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Dougherty, L. A.

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Opportunities in Producing and Marketing Strawberries in New Hampshire

By L. A. Dougherty

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

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Acknowledgments

The writer is appreciative of the cooperation of Clayton Cross of Durham, George Wiggin of Stratham, and Warren Bliss of Derry, who permitted observations and the picking and handling of berries in their fields. Appreciation also is expressed to Walter Morss of Bradford, Mass., for supplying a number of varieties of berries from his fields for use in tests on keeping quality.

The picture on the cover shows a Great Bay strawberry field. In the bushy rows at the right, the plants are bearing. At the left and in the center, all but the original plants have been removed for resetting. In the background and at the extreme right are the new settings.

Summary

Strawberry Production. More than one half of New Hampshire's strawberries are produced in Rockingham and Hillsborough counties. Many markets are undersupplied, particularly late in the season. Some surpluses exist at the height of the season. Slightly less than 3 percent of New Hampshire farms produce strawberries.

Strawberry Consumption. Strawberry consumption in the United States in 1949 was 1.7 quarts per capita. If we assume that we eat one half this amount during the local season in New Hampshire, we would still meet only one half our needs through our own production (.4 quart per capita produced in New Hampshire in 1949).

Strawberry Yields. The yields as reported in the census figures are low (1,971 quarts per acre in 1949 in New England and 1,404 quarts in New Hampshire). Yet in eleven commercial plots in New Hampshire average yields varied from 6,000 to 12,000 quarts per acre. Individual varieties in 1949 ranged from 9,783 to 17,370 quarts per acre (based on check plots). Top yielding varieties in order of yield were Pathfinder, Howard 17, and Great Bay in 1949, and Sparkle, Great Bay, and Howard 17 in 1950. Sparkle and Great Bay were the two best-yielding late varieties with peak yields about a week later than Howard 17.

In 1950, a southern New Hampshire grower had 89 percent of his Great Bay's ripen after July 1, compared to 23 percent for Howard 17. A northern New Hampshire grower had 91 percent of his Great Bay's ripen after July 9, compared to 49 percent of his Howard 17's. The Pearl, a very late variety, produced more than 95 percent of its yield after July 1, compared to 33 percent for Howard 17. But the yield of Howard 17 was 70 percent greater.

Strawberry Size. Size is important as it relates to picking costs, prices, and sales. Great Bay and Catskill varieties are both large varieties. For one grower in 1950, 60 percent of the Great Bay's graded large as compared to 31 percent for Howard 17. The costs per quart for picking test rows in 1950 ranged from 6.7 cents to 9.7 cents per quart with time valued at 60 cents per hour. The picking cost for Great Bay's in 1950 ranged from 3 cents (third picking) to 17.1 cents (11th picking) and averaged 6.7 cents per quart with time valued at 60 cents per hour.

Sales. Most growers in New Hampshire retail at least part of their crop. Success in selling berries on the patch depends on good management, good berries, reasonable prices, proper publicity, and a continuous program.

Some supermarkets tend to prefer to sell all berries at one price and they may not allow proper differentials for quality. In customer checks made, it was found that about 37 percent bought strawberries and about 75 per cent of those bought only one quart.

Cellophaned strawberries did not sell as well as uncellophaned ones as customers were suspicious of the quality they were getting.

Everbearing strawberries sold well in August at prices about double those in the regular season.

Some of the locker plants buy a few strawberries for freezing. One Massachusetts plant, which makes a business of processing, bought New Hampshire berries.

Returns for strawberries on two farms would have ranged from $1,767 to $3,038 per acre after cost of picking, boxes, and selling, if yields based on test rows were obtained. Marketing costs and charges may approximate one half the retail price. Example: retail price, 40 cents per quart; boxes, 1.5 cents; picking, 8 cents; delivery and sale, 5 cents; retailer's margin, 20 percent or 8 cents; total, 22.5 cents. Thus sales on the vines at half retail price may be as profitable as jobbing to stores.

