twin Cities and Minnesota	Southern markets	Milwaukee and Chicago	Duluth
Aitkin	36½	7	33	27	53	22
Albert Lea	18½	3	22	0	34	37
Bayfield	17½	24	55	36	16	41
Bemidji	47½	6	37	39	66	33
Brainerd	37½	0	27	26	56	27
Duluth	31½	11	27	27	47	0
Excelsior	25	6	17	13	42	27
Faribault	25	6	18	13	42	27
Grand Rapids	42	13	37	37	58	22
Howard Lake	31½	0	19	16	51	33
Long Lake	25	6	17	13	42	27
La Crescent	10	24	33	6	17	41
La Crosse	0	24	23	5	0	62
Mankato	25	6	18	13	42	27
Minneapolis	23	6	0	12	42	27
Rochester	18½	11	18	10	33	33
Sparta	2½	26	55	7	0	65
Virginia	39	16	37	36	54	19
Warrens	5½	24	49	18	3	55
Winona	16½	20	23	12	26	37
Lowest rate	41½	61	0	59	34	0

The lowest rate plus the excess gives the rate to each market from the specified destinations.

The average pint box of raspberries contains about 11 ounces of berries although the net weight may vary as much as two ounces depending on the variety, size, and moisture content of the fruit. A 24-pint crate usually contains about 16½ to 17 pounds net weight of raspberries when it arrives on the market.

Similarly, the average quart box of strawberries contains about 18 to 20 ounces of berries at the time of picking, although this weight may vary as much as three ounces. A 24-quart crate may contain from 28 to 30 pounds net weight of strawberries on arrival on the market, usually averaging about 28 pounds.

Express Rates to Consuming Markets

Berries that are shipped considerable distances generally move by express. The grower ordinarily will receive approximately the wholesale price in the consuming center for his type and quality of berry less the cost of transportation to that center and possibly a margin which is deducted for handling. The express rates from the various shipping points to the consuming markets are, in consequence, of importance in the price to producers.

Rates have been secured for L.C.L. shipments between 20 Minnesota and Wisconsin shipping points and 30 consuming markets to which these berries are shipped.³ In a few cases the ex-

press company allows special rates on lots of 300 pounds or more. In the following computations these rates were used in the place of the L.C.L. rates between the markets where offered. Carlot rates were in effect only between Bayfield, Wisconsin; Excelsior; the Twin Cities; and Sparta, Wisconsin, and one or more of the following cities: Aberdeen, Chicago, Devils Lake, Fargo, Duluth, Grand Forks, Huron, Kansas City, Milwaukee, the Twin Cities, Minot, Omaha, Sioux City, Sioux Falls, and Watertown.

The rates given are those prevailing in the summer and fall of 1935. Any considerable movement of berries between specified points might lead the Interstate Commerce Commission to specify special rates upon request of the interested parties. In consequence, the rate structure for berries cannot be looked upon as a permanent arrangement but is subject to modification upon an increase in the demand for services. Growers should be on the alert to seek these changes as occasion arises. Analysis, however, is possible only on the basis of the existing rate structure.

Table 2 gives the express rate on L.C.L. shipments of berries on the basis of 35-pound crates from each of the 20 shipping points. An average rate for the 30 markets and for markets located in five areas—the Dakotas, the Twin Cities, southern markets, Milwaukee and Chicago, and Duluth—has been computed. The Dakota markets include Sioux Falls, Watertown, Aberdeen,

³ The shipping points were: Aitkin, Albert Lea, Bayfield, Wis., Bemidji, Brainerd, Duluth, Excelsior, Faribault, Grand Rapids, Howard Lake, Long Lake, La Crosse, La Crosse, Wis., Mankato, Twin Cities, Rochester, Sparta, Wis., Virginia, Warrens, Wis., and Winona. The consuming markets were Aberdeen, S. D., Alexandria, Bemidji, Chicago, Ill., Crookston, Davenport, Iowa, Des Moines, Iowa, Devils Lake, N. D., Duluth, Fargo, N. D., Fergus Falls, Fort Dodge, Iowa, Grand Forks, N. D., Huron, S. D., Kansas City, Mo., La Crosse, Wis., Mandan, N. D., Mankato, Marshall, Milwaukee, Wis., Minneapolis, St. Paul, Minot, N. D., Omaha, Neb., Pipestone, Rapid City, S. D., St. Cloud, Sioux City, Iowa, Sioux Falls, S. D., and Watertown, S. D.

Huron, Rapid City, Fargo, Grand Forks, Devils Lake, Minot, and Mandan. The southern group of markets includes Omaha, Kansas City, Sioux City, Des Moines, Davenport, Mason City, Fort Dodge, and La Crosse. Where more than one market is included in the receiving area, the express rates have been weighted by the populations of the included markets, on the assumption that the rates to the larger markets were more important than those to the smaller markets. The lowest rate to any market from the designated point or area is given at the bottom of

the table, and the excess rates to the other markets above this minimum are in the rows following the designated market. Thus, La Crosse with a rate of 41½ cents per crate has the lowest average weighted rate to all the 30 markets. La Crescent has a rate 10 cents above this, or 51½ cents per crate. The rate from any shipping point to the designated market may thus be obtained by adding the excess of rate of that market above the lowest to the lowest rate. For all the 30 markets, La Crosse, Sparta, and Warrens have an advantage largely because

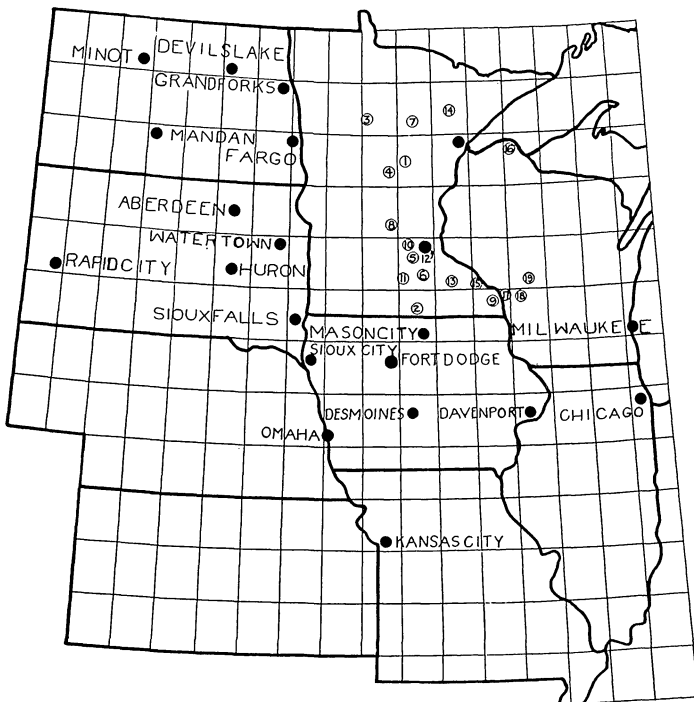


FIG. 5. PRINCIPAL SHIPPING AND RECEIVING POINTS FOR MINNESOTA BERRIES AND EXPRESS RATE BLOCKS FOR THE TERRITORY

The receiving centers are designated by the solid dots. The shipping points are designated by number as follows: 1, Aitkin; 2, Albert Lea; 3, Bemidji; 4, Brainerd; 5, Excelsior; 6, Faribault; 7, Grand Rapids; 8, Howard Lake; 9, La Crescent; 10, Long Lake; 11, Mankato; 12, Minneapolis-St. Paul; 13, Rochester; 14, Virginia; 15, Winona; 16, Bayfield; 17, La Crosse; 18, Sparta; 19, Warrens.

of the importance of Chicago in determining the rate. For the Dakotas, Brainerd, Howard Lake, and Albert Lea have the lowest rates. For the Southern markets, Albert Lea, La Crosse, La Crescent, and Sparta have advantages. For Milwaukee and Chicago, Sparta, La Crosse, and Warrens have the lowest rates. For the Twin Cities and Duluth, the local growers have distinct advantages, with a considerable number of shipping points at somewhat similar, higher rates.