Strawberry Prices. Strawberry jobbing prices for four New Hampshire cities, as quoted by the New Hampshire Market Bulletin for the past six years, averaged from 31 cents (1950) to 49 cents (1946) per quart. Retail prices most frequently asked in 34 stores in 13 towns in 1950 ranged from 35 to 49 cents a quart during the season. The average was 39 cents per quart.

Tray berries in Boston over the past 15 years have averaged about 3 cents per quart over crate berries.

Late strawberries usually bring a premium over midseason ones. Maine berries sold in Boston during July, 1951, averaged 11 cents per quart over the June market price.

Strawberry Losses and Keeping Quality. Wastage of strawberries on the vine is heavy in many commercial patches. Such spoilage on the vine slows picking, injuries the grade, and increases spoilage in the boxes.

Sound berries can be held under refrigeration three to five days with small losses. They held for eight days under refrigeration better than for two days at room temperatures.

Spoilage of strawberries in the retail store may be heavy when held for a second day, particularly when the grower held them overnight before bringing them in. Excessive bruising, as may result from careless picking, materially shortens the life of the product.

Some firm varieties, such as the Sparkle, keep better than softer varieties, such as the Pathfinder. But care in handling, the maturity of the fruit, and temperature are all important factors.

Opportunities in Producing and Marketing Strawberries in New Hampshire

By L. A. DOUGHERTY
Assistant Agricultural Economist

Introduction

A study was made on marketable supplies, size, spoilage, sales, and returns for strawberries in New Hampshire during the 1949 and 1950 seasons, in cooperation with four commercial growers. An irrigated plot was included in each year. Both seasons were unusually dry and lack of water undoubtedly reduced yields in the unirrigated plots. However, the differences in size and yield were not as great as might be expected. Since rainfall was light during the picking period, spoilage was not excessive in either year.

Great Bay, a new introduction of the New Hampshire Agricultural Experiment Station, was included with other varieties in each year. Because of its size and lateness of season, it appeared to be of commercial interest.

Areas of Production

Rockingham and Hillsborough counties accounted for more than one half the strawberry production in New Hampshire in 1949, according to U. S. Census data, while Carroll, Cheshire, and Coos counties together accounted for less than 9 percent of the total production.

Most of New Hampshire's production now goes into nearby markets. Several counties produce far less than the potential consumption in season as indicated in Table 1.

Production was insufficient to supply farmers in many areas. Since many poultry and dairy farmers raise no strawberries, they are potential customers.

Per Capita Production

Slightly more than 3 percent of our farms produced strawberries in 1949 and they ranged from .9 percent in Coos County to 6.1 percent of all farms in Rockingham County.

The per capita production in the counties ranged from a .07 of a quart in Coos County to 1.1 quarts in Rockingham County and averaged .38 of a

quart. The per capita consumption for the United States in 1949 was about 1.6 quarts. Assuming we eat about the average amount, we are producing only about one fourth of our needs. Of course some of this total is eaten in advance of the local season. Slightly more than one half of the Boston receipts are obtained in the ten months other than June and July, and only about 25 percent of the total receipts come from Massachusetts.

It seems probable, therefore, that more than one half of our strawberries are eaten when not available locally in season.

Table 1. Strawberries Produced on New Hampshire Farms — Census, 1949

County	Farms Strawberries Producing	Percent of Farms All	Average No. Producing Berries Quarts Per Farm	Average No. Quarts (All Farms) Per Farm	Average No. Capita* Quarts Per
Belknap	37	4.4	340	15	.47
Carroll	11	1.8	780	14	.54
Cheshire	23	2.2	269	6	.16
Coos	8	.9	332	3	.07
Grafton	23	1.3	937	12	.45
Hillsboro	73	3.4	419	14	.2
Merrimack	46	2.4	354	9	.26
Rockingham	135	6.1	547	33	1.1
Strafford	46	4.7	432	20	.39
Sullivan	21	2.1	482	10	.4
State	423	3.2	478	15	.38

*Preliminary data, 1949 Census.