Except where special tariffs are in effect express rates are constructed upon a system of blocks and sub-blocks. Each block includes a territory roughly 45 to 50 miles from east to west in Minnesota and 69 miles north and south. Each block is composed of 16 sub-blocks. Within the block and to neighboring blocks rates are constructed by sub-blocks, but for greater distances the rate is uniform for an entire block. Thus, the express rate from any point in the block containing Minneapolis to any point in the block containing Grand Forks, N. D., will be the same as the express rate between Minneapolis and Grand Forks. Minnesota lies in about 36 blocks as shown in Figure 5.

Typical rates for shipments within the territory are given in Table 3. Examination of this table will show that beginning with a basic rate of 64 cents per hundred pounds for nearby shipments, the rate increases by approximately 20 cents per hundred pounds for each 50-mile increase in distance. For shipments within the state of Minnesota, a lower scale applies which lowers the second-class rate as usually calculated for certain commodities at 75 per cent of first class to 50 per cent of first class for intra-

Table 3. Typical Express Rates per 100 Pounds for Berries Shipped Various Distances in the Western Territory and in Minnesota

Shipments traveling a distance of—	Usual rate established by Interstate Commerce Commission for this territory	Rate established for shipments within Minnesota
miles	cents	cents
0 - 12½	64	43
12½- 25	67	45
25 - 37½	71	48
37½- 50	75	50
50 - 75	82	55
75 -100	94	63
100 -150	116	78
150 -200	139	93
200 -250	157	105
250 -300	176	118

state movements. This gives a decided advantage to Minnesota growers in shipping to points within the state itself. There are no similar advantages to shipments outside the state. For example, second-class rates on shipments from Bemidji to Duluth are 93 cents per hundred pounds and \$1.16 per hundred pounds from Bayfield, Wisconsin, which appears even closer on the map. Comparing La Crosse, Wisconsin, and La Crescent, Minnesota, which are on opposite sides of the Mississippi River, we find La Crescent enjoying an advantage of 58 cents per hundred pounds on second-class rates to Duluth, a 65-cent advantage to Marshall, and a 73-cent advantage to Fergus Falls. La Crescent also has an advantage of 46 cents per hundred pounds on the second-class rate to the Twin Cities. La Crosse, however, has a special rate of 65 cents per hundred pounds on berries shipped in lots of 300 pounds or more, which gives it an advantage of 28 cents per hundred pounds over La Crescent when shipments are of that size.

The Twin Cities are the largest single market in the state for berries. Therefore, the relative advantages in express rates of shipping to Minneapolis-St. Paul rather than to other consuming centers is important. This comparison has been made in Table 4 for the 20 shipping points. The compared destinations are the same as those used previously for the average weighted rates, namely, Milwaukee and Chicago, Omaha, and the South, the Dakotas, and Duluth. The table is constructed from the difference in the express rate between the shipping point and the Twin Cities and the rate from the shipping point to the designated alternative market. For ex-

Table 4. Differences in Market Prices at Which Shipments to Various Alternative Markets Will Bring Larger Returns Than Shipments to the Twin Cities

When the Price in the Twin City Market Is Less Than the Price at the Alternative Market of:

	Milwaukee-Chicago		Southern Markets		Dakotas		Duluth	
By 10 cents Shipments may be made from:							Excelsior Faribault Long Lake La Crescent Mankato Sparta	0¢ 1¢ 0¢ 3¢ 1¢ 0¢
By 20 cents Shipments may be made from:	La Crescent	2¢	La Crosse Sparta	5¢* 9¢*			Albert Lea Howard Lake La Crosse Rochester Winona	5¢ 6¢ 7¢* 5¢ 6¢
By 30 cents Shipments may be made from:			Warrens	2¢*	Bayfield Bemidji	0¢* 0¢†	Twin Cities	3¢
By 40 cents Shipments may be made from:	Winona	0¢	Albert Lea La Crescent	3¢ 8¢*	Aitkin Brainerd Grand Rapids La Crosse Sparta Virginia Warrens	5¢† 6¢† 3¢† 5¢* 8¢* 0¢† 5¢*		
By 50 cents Shipments may be made from:	Albert Lea Rochester	4¢ 1¢	Bayfield Winona	10¢* 2¢	Albert Lea Duluth Excelsior Faribault Howard Lake Long Lake	8¢ 3¢ 0¢ 1¢ 8¢ 0¢		
By 60 cents Shipments may be made from:	Aitkin Duluth Excelsior Faribault Grand Rapids Long Lake Mankato Virginia	7¢† 6¢† 1¢ 2¢ 5¢† 1¢ 2¢ 9¢†	Aitkin Duluth Brainerd Excelsior Faribault Grand Rapids Howard Lake Long Lake Mankato Rochester Virginia	7¢† 1¢† 2¢† 5¢ 6¢ 1¢† 4¢ 5¢ 6¢ 9¢ 2¢†	Mankato Rochester La Crescent Winona	1¢ 6¢ 8¢ 2¢		
By 70 cents Shipments may be made from:	Bemidji Brainerd Howard Lake	7¢† 7¢† 4¢	Bemidji	9¢†	Twin Cities	2¢		
By 80 cents Shipments may be made from:	Twin Cities	4¢	Twin Cities	9¢				

The small figures show the gains in net returns, other things being equal.

* Greater net returns will still result from shipping to markets of Milwaukee-Chicago.

† Greater net returns will still result from shipping to Duluth.

ample, the weighted express rate from La Crescent to Chicago-Milwaukee is 18 cents more per crate than the express rate from La Crescent to the Twin Cities. In consequence, when the price in the Twin City market is less than the Milwaukee-Chicago price by 20 cents, shipments from La Crescent may be made to Milwaukee-Chicago with an advantage of 2 cents in net return over shipments made to the Twin Cities. Or when the price in the southern markets is above the Twin City price by 40 cents, shipments may be made to those markets from Albert Lea with a 3-cent advantage in return over shipments made to the Twin Cities. A market is entered in the table only at the point where diver-

sions from the Twin City market first become advantageous. Greater differences in price between the Twin Cities and the alternative market, of course, widen this advantage correspondingly. Shipping points which lie far down in the table are those most restricted to the Twin Cities as an outlet for their berries, while those toward the top have other outlets becoming advantageous as Twin City prices drop relative to alternative markets.

It is evident that if prices in the Dakotas exceeded Twin City prices by 40 to 50 cents, a large number of Minnesota markets would find more advantageous outlets at Dakota points. Prices in the southern markets would need to be 50 to 60 cents higher before

Table 5. Express Rates to Given Receiving Markets from Various Shipping Points for 35-pound Crates

Receiving market	Shipping points with lowest rate to the receiving market	Shipping points with express rates per crate within 10 cents of point with lowest rate
Aberdeen, S. D.	Howard Lake—55¢	Excelsior, Faribault, Brainerd, Long Lake, Mankato, Twin Cities—62¢
Chicago, Ill.	La Crosse, Sparta—35¢	Warrens—39¢
Crookston, Minn.	Bemidji—28¢	Grand Rapids—33¢; Aitkin, Howard Lake, Virginia—37¢
Davenport, Ia.	La Crescent, La Crosse—44¢	Sparta—49¢; Winona—51¢
Des Moines, Ia.	Albert Lea, Sparta—49¢	La Crosse, La Crescent—55¢
Devils Lake, N. D.	Bemidji, Brainerd—62¢	Aitkin, Grand Rapids, Howard Lake—69¢
Fargo, N. D.	Brainerd—41¢	Aitkin, Bemidji, Howard Lake—49¢
Grand Forks, N. D.	Bemidji, Brainerd—49¢	Aitkin, Grand Rapids, Howard Lake—55¢
Huron, S. D.	Excelsior, Faribault, Howard Lake, Long Lake, Mankato, Twin Cities—62¢	Albert Lea, Brainerd, Rochester—69¢
Kansas City, Mo.	Albert Lea, La Crosse, La Crescent, Sparta—75¢	Rochester, Winona—82¢
Mandan, N. D.	Brainerd, Howard Lake—69¢	Aitkin, Bemidji—75¢
Mason City, Ia.	Faribault, Mankato—22¢	Albert Lea—27¢; Excelsior, Long Lake—28¢
Milwaukee, Wis.	Sparta, Warrens—29¢	La Crosse—33¢
Minneapolis	Excelsior, Long Lake—17¢	Faribault, Mankato, Rochester—18¢; Howard Lake—19¢; Albert Lea—22¢; La Crosse, Winona—23¢; Brainerd, Duluth—27¢
Minot, N. D.	Albert Lea—76¢	
Omaha, Neb.	Albert Lea—55¢	
Rapid City, S. D.	Howard Lake—92¢	Albert Lea, Bemidji—97¢
Sioux City, Ia.	Albert Lea—37¢	
Sioux Falls, S. D.	Albert Lea—49¢	Excelsior, Faribault, Howard Lake, Long Lake, Mankato, Twin Cities—55¢
Watertown, S. D.	(Same points as Huron)—55¢	(Same points as Huron)—62¢

a large number of markets would find it advantageous to divert their shipments from the Twin Cities. A similar situation holds true with respect to Chicago.

The shipping point with the lowest express rate to each of 20 receiving markets is given in Table 5 together with the shipping points with express rates within 10 cents per 35-pound crate of the market with the lowest rate. For example, Howard Lake with a rate of 55 cents per crate has the lowest rate to Aberdeen, S. D., but Excelsior, Faribault, Brainerd, Long Lake, Mankato, and the Twin Cities all have a 62-cent rate to Aberdeen. Thus, while Howard Lake has an advantage of rate to the Aberdeen market, six other shipping points have nearly as good opportunities of reaching that market. On the other hand, none of the Minnesota shipping points have rates within 10 cents of the Sparta and Warrens rates to Milwaukee or the La Crosse and Sparta rates to Chicago. It is naturally advantageous to a shipping point to be in the comparatively low-rate group for a number of markets, and to be favorably situated to a market or markets where comparatively few other shipping points have similar advantages.

FREEZING RASPBERRIES AND STRAWBERRIES FOR COM- MERCIAL USE

The general requirements for handling and packing fruits for freezing storage are described in Minnesota Extension Bulletin 200 which deals with the freezing of products for home use in the locker storage. The freezing of fruits for commercial use differs in

certain important respects from the procedure given in that publication.

When freezing raspberries and strawberries for commercial use it is important to determine in advance the market in which the fruit will be offered for sale, or to contract for at least a portion of the pack before the harvest commences. Each market outlet requires a particular size and type of container and the packing methods and varieties often must be varied to meet the demands of the user. Many of these special requirements are discussed in this publication. Failure to consider and investigate the possible outlets before the fruit is packed may result in serious marketing difficulties.

Storage Costs

The freezing and storage rates for locker storage use are adjusted to the facilities offered to the locker patron but are too expensive to be considered for commercial storage. The prevailing commercial rate for freezing and storage of fruits packed in cartons or cans in less than carload quantity at St. Paul and Minneapolis is 15 cents per 100 pounds per month with an additional charge of 15 cents per 100 pounds for handling the product in and out of storage and a charge of 5 cents per 100 pounds for freezing. Thus, the freezing and storage cost for 6 months would amount to 1.1 cents per pound as compared to a minimum cost of about 3.3 cents per pound in the storage locker.

Storage Temperature

Raspberries and strawberries frozen for commercial use must be of the highest possible quality when with-

drawn from storage to compete successfully with similar products on the market. For this reason it is usually not advisable to consider storage at any temperature higher than 0° F.

Containers

Containers for frozen raspberries and strawberries to be used for retail distribution usually are made of paperboard, in some instances having an inside lining or bag made from transparent cellulose film. The pint size is preferred. Containers made for the storage of frozen products must be used as the ordinary paperboard container made for other purposes is unsatisfactory. The appearance of the container is an important consideration, so that it may present the product to the best advantage. A container that makes possible the use of an attractive label is desirable or a special order may be placed for printing on the cover before the material is waxed. If a printed label is used the adhesive must be of a special type made for this purpose because the adhesive on the back of an ordinary gummed label shrinks at freezing temperatures and permits the label to fall off. Paperboard containers usually are available in different colors and those with a bright attractive color should be selected. The cost of pint containers in lots of 1,000 or more is about \$20 per thousand.

Enamel-lined cans are used when the frozen product is to be sold for restaurant or hotel trade, or for many commercial purposes other than retail distribution. Cans made for this purpose are available in 10-, 15-, and 30-pound sizes and are packed in cases holding 54, 32, and 16 cans, respec-

tively, at a cost of about 12½, 17, and 20 cents for the different sizes. The enamel used must be a lacquer resistant to fruit acids. For this reason "cans for frozen fruits" should be specified. This type of can is not used for all frozen products, as the enamel is not fully resistant to acids from rhubarb, for example. The 30-pound egg can is similar in type to the frozen fruit can but has slightly different dimensions.

Frozen raspberries and strawberries for large commercial users such as preserving factories and large ice cream manufacturers are packed in 50-gallon wooden barrels.

Packing Methods

Raspberries for retail distribution usually are best packed in a sugar sirup of 40 to 45 per cent density as described in Minnesota Extension Bulletin 200. For washed berries of the Chief, King, and Latham varieties a 45 per cent sirup will provide sufficient sweetness.

Because the berries retain water in washing, the 45 per cent sirup is actually equivalent to about a 40 per cent sirup on a dry fruit basis. It is advisable to use a hydrometer to standardize the sirup. A hydrometer may be purchased from any chemical supply firm at a cost of about \$2. An instrument of this type is known as a Brix or Balling hydrometer depending on the scale of readings shown, which should be from 30° to 60° Brix or Balling. The Brix and Balling scales are synonymous. A sugar sirup having a density of 40° Brix is equivalent to a 40 per cent sirup made by dissolving sugar in water in the proportion of 4 pounds of sugar to 6 pounds

of water. A hydrometer calibrated for a sirup temperature of 20° Centigrade (68° F.) is commonly used.

Raspberries frozen for other commercial purposes should be packed in dry sugar in the proportion of 3 to 4 pounds of berries to one pound of sugar, except in some instances such as in the preserving industry where a "straight" pack without sugar is preferred.

A dry sugar pack usually is preferred for strawberries, in the proportion of 4 pounds of berries to one pound of sugar when packed for retail distribution. For general restaurant and hotel use a 3 to 1 pack is commonly used while other commercial users prefer a 4 to 1 or a 2 to 1 pack. Varieties that are quite acid to the taste, such as Blakemore, would be better in a 3 to 1 pack for retail trade. When packing in sugar it is important that each berry becomes coated in the dissolved sugar and fruit juice before the product is frozen. Unless very large quantities

of berries are being packed this is best accomplished by placing about 4 pounds of the hulled and washed berries in an enamel pan and sprinkling the required amount of sugar as evenly as possible over the fruit. A strainer with very fine wire mesh is useful for sifting the sugar over the berries. After allowing a minute or two for the sugar to dissolve in the fruit juice the berries are turned over a few times with a large enamel or wooden spoon until each berry is properly coated. This procedure is illustrated in Figure 6. When this is done the fruit is packed into the containers, labeled, and then is ready for freezing.

Cleanliness in packing operations and prompt handling of the fruit from field to storage is of the utmost importance to maintain a low bacterial count in the frozen product. Some commercial buyers, such as certain ice cream manufacturers, require a guarantee of a certain minimum bacterial count and the frozen fruit must meet the sanitary provisions of the State Department of Agriculture for food products. Fruit that cannot be packed promptly should be placed in cold storage at a temperature of 32° F.

In connection with the experiments on frozen fruits at the University of Minnesota a machine was devised to wash moderately large quantities of berries on a slowly moving screen, as shown in Figure 7. This machine will handle about 10 24-pint crates of raspberries per hour.