Varieties and Yields

It is possible to get yields of between 10,000 and 20,000 quarts per acre in commercial patches in New Hampshire, as determined by data from test rows in some patches. Yields from test rows may, however, exceed those for the patch as a whole for these reasons:

1. The test row is selected as a good commercial row and, while not the best in the patch, rows having missing areas are avoided. Therefore, patches with many weak or missing areas may yield less on an acre basis than indicated in test rows.

2. The test rows are picked clean every other day. In most commercial patches, it is difficult to avoid wastage, especially with children for pickers. Berries are missed and spoil; some are eaten. These factors reduce yield.

Variety Yields

Howard 17 has always been a good commercial variety. In all checks made it exceeded Catskill in yield.

Great Bay yielded about the same as Howard 17, but was later and berries were considerably larger. The plant stand was not as good as for Howard 17 under the same conditions (two very dry seasons). With the same plant stand it should do better. Early setting and good soil appear to be essential conditions.

Pathfinder, under irrigation in 1949, out-yielded both Howard 17 and Catskill by 2,600 and 3,000 quarts per acre, respectively. Sparkle, under

Table 2. Comparative Harvest Dates — Great Bay and Howard 17 Strawberries, 1950

Grower	Variety	Year	Percent Total Crop Harvested		
			Before July 1	July 1-4	July 5-17
1	Great Bay	1950	11	54	35
5	Great Bay	1950	48	30	22
1	Howard 17	1950	77	18	5
4	Howard 17	1950	74	10	16
			Before July 10	July 10-19	July 20-Aug. 2
6	Howard 17	1951	51	39	10
6	Great Bay	1951	9	52	39

irrigation in 1950, out-yielded Howard 17 and Catskill by almost 2,700 and 3,000 quarts per acre, respectively.

Sparkle, Great Bay, Howard 17, and Catskill are all good proven varieties in New Hampshire. All have shown yields of more than 10,000 quarts per acre. In addition to high yields, Great Bay and Catskill have large size, and Sparkle, while smaller, has quality, and is well liked by the public.

Another grower obtained good yields on Majestic, a smooth, light-colored berry, little grown in New Hampshire.

Yields from Small Areas

Many growers who have small patches of strawberries obtain high yields per plant set. This may be due to a high degree of fertility, good care, and very narrow picking aisles. They may also pick the berries more thoroughly.

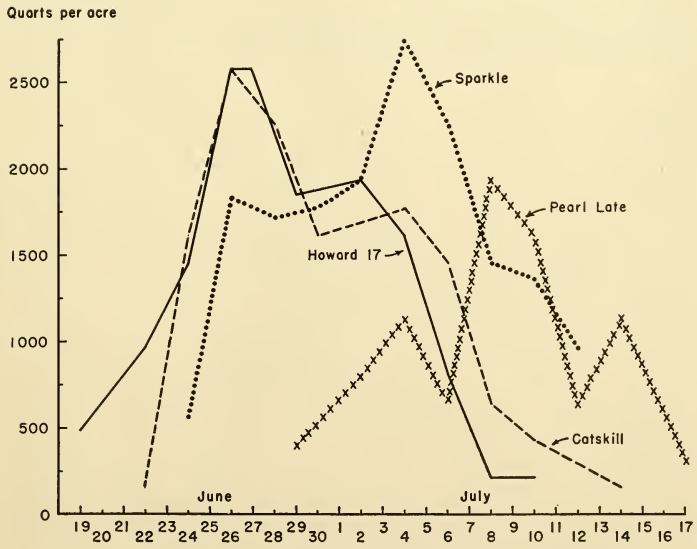

Figure 1. Yield pattern on four strawberry varieties through the 1950 season. Data from Grower 4.

One grower of Great Bay in Durham obtained 4 quarts per plant set. A grower in Chester obtained 3 quarts per plant set from Pathfinder and 2.8 quarts per plant set from Sparkle. These yields were equivalent to 17,424 and 16,340 quarts per acre, respectively.