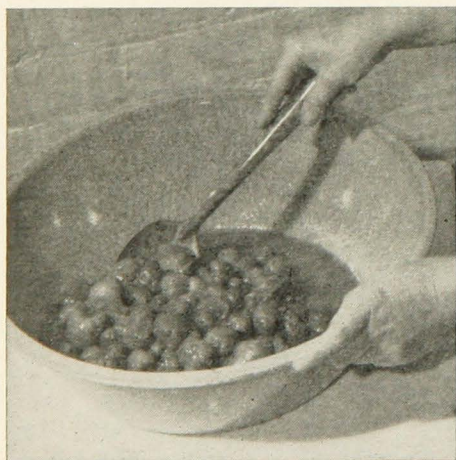


FIG. 6. METHOD OF MIXING STRAWBERRIES WITH SUGAR BEFORE PACKING THE FRUIT INTO CONTAINERS FOR FREEZING

Varieties for Freezing Storage

The rating of any variety of raspberry or strawberry for freezing storage depends to a large extent on the

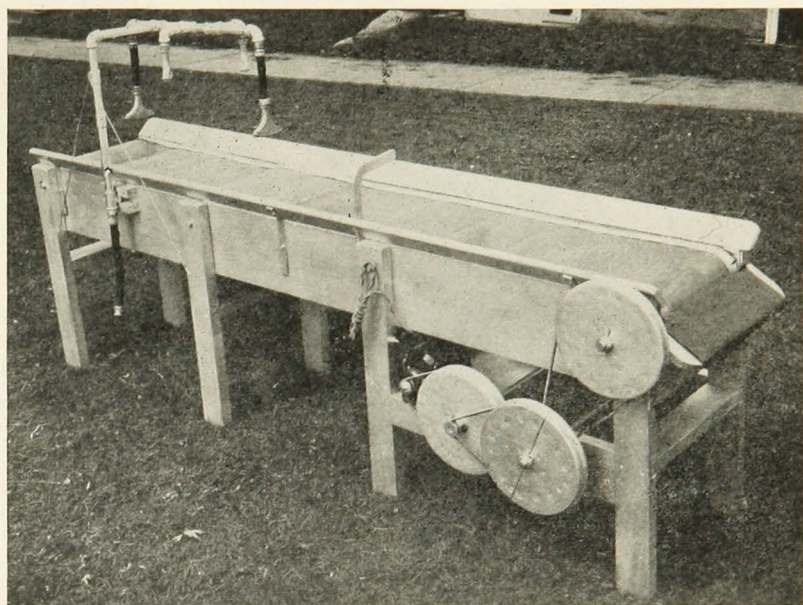


FIG. 7. BERRY WASHING MACHINE

use to which the fruit will be put after it is sold. For this reason no general rating of varieties can be given. Varieties are discussed in this publication under the various commercial uses for the frozen product.

COMMERCIAL UTILIZATION OF RASPBERRIES AND STRAWBERRIES

The principal commercial uses of berries are in jam and preserves, in ice-cream manufacture, for soda fountain trade, and in the baking industry. No census data are available of the quantities of berries used for these various purposes. The probable quantities used locally, however, have been estimated by various methods and are given on the following page. For each commercial use a particular type of

berry is desirable. In certain cases the present types of berries grown in Minnesota appear suitable, but in other cases shipped-in berries appear to have more desirable characteristics in general.

A relatively new commercial outlet for these fruits is in frozen form for home use.

Frozen Berries for Retail Distribution

The market for frozen raspberries and strawberries packed for home use has increased rapidly within recent years as facilities for the temporary storage of these products become more generally available in retail establishments. Experience has shown that about 9 packages of frozen strawberries will be sold to each package of frozen raspberries despite the fact that red raspberries retain their flavor and

quality after thawing better than do strawberries.

It is possible that this trend will change after the trade becomes better acquainted with the high quality of properly frozen red raspberries. Black raspberries are not desirable when frozen for dessert use because of their seedy character.

Experiments conducted in Minnesota, as well as commercial experience, have shown that the quality and appearance of the Chief and Latham varieties when frozen for dessert use is not surpassed by any other variety of red raspberry commonly available on the frozen fruit market. These are the principal commercial varieties grown in Minnesota. The Viking, a variety seldom grown locally, also was found to be excellent for this purpose.

Tests of Minnesota-grown strawberries, commenced in 1936, have shown that several varieties are excellent in quality and appearance when frozen for dessert use. Much depends on the quality of the fresh fruit when packed and on the care used in handling and packing.

Well grown Beaver strawberries were found to be the best of the June-bearing varieties for this purpose. These were closely followed by Premier and Dunlap. Wayzata and Gem were found to be the best of the ever-bearing types of strawberries. A more detailed account of these tests has been presented in another publication.⁴

Several Minnesota growers have been able to dispose of all or part of their crop as a frozen product for distribution through regular retail outlets and for sale to restaurants, hotels, and local ice cream manufacturers.

Only the best grade of fruit can be packed for dessert use. It is suggested that second grade fruit could be packed in larger containers and sold through the same retail channels for the making of jam and preserves at home. Experiments have shown conclusively that jam and preserves prepared from frozen fruit stored for several months are far superior to jam and preserves made from the same fruits when fresh and stored for an equal length of time. This is because the cooked product made from frozen fruit has as bright a color and as fresh a flavor as when made while the berries were still in season, while jam or preserves made at that time will lose some of these qualities during storage. In this manner those who failed to procure berries in season or those who prefer to do the cooking in cooler weather can be supplied.

Certain varieties of strawberries are better than others for the making of jam and preserves. Tests conducted by the Division of Home Economics at University Farm and elsewhere with Minnesota-grown fruit show that Catskill, Dorsett, Dunlap, Fairfax, Gem, and Premier are very satisfactory for this purpose.

Among the varieties which have the highest ratings for jam and preserves are Beaver, Blakemore, Culver, and Wayzata. Several un-named seedlings have shown unusually good preserving quality, including Minn. No. 1192 from the University of Minnesota Fruit Breeding Farm, a seedling from Mr. Fred W. Braden of Wayzata, and a seedling from Mr. Elmer C. Haralson of Excelsior. The varieties Aberdeen, Clermont, and Gibson have given poor

⁴ Winter, J. D. Strawberry varieties for freezing storage. Amer. Soc. Hort. Sci. Proc. 37:579-582. 1939.

results in the preserving tests used upon them.

Most of the red raspberries commonly grown in Minnesota are satisfactory for jam and preserves, Chief and King being slightly better than Latham for this purpose.

A pint container packed for freezing storage will contain about 10 ounces of berries in a sirup pack and up to about 12 ounces of berries in a sugar pack. The total net weight of the frozen product will be about 14 to 16 ounces. A 24-quart crate of strawberries will seldom yield more than 24 pounds of hulled and washed berries for packing, and a 24-pint crate of red raspberries will yield about 15 pounds of berries. Unless the grade of fruit is unusually good, about 20 per cent is not likely to have the attractive appearance and uniform maturity demanded for dessert use and must be packed separately for the making of products such as jam and ice cream. In packing pint containers there will be a labor cost of about 2 cents per pint for strawberries and about one cent per pint for raspberries.

Growers in Minnesota who contemplate selling berries in frozen form must label their product to conform with the provisions of the state law. The product or products used must be named. The name and address of the grower must be stated, or the name of the distributor, in which case the words "distributed by" or "manufactured for" must be included. The net weight must be shown, and if over one pound it must be given as pounds and ounces, and not, for instance, as 20 ounces. Printing must be not smaller than 8 point caps or Brevier caps, or the label may be typed or written in longhand.

Commercial Manufacture of Jams, Preserves, and Jellies

Growers in Minnesota who intend to sell a part of their berry crop in the form of jam or preserves must label their product in the same manner as described in the preceding column for the sale of frozen fruit. Neither citric acid nor pectin, if added, must be declared provided these ingredients are added only in a quantity which reasonably compensates for any deficiency in the fruit used. The use of sugars other than cane or beet must be shown and the maximum quantity of corn sirup permitted is one half of the cane or beet sugar used on the basis of the weight of total solids. A state license also is required as explained on page 28 for commercial canning.