Table 3. Size and Yield of Strawberry Varieties in 1950

Variety	Grower	Irrigated	Size Order	Average No. Berries Per Quart	Yield Order	Total Yield Quarts Per 100' Row
Great Bay	1	No	1	70	3	167
Pearl	4	Yes	2	78	6	89
Catskill	4	Yes	3	88	5	149
Howard 17	1	No	4	90	2	168
Howard 17	4	Yes	5	90	4	152
Sparkle	4	Yes	6	105	1	179

Note: These data should be regarded as factual rather than comparative as they apply to different growers under different sets of conditions.

Yield Patterns

In addition to yield, growers are interested in the time and the length of the period in which strawberries of different varieties are available. Berries available early or late in the season usually bring higher prices. For example, a late variety, such as Great Bay or Sparkle, will yield large high-quality berries when earlier varieties are dropping in size.

The peak of the Sparkle yield was seven days later than Howard 17 for one grower in 1950 (see Figure 1). The peak for Great Bay was ten days later than Howard 17 in 1950 for another grower. But the season for Howard 17 was 24 days or three days longer (see Figure 2).

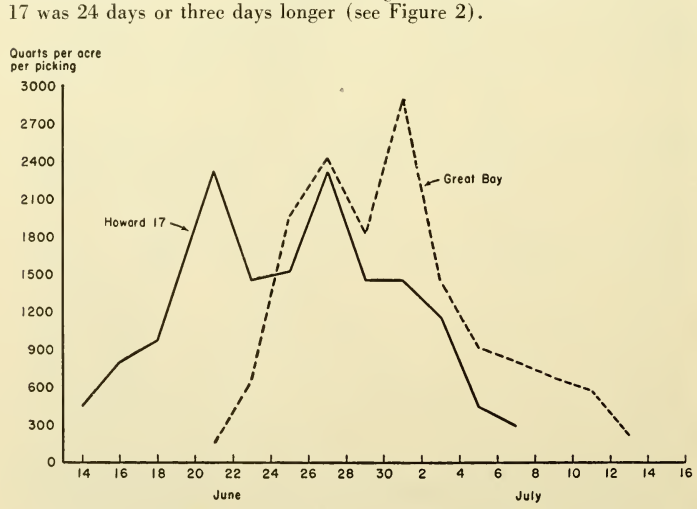

Figure 2. Yield pattern of Great Bay and Howard 17 strawberries in 1950. Data from Grower 1.

Harvesting Problems

THE SIZE OF strawberry varieties is important in terms of picking costs, ease of sales, and sales prices. In several cases, varieties with large berries have also been heavy yielders. Comparative data for 1950 are shown in Table 3. Note that Great Bay shows up well in both size and yield even on unirrigated ground.

Great Bay not only had a large percent of boxes classifying "large", but there were remarkably few classifying as "small" size. The size divisions are arbitrary. In this study "large" means 75 or fewer berries per quart, "medium" stands for 76-125 per quart, and "small" is 125 per quart (see Table 4).

Table 4. Percentage of Large, Medium, and Small Berries, and Boxes of Berries for Two Growers, 1950 Season

Variety	Per Cent Large		Per Cent Medium		Per Cent Small	
	Boxes	Berries	Boxes	Berries	Boxes	Berries
			Grower 4*			
Howard 17	54.8	39	25.8	29.6	19.4	31.4
Catskill	46.	30.9	45.4	56.4	8.6	12.7
Sparkle	23.7	10.8	50.1	47.5	26.2	41.7
Pearl Late	57.	40.9	26.2	30.5	16.8	28.6
			Grower 1			
Great Bay	60.1	42.1	37.2	52.2	2.7	5.7
Howard 17	31.	26.2	48.1	51.6	20.9	22.2

*Irrigated patch.