A survey made in 1935 showed that during the previous year preserving factories in St. Paul and Minneapolis purchased 1,340 fifty-gallon barrels of frozen-pack raspberries and 3,850 fifty-gallon barrels of frozen-pack strawberries. This is equivalent to 509,000 pounds or about 36 carloads of fresh raspberries and 1,347,500 pounds or about 107 carloads of fresh strawberries. The strawberries were computed on the basis of 7 pounds of fresh berries per gallon of 2-1 pack (2 parts of berries—1 part of sugar). These berries were purchased for jam, preserves, and jelly. Jam is essentially the same product as a preserve, and only a very small proportion of the quantity purchased is used for jelly.

Most of the fruit is purchased in frozen form packed in fifty-gallon barrels. Strawberries are packed in sugar, but raspberries used by these factories generally are frozen without sugar. Each barrel of raspberries con-

tains about 380 pounds of berries, and each barrel of strawberries contains about 450 pounds of berries and sugar.

Use of Minnesota Raspberries by Preserving Factories

During 1934 about 7,700 pounds of Minnesota-grown raspberries were purchased by preserving factories in the Twin Cities, or about 1½ per cent of the total quantity bought. The principal sources of berries for preserving in Minnesota are Washington and Oregon, so the prices of Minnesota berries must be limited by the cost of berries from these sections. The cost of packing berries in barrels and placing them in cold storage is approximately two cents a pound. The freight rate on frozen berries from the state of Washington is about 1¼ cents per pound. Therefore, the price paid by local factories for fresh raspberries is likely to be somewhat less than the price of berries packed in barrels at shipping points on the west coast. The barrel price of frozen-pack raspberries at the shipping point usually fluctuates between 7 and 10 cents per pound. Prices include the cost of freezing and storage for one month.

The price paid for fresh raspberries at the local factories has averaged from 7 to 8 cents per pound during recent years. This is equal to about \$1.15 to \$1.32 per 24 pints. As the crates are returnable, this price is equivalent to a price of about \$1.40 to \$1.57 on the fresh fruit market. Because of crop shortage in 1935, local factories paid up to 9 cents per pound for fresh raspberries, which is equivalent to a price of about \$1.81 per crate on the fresh fruit market.

Use of Minnesota Strawberries by Preserving Factories

During 1934 about 13,570 pounds of Minnesota-grown strawberries were purchased by preserving factories in the Twin Cities, or about 1 per cent of the total quantity bought. A bright red berry that does not turn dark after cooking is required for this purpose. The berry must not have a light flesh color. A firm berry of medium size is desired, about ¾ to 1 inch in diameter, and the seeds must be evenly distributed. Deformed berries with a large proportion of the seeds near the tip are very unsatisfactory for preserves. Local factories prefer the 2-1 pack for jam and preserves, a 50-gallon barrel holding about 300 pounds of hulled berries and 150 pounds of sugar.

The cost of packing the berries in barrels and placing them in cold storage is approximately three cents per pound. In addition there will be shrinkage from hulling and sorting. Therefore, the price paid for fresh strawberries locally will be lower than the price of berries in barrels at shipping points on the west coast after due allowance is made for the cost of sugar used in the barrel pack.

The price paid for fresh strawberries at the local factories has averaged about five to six cents per pound during recent years. The price is equal to about \$1.45 to \$1.74 per 24 quarts, which would be equivalent to a price of about \$1.75 to \$2.04 per 24-quart crate on the fresh fruit market. The barrel price of frozen-pack strawberries in a 2-1 pack at the shipping point usually fluctuates between 6 and 10 cents per pound, averaging about 7 to 8 cents per pound. Prices include cost of freezing and storage for a month.

Prospects for Market in Preserving Industry

Under present conditions it is unlikely that a profitable market outlet can be found in the preserving industry for Minnesota-grown berries. The relatively low prices at which frozen-pack berries in barrel lots are generally available offer little inducement to Minnesota growers, except perhaps at the peak of the season in years of heavy crop production. While the volume of berries used by these factories is very large, most of this volume is contracted for in advance of the crop season and factories will not desire to handle large quantities of berries except on a contract basis.

Requirements of the preserving trade for varieties suitable for this purpose, the need for special equipment such as that used to grade strawberries for size, and the various problems involved in handling barrel lots would present many difficulties in packing berries for this trade.

The Marshall strawberry, which does not grow satisfactorily in Minnesota, is the outstanding variety for jam and preserves manufactured in this region. Both Klondike and Missionary are rated as good preserving varieties according to reports obtained during this survey, but they are not used locally. Preserving factories in certain eastern states consider Blakemore one of the very best varieties for preserving purposes. Factory tests made in Minnesota since 1936 with most of the locally grown strawberries indicate that Beaver is the only variety that may be acceptable for this purpose. The

Wayzata was found to be satisfactory but this variety is grown primarily for its fall crop on the fresh fruit market.

A desirable raspberry for the preserving trade is one that does not crumble or collapse readily, lacks seediness, and has a deep red color and rich flavor. The Chief, Latham, and King varieties have been found satisfactory for jams and preserves, although they are not considered equal to the Cuthbert for this purpose. Cuthbert is superior in color and the seeds do not separate from the pulp so readily during the preserving process. The Cuthbert is not well suited to Minnesota conditions. When Chief, Latham, and King berries are used it is customary to mix them with Cuthbert berries, using 50 per cent or more of the latter variety. The freezing and storage of raspberries in the original crate involves too much expense to be of practical value in supplying berries for this industry.

Berries Used for Ice Cream Manufacture

An analysis of the different flavors of ice cream manufactured in the United States was made in 1931 by the International Association of Ice Cream Manufacturers. These data show strawberry-flavored ice cream as constituting 8.27 per cent of the ice cream and raspberry flavor 0.17 per cent.⁵

Production of ice cream in Minnesota was reported as 4,892,663 gallons in 1934 by the Minnesota State Department of Agriculture, Dairy and Food.⁶ Based on the proportions shown by the International Association of Ice Cream

⁵ Special Bulletin 42. International Association of Ice Cream Manufacturers, Harrisburg, Pa. March 1933.

⁶ In 1938 this production had risen to 6,552,603 gallons, with an additional 1,334,834 gallons of sherbets, ices, frozen malted milk and nickel items.

Manufacturers, there was a production of 404,623 gallons of strawberry-flavored ice cream and 8,318 gallons of raspberry-flavored ice cream in Minnesota during 1934.

A survey of ice cream factories in St. Paul and Minneapolis made in 1935 showed that most of the strawberries used by these factories are purchased from the west coast and are shipped frozen in sugar. The larger factories buy the berries in fifty-gallon barrels of about 450 pounds capacity, and the smaller factories buy them in smaller containers. The Marshall variety is used and is packed mostly in the proportion of three pounds of fruit to one pound of sugar, although some 2-1 pack is used. A 3-1 pack is preferred because it adds less sugar to the mix than a 2-1 pack and therefore produces an ice cream that remains firmer at the usual cabinet temperatures. A very small proportion of the berries came from the east, and these consisted of the Premier variety.

The quantity of 3-1 pack used by different manufacturers in each gallon of strawberry ice cream will vary to some extent, but will average about three-quarters of a gallon to each 10 gallons of ice cream. The estimated quantity of strawberries used in Minnesota for ice cream manufacture in 1934 on the basis of the foregoing data is 30,346 gallons of 3-1 frozen pack or equivalent, which would equal 227,595 pounds of fresh berries or about 18 carloads. This includes sherbets and water ices and is computed on the basis of $7\frac{1}{2}$ pounds of fresh berries per gallon of 3-1 pack.

A small proportion of the total quantity of strawberries used in ice cream

is purchased locally during the crop season. According to estimates secured from manufacturers, the total quantity of Minnesota-grown berries purchased for this purpose probably does not exceed 20,000 pounds annually.

It is generally believed in the ice cream industry that fresh strawberries are superior to frozen-pack berries and to canned berries for flavoring ice cream. Also it is generally believed that the frozen pack is superior to the canned product and that both are much superior to alcoholic strawberry extract which is the cheapest source of flavor. These conclusions are supported by Fabricius' and other investigators.

Many ice cream makers having a small volume of output must rely on canned strawberries for their strawberry ice cream except during the fresh fruit season, because storage facilities are not available for frozen-pack berries. They are purchased usually in No. 10 cans, each can holding about three quarts of fruit. Some quart cans also are used. A special pack is used that is prepared particularly for the ice cream trade.