The size of strawberries of all varieties drops as the season advances. But some varieties hold up better than others. (See Figures 3, 4, and 5 for

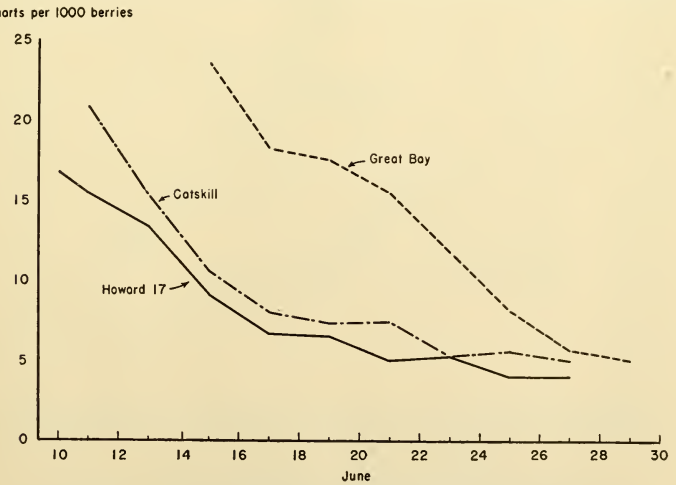

Figure 3. Size of strawberries marketed through the 1949 season. Data from Grower 1.

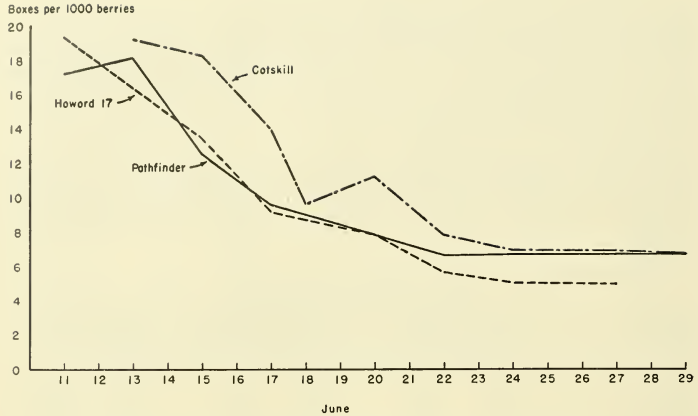

Figure 4. Size of strawberries marketed through the 1949 season. Data from Grower 2.

size patterns through the season.) Great Bay held its size longer than any other variety (100 berries per quart or 10 quarts per 1,000 berries for 13 days). Pearl also held its size well.

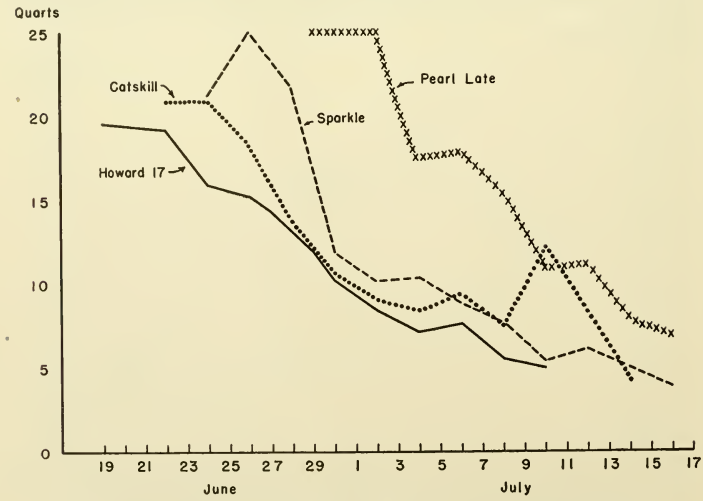

Figure 5. Size of strawberries marketed at each picking through the 1950 season. Data from Grower 4 on the basis of quarts per 1,000 berries picked.

Rate of Picking as Influenced by Size and Yield

The size and yield of strawberries in general declines as the season advances, and so does the time and cost of picking. Peak size is reached before peak yields, so picking time decreases for a few days and then increases for the balance of the season.

Some varieties drop faster than others in size and in percentage of quarts which will grade large. This is quite important as it is a factor in yield, picking cost, and prices received. (See Figure 6.)

Picking Time as Related to Yield

In picking Great Bay strawberries in 1949, the time per quart increased from 5½ minutes to 22 minutes, while the yield per acre per picking dropped from 1,900 to 330 quarts. Size is also involved for it drops as yields decrease, and both are important factors in picking time and costs. (See Figure 7.)

Cost of Picking

Costs of picking vary a great deal and are influenced by labor supply, location of the patch, and the character of the picking. The picking in turn is influenced by thickness of the vines, the yield and size of berries, and freedom of the patch from grass and weeds. The bulk of the strawberries cost between 5 and 10 cents per quart to pick in 1950 and 1951. Based on the picker handling test rows, costs for different varieties in 1950 ranged from 6.7 to 9.2 cents per quart, if a wage of 60 cents per hour were used. (See Tables 5 and 6.)

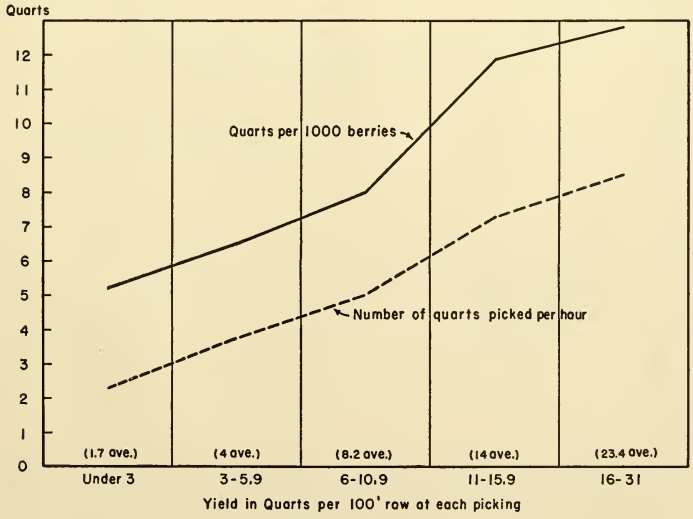

Figure 6. Time in picking strawberries as related to size and yield. Data averaged for all varieties in 1949.

The picker on test rows picked from 3.5 to 20 quarts per hour. At 5 cents per box his wage would have varied from $.17½ to $1.00 per hour. Or if he had been paid 60 cents per hour, the picking would have cost from 3 to

Table 5. Cost of Picking Strawberries*
Three Growers (1950)

Grower	Variety†	Average Size of Berries	Yield Acre Basis	Picking Time		Cost of Picking At 60c Hr.
		(No. Per Qt.)		Mins. Per Qt.	Qts. Per Qt.	Cents Per Qt.
1	Howard 17	89.7	14.617	7.86	7.6	7.8
	Great Bay	70.	14.520	6.67	9.0	6.7
2	Sparkle	104.5	17.370	8.26	7.26	8.26
	Howard 17	90.1	14.707	9.19	6.53	9.19
	Catskill	87.7	14.383	8.65	6.94	8.65
	Pearl Late	77.8	8.630	8.84	6.79	8.84

*Based on picker No. 3 on test rows.

†Variety is, of course, only one of many factors influencing yield. These comparisons were made on farms growing the varieties under similar conditions. But even on the same farm other factors, such as virus in the stock, have accounted for important differences in yield.