The total quantity of raspberries used in ice cream in Minnesota probably does not exceed the equivalent of 6,000 pounds of the fresh berries, of which not more than about 1,000 pounds come from Minnesota growers.

Prospects for Market in Ice Cream Industry

The survey conducted as a part of this investigation suggests a possible market of considerable extent in this industry for Minnesota-grown straw-

¹Fabricius, N. E. Strawberries for Ice Cream Manufacture. Iowa Agr. Exp. Sta. Circ. 132. 1931.

berries especially among the smaller manufacturers. In order to develop this market, it will be necessary to select suitable varieties and to prepare them for use in ice cream. A start in this direction has been made, and some growers are now marketing a small volume of frozen berries for this purpose.

Ice cream manufacturers prefer to buy strawberries already washed and hulled because the strawberry season comes at a time of the year when the factories are very busy. These factories seldom have storage facilities to take care of one year's supply of frozen berries, so commercial storage must be available.

The most important requirement for berries used in this industry is good flavor and the ability of the variety to retain this flavor during the manufacturing process. Color is of much less importance, because color is added to the finished product. Firm berries of medium size are preferred.

Tests conducted at the University of Minnesota since 1936 indicate that most of the standard varieties of strawberries grown commercially in Minnesota are satisfactory for use in ice cream. Fairfax and Wayzata were found to be outstanding in their ability to retain flavor, texture, and appearance.

A dry sugar pack using strawberries in the proportion of 3 pounds of berries to 1 pound of sugar is suggested as being best adapted to the present requirements of the ice cream trade.

Raspberries are used very little in the manufacture of ice cream. One of the largest factories in the Twin Cities made an attempt to establish raspberry ice cream on a regular production basis but found that raspberry ice cream was not a popular item in

the trade. Most of the raspberries are used in sherbets. For the present, there is no local outlet for any volume of Minnesota red raspberries in the manufacture of ice cream.

Crushed Fruits for Soda Fountain Trade

Large quantities of strawberries are used in the preparation of preserves for the soda fountain trade. Preserves manufactured for this purpose are commonly known as "crushed fruit," but as a matter of fact the berries must be whole and must retain their shape to be satisfactory for this trade.

Berries of medium size are preferred, and it is necessary to select a variety that will retain a good flavor in the finished product. Color is not important, because it is customary to add color. The Marshall strawberry is commonly used in this territory to manufacture preserves for the fountain trade. The 2-1 or 3-1 frozen pack is used extensively for this purpose. The berries are put up in No. 10 cans and in glass jars. Raspberries are seldom used.

No statistics are available on the volume of strawberries consumed in this manner. One of the large retail distributors^s reported that 250 gallons of crushed strawberries (3-1 pack) were supplied to their stores during the same period in which 63,000 gallons of ice cream were sold. This shows a consumption of approximately 4 gallons of crushed strawberries to each 1,000 gallons of ice cream sold. If the proportion of crushed strawberries to total ice cream sales for the state is the same as for this large distributor, then 19,571 gallons of straw-

^s The Walgreen Company, Minneapolis.

berry preserves were used for this purpose in the state in 1934. This is the equivalent of 146,780 pounds of fresh strawberries, or about 11 carloads, computed on the basis of 7½ pounds of fresh berries per gallon of 3-1 pack.

Berries Used in the Baking Industry

A relatively large volume of raspberries and strawberries is used in the baking industry, but there are so many organizations and individual operators engaged in this trade that statistics are difficult to obtain.

Frozen-pack raspberries and strawberries are used extensively by pie manufacturers, one large company reporting the use of approximately 20,000 pounds of raspberries and 20,000 pounds of strawberries annually. Raspberries are used widely in the form of imitation jelly for jelly rolls and similar bakery products, the imitation jelly usually containing about 10 per cent of the true fruit preserve.

A conservative estimate of the total quantity of these fruits used annually in the baking industry in Minnesota is 185,000 pounds of raspberries and 150,000 pounds of strawberries.

Commercial Canning

The canning industry desires a deep red berry that holds its red color when cooked. There are no commercial factories in Minnesota canning raspberries and strawberries, so there is no local outlet for berries for commercial canning at the present time.

It is not likely that commercial canning would be successful with the varieties of raspberries and strawber-

ries at present grown commercially in Minnesota.

The Minnesota state law requires that a license be obtained before products may be canned and offered for sale. The license costs one dollar and an additional assessment is made not exceeding one half of one per cent of the value of the products sold. The assessment usually runs much lower.

Summarized Statement of Quantity of Berries Used for Commercial Manufacture in Minnesota

A summary of the data previously given shows that approximately 50 carloads of raspberries and 149 carloads of strawberries were used in Minnesota for commercial manufacture in 1934. This is shown in table 6.

Less than two per cent of all the raspberries and strawberries used for

Table 6. Raspberries and Strawberries Used in Minnesota for Commercial Manufacture in 1934

	Pounds of fresh fruit or equivalent	Equivalent number of carloads	Approximate value
Raspberries	700,000	50	\$ 98,000
Strawberries	1,871,875	149	149,750

Table 7. Source of Raspberries Used in Commercial Manufacture in Minnesota in 1934*

Manufactured product	Grown in Minnesota	Grown in other states	Per cent of total grown in Minnesota
	lbs.	lbs.	per cent
Jam and preserves	7,700	501,300	1.5
Ice cream	1,000	5,000	16.7
Soda fountain fruit	Negligible	Negligible
Total	8,700	506,300	1.7

* Quantity of fruit used in the baking industry not included because data on source of this fruit are not available.

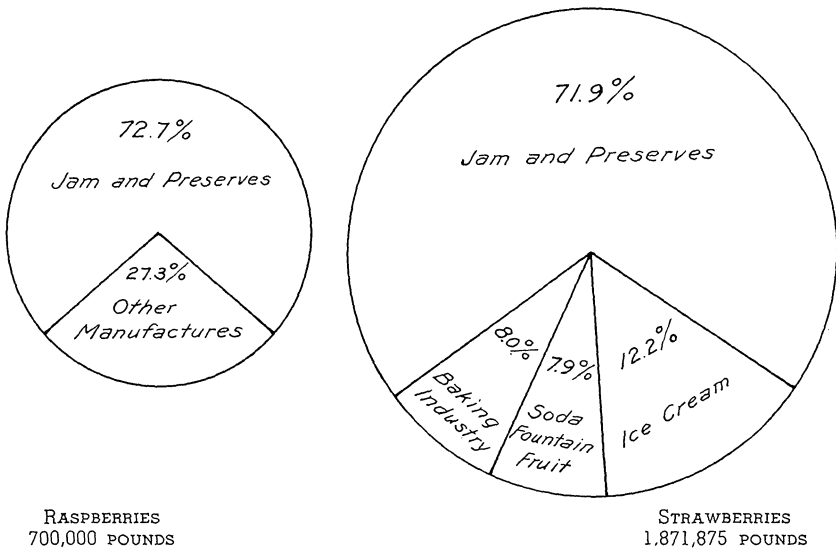


FIG. 8. USE OF RASPBERRIES AND STRAWBERRIES IN COMMERCIAL MANUFACTURE IN MINNESOTA IN 1934

this purpose were grown in Minnesota, according to data secured in this survey, and this is typical of average years according to the manufacturers from whom these data were secured. The quantity of fruit purchased in Minnesota is shown in tables 7 and 8.

A very large proportion of the raspberries and strawberries used in commercial manufacture are made up into jam and preserves as shown in figure 8.

Table 8. Source of Strawberries Used in Commercial Manufacture in Minnesota in 1934*

Manufactured product	Grown in Minnesota	Grown in other states	Per cent of total grown in Minnesota
	lbs.	lbs.	per cent
Jam and preserves	13,570	1,333,930	1.0
Ice cream	20,000	207,595	8.8
Soda fountain fruit	Negligible	146,780
Total	33,570	1,688,305	1.9

* Quantity of fruit used in the baking industry not included because data on source of this fruit are not available.

An idea of the importance of the commercial manufacture may be gained by comparison between the total quantity of raspberries and strawberries used in commercial manufacture in Minnesota in 1934 and the total quantity of these fruits sold by the five co-operative marketing associations in Minnesota in 1935. The former used approximately 700,000 pounds of raspberries and 1,871,875 pounds of strawberries, while the five marketing associations in Minnesota sold 354,568 pounds of raspberries and 569,195 pounds of strawberries. This comparison shows that the quantity of berries used in commercial manufacture in Minnesota exceeded nearly three times the total quantity of berries sold by the co-operative marketing associations. These five marketing associations do not handle the entire commercial crop of berries in Minnesota.

Large quantities of raspberries and strawberries are sold through other channels, but the comparison indicates clearly the great volume of berries used in commercial manufacture in the state.

The extensive use of shipped-in berries does not mean that there is an existing market for Minnesota berries in these commercial uses. There are undoubtedly valid reasons for the predominant use of western berries. For Minnesota growers to compete successfully for this market, it will be necessary for them to grow a type of berry desired by the processors and to provide it in quantity at prices as low as other sources of supply available to the processors. Whether this is possible or profitable remains to be demonstrated.

USE OF MINNESOTA APPLES, PLUMS, AND GRAPES FOR COMMERCIAL MANUFACTURE

There are important commercial uses of apples in the manufacture of apple butter and jelly, as baked apples in hotels and restaurants, and in bakery products such as pies. Plums are used for preserves and jelly, and grapes for juice and jelly. Low cost appears to be essential for apples used in apple butter and jelly, but baking apples and pie apples require special characteristics. This is especially true of baking apples, and if Minnesota growers could provide apples of the desired characteristics they would undoubtedly compete successfully with other apples on the market.

Certain varieties of the dark-fleshed plums which are now being grown seem to be well adapted to the commercial manufacture of jam and preserves.

Apples and Crabs

Almost any variety and size of apple is satisfactory for the manufacture of apple butter and jelly. The degree of ripeness is not important as long as the fruit is reasonably sound. For these reasons apples purchased by commercial factories are secured at low cost, prices paid in 1935 (a heavy crop year) averaging \$7 to \$10 per ton. Duchess and Okabena are found to give factory yields somewhat above the average, in terms of the quantity of apple butter per bushel of fruit.

Tests of the Dolgo crab for jelly were made in 1935 by two commercial factories.⁹ This crab produces a jelly of high color, similar in appearance to strawberry or currant jelly. The factory tests indicated that this variety would be very satisfactory for commercial production. Under present market conditions it would have to be available in quantity at a probable price of about \$20 per ton if used in large volume by the commercial factories.

Plums

Preserving factories require a plum with dark-colored flesh. The Satsuma plum is used to a large extent for this purpose, being purchased by local factories in dried form with the pits removed.

⁹ The authors wish to acknowledge the valuable assistance given by Wheeler-Barnes Company of Minneapolis and by Griggs-Cooper Company of St. Paul in making factory tests of new fruits for commercial preserves and jelly.

In August 1935 samples of several Minnesota-grown plums and cherry-plums were submitted for factory test. Both Hennepin and Sapa were found to be very satisfactory for commercial production, and when these two varieties were mixed in equal proportion a preserve of exceptional quality was produced. These two varieties mixed in equal proportion also made an excellent jelly. As a result of these tests, several tons of Sapa cherry-plum were purchased immediately from a grower by one of these factories. It is probable that a considerable volume of both varieties can be utilized by commercial factories. Under present market conditions these varieties could be expected to bring from \$60 to \$100 per ton at the factory.

Several other varieties of Minnesota plums were submitted to these factories for examination, but no actual factory tests were made. The Oka cherry-plum appeared to be equally as satisfactory as the Sapa. Several named varieties of Minnesota hybrid plums were considered unsuitable because of their flesh color. The St. Anthony cherry-plum was considered unsuitable by one factory because of a high tannin content of the skin.

Grapes

No tests of Minnesota-grown grapes were made in connection with this project. However, the factories have been using limited quantities of Beta grapes for a number of years. It is not probable that any large volume of this variety will be used, because the color of the manufactured product is inferior to that produced from the Concord grape and the berry does not yield sufficient pulp.

VALUE OF MINNESOTA APPLES FOR COMMERCIAL BAKING

Requirements for the Baked Apple Trade

A survey was made during 1935 to determine what varieties of apples are being used commercially in some of the best hotels and restaurants for baking. Ten of the leading hotels and restaurants in the Twin Cities and in Rochester, Minnesota, were interviewed for this purpose.

In nine of these places the Rome is being used to the exclusion of all other varieties, except late in the season when Rome apples are not available on the market, at which time five of these places use the Winesap. The remaining four usually do not supply baked apples after the Rome is gone. One hotel was using Minnesota-grown McIntosh as the preferred variety during its season.

Fancy and extra fancy grades are used mostly for this purpose. A large-sized apple is required. Five of the places use a 64 or 72 size, one uses a 72 or 80 size, two use an 88 or 96 size, and two use a 104 or 112 size. The 64 size is a 3¼-inch apple and the 112 size is a 3-inch apple.

Many of the smaller hotels and restaurants use a wider range of varieties for baked apples, depending to some extent on the varieties readily available. The Jonathan is used to some extent, and late in the season the Winesap is frequently used. Delicious is not a satisfactory apple for baking. The most widely grown winter apple in Minnesota at the present time, the Northwestern, is unsuited to the best class of hotel and restaurant trade be-

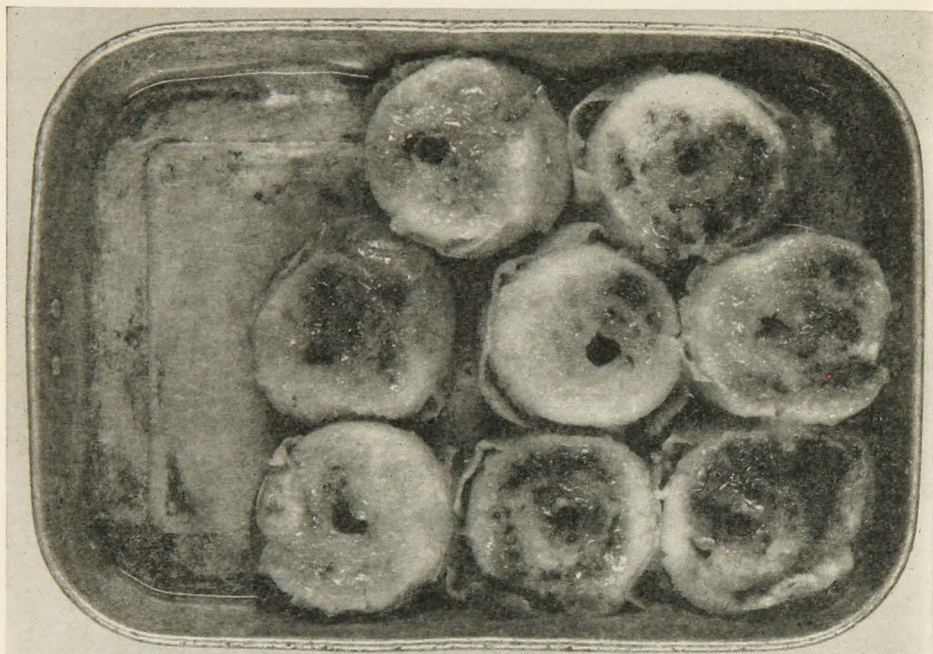


FIG. 9. TEST PAN OF WEDGE APPLE BAKED BY ONE OF THE LARGE MINNEAPOLIS HOTELS; NOTE THE FIRM SHAPE AFTER COOKING.—PHOTOGRAPHED, OCTOBER, 1938

cause it does not hold its shape well and is not so attractive when baked as the Rome.

In the testing of new varieties for their value for baking, it is obvious that Rome should be used as the standard of comparison. According to the consensus of opinion among these hotels and restaurants, an apple to be used for baking should meet the following requirements:

1. The apple must be free from worms.

2. The size of the fruit must be uniform and as specified by the baker.

3. The apple must be available for a reasonably long period.

4. The apple must be of good flavor when cooked and not too acid.

5. The fruit must retain its shape during the cooking process.

6. The skin and the flesh color must be attractive when cooked.

7. The flesh must cook evenly to the core.

It is apparent that not only the cooking value of fruit itself must be considered, but also cultural practices, grading, and storage quality. The purchaser of apples for this purpose demands fruit from well-sprayed orchards where freedom from worms is assured. The apples when baked must be uniform in size, not only from day to day but from month to month.

Color of the fresh fruit is not important, because color is judged on the basis of the cooked product. The variety must keep well over a long period of time. A succession of different varieties would involve changes in quality of the product and would

not permit the same degree of standardization in their method of preparation.

Tests of Minnesota Varieties for Baked Apples

Because none of the standard apple varieties commonly grown in Minnesota equals the Rome for the baked apple trade, a careful survey was made among the new selections under test at the University of Minnesota Fruit Breeding Farm for varieties that might meet the requirements of the trade. As a result of this survey, 13 varieties were selected in 1935 for further testing. One variety from the Iowa Agricultural Experiment Station, the Joan, was included in these tests, making a total of 14 varieties.

Arrangements were made with the Division of Home Economics¹⁰ at University Farm to make a preliminary cooking test of these selected varieties, and further tests were arranged through the courtesy of several of the larger hotels and restaurants in St. Paul and Minneapolis.¹¹

Results of these tests indicated that two of the 14 varieties, Minn. No. 790 and Joan, were entirely satisfactory for commercial use. These apples were considered equal to Rome in baking quality.

Similar tests were continued during the years 1936 to 1939 with the result that Wedge was added to the list of large sized apples that were found

satisfactory for commercial baking. In general, Wedge was considered superior to Minn. No. 790 and Joan.

In establishments where apples of 112 to 125 sizes (2 $\frac{1}{2}$ to 3 inch) are used for nickel servings the varieties Haralson and Minn. No. 396 were found to be excellent for baking, and the following were rated as good to very good: Cortland, Golden Delicious, Perkins, Prairie Spy, and Minn. Nos. 638 and 838.

Other varieties included in these tests were Folwell, McIntosh, Northwestern, and Minn. Nos. 643, 658, 792, 821, 991, 993, 995, 1008, 1014. McIntosh and Minn. No. 993 were rated as inferior to the others listed in baking quality.

Minn. No. 790 and Joan, while of excellent baking quality for commercial use, were not considered of good baking quality for home use in tests made at the Division of Home Economics. This, undoubtedly, is due to the fact that standards for commercial baking differ in some respects from those for home baking.

During the conduct of these experiments it was evident that cooking tests must be made with well matured fruit during the normal storage season for the variety, otherwise results are likely to be misleading. For example, the Wedge is a late fall to early winter apple coming on the market before Rome. In its season it rated first in the tests made, but when tested in January from cellar storage it took a low rating.

¹⁰ The authors hereby wish to acknowledge the active assistance and co-operation extended by the Division of Home Economics in connection with the testing of apples for baking.

¹¹ The authors wish to acknowledge the splendid co-operation extended by the following hotels and restaurants in making possible the tests of these apples under actual commercial conditions: Greater Hotel Lowry, St. Paul; Hotel St. Paul, St. Paul; The Golden Rule, St. Paul; Schuneman's, Inc., St. Paul; The Eat Shop, St. Paul; The Dayton Company, Minneapolis; Nicollet Hotel, Minneapolis; The Cafeteria, University Farm.

Requirements for Commercial Pie Making

The requirements for a good pie apple are different in some respects from those for the baked apple trade, according to a survey conducted as a part of this investigation. A first-class pie must have an attractive appearance with a crisp, golden-brown crust that does not fall away from the filling. A good pie apple is one that will remain firm after baking, so that the slices used for the filling will retain their shape as much as possible and yet be soft in texture. The color of the filling should be as light and clear as possible. Apples that have a dark muddy color when cooked or that are decidedly green in color in the filling are not desirable. The apple must not be too juicy, and too great a degree of acidity is not desired because it is necessary to use larger quantities of sugar. Color of the fresh fruit is of no importance.

Apples having a narrow seed cavity are preferred because coring machines cut a hole about 11/16 inch in diameter, and all the seeds are not taken out if the cavity is wide. Apples of uniform size are most satisfactory for handling. Pie factories do not like to handle apples smaller than the 2¼-inch size or larger than the 3-inch size.

Arkansas Black, Rhode Island, Northwestern, Rome, Willow, and Winesap are used extensively for pie making. Duchess and Patten also are used, but their season is too short to permit their use in large volume. This is especially true of Duchess, because as soon as the apples become at all mealy they are unsatisfactory for pie making. The Duchess also has a very large seed cavity, which is objection-

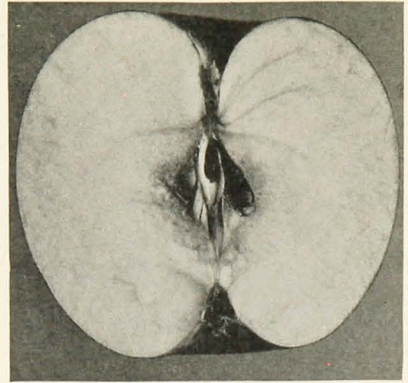


FIG. 10. HARALSON, A GOOD PIE APPLE;
NOTE THE SMALL SEED CAVITY

able. One factory stated that Patten "foams" too much in baking to be a satisfactory commercial variety.

Wealthy is used to some extent, especially when green, but it is considered too tart and too juicy for the best results. Jonathan is fairly good for this purpose. Varieties such as Delicious, McIntosh, and Ben Davis are unsatisfactory, the latter requiring too much time for cooking. The actual choice of varieties depends largely on which of the better pie apples are available at the lowest price.

The pie industry does not require nearly as high a grade of apple as is used for baking. For this reason, it would not be profitable to grow an apple particularly for this trade. However, large quantities of second-grade apples are used in this industry, and it offers a ready market for fruits of medium size and uniform grade that are suitable for pie making.

There are three large pie factories in the Twin Cities with a combined output of sufficient volume to use approximately 30 to 50 carloads of apples each year. In addition, there are numerous other bakeries in the Twin

Cities using apples for pie making. No statistics are available on the total volume of apples used in this industry.

Tests of Minnesota Apples for Pie Making

Northwestern is practically the only late-keeping apple grown in Minnesota that has been used in the pie industry. For this reason, a number of the more promising of the named varieties and new selections from the University of Minnesota Fruit Breeding Farm were tested for pie making. The variety Joan, from the Iowa station, also was included in these tests.

The first tests were made by the Division of Home Economics, and results indicated that most of the 13 varieties tested were suitable for pie making. Arrangements then were made with several commercial pie factories, bakeries, and restaurants in St. Paul and Minneapolis¹² to conduct a comprehensive test of these varieties under commercial conditions.

These tests show that all varieties would be satisfactory as commercial pie apples. The outstanding varieties as pie apples were found to be Haralson, Wedge, Minn. No. 643, Minn. No. 995, Minn. No. 1008, and Minn. No. 1014.

Similar tests made in 1939 indicated that the following varieties may be added to the list of good pie apples: Cortland, Golden Delicious, Prairie Spy, and Minn. Nos. 396, 638. The varieties Joan and Minn. No. 993 were found to be unsatisfactory apples for pie making.

Apples that have a long storage season are preferred by the pie factories because such varieties furnish an adequate supply during the late winter and spring months. A quantity of Haralson apples were kept in cold storage until June 22 and then were tested by one of the pie factories that had made tests of the same variety earlier in the season. These apples came out of storage in excellent condition and were rated "very good" for pie making in a test made on June 25.

¹² The authors wish to acknowledge the splendid co-operation extended by the following organizations: The Eat Shop, St. Paul; Paramount Pie Company, St. Paul; Rainbow Pie Company, St. Paul; Egekqvist's Bakeries Inc., Minneapolis; Lakeview Pie Company, Minneapolis.