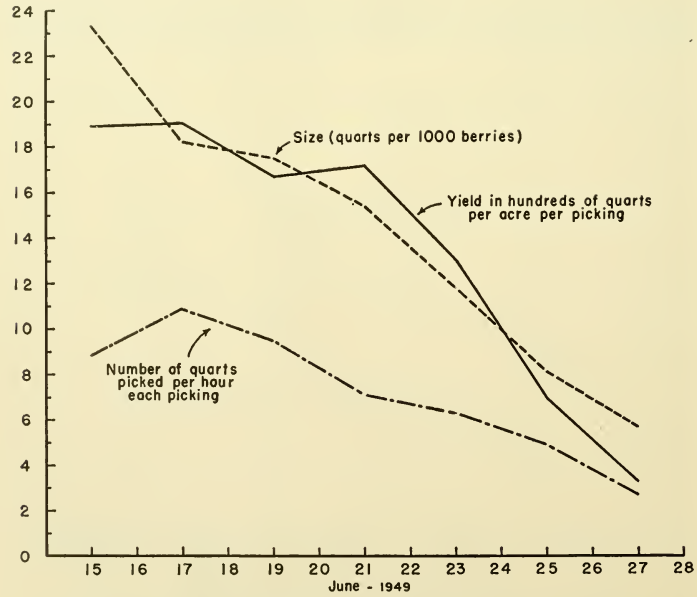

Figure 7. Size, yield, and picking rate for Great Bay strawberries in 1949. Dota from Grower 1.

17.1 cents per box. It is obvious that rates had to be varied through the season in order to maintain wages and hold pickers.

Returns from Strawberries

Production and gross returns from strawberries vary tremendously. In 1949 the yields on seven varieties in nine plots varied from about 6,000 to 12,000 quarts per acre and estimated returns varied from about $1,200 to $2,300 per acre after allowance for boxes, picking, and selling costs. These figures were based on amounts picked from check rows and after costs of 1.5 cents per box, picking costs of from about 8 to 11 cents per quart, and selling costs of 5 cents per quart.

In 1950 yields of five varieties on six plots varied from 8,630 quarts on the Pearl variety to 17,370 quarts per acre on the Sparkle variety as based on pickings from check rows. Returns, after allowance of box costs (1.5 cents), picking costs (6.7 to 9.2 cents per quart), and selling costs of 5 cents per quart, varied from $1,767 to $3,039 per acre. These returns were based on sales at average jobbing prices each day throughout the season. (See Table 7.)

Methods of Payment for Picking

The price growers must pay to get strawberries picked depends on the quality of the patch and the local labor situation. Different plans are used:

1. A straight price for the season, such as 5 cents per quart.

2. A standard rate for the main part of the season, with a higher price near the end.

3. A standard price, plus a bonus of so much a quart, such as 1 cent, for those who stay through the season.

4. An hourly wage for the season.

5. An hourly wage plus a certain amount per quart for satisfactory picking (quantity and quality).

6. A rate set from day to day by a check picker, but with a set minimum.

Too much dependence seems to be placed on children, some of whom do not do a good job. Many growers could afford to pay a higher price for a job well done.

Rates paid in 1951 ranged from 5 to 10 cents per quart. It appears that an average of 6 or 7 cents is none too high to give returns that would attract reliable pickers.

Selling Berries on the Patch

Some growers have sold berries on the patch over a period of years. But it has been done most often as a means of selling berries when picking was poor, as at the end of the season. Or it has been done in patches which were held over a second year and where picking was not especially good. There has been a tendency to let the public in on the poorest part of the crop.

Table 6. Labor and Cost of Picking One Acre of Great Bay Strawberries
(Based on Case Study in 1950)

Date	Yield in Quarts Per Acre	Average No. Berries Per Quart	Quarts Picked Per Hour	Hours Picking Time Required	No. Pickers Required Working (Hours) 4	6	8	Price Per Quart To Pay 60c Hour (Cents)	Hour Wage At 5c Quart (Cents)
June									
21	145.2	44	12.	6.1	2	1	1	5.	60
23	653	39	16.4	20.	5	4	3	3.7	82
25	1960	39	20.	49.	13	9	7	3.	100
27	2420	49	14.	86.5	22	15	11	4.3	70
29	1815	59	13.3	68.4	17	12	9	4.5	66.5
July									
1	2904	69	9.8	147.6	37	25	19	6.1	49
3	1452	100	6.1	118.6	30	20	15	9.8	30.5
5	907	96	7.	64.4	16	11	8	8.6	35
7	799	93	6.2	64.1	16	11	8	9.7	31
9	678	102	4.7	71.8	19	12	9	12.8	23.5
11	581	125	3.5	82.3	21	14	11	17.1	17.5
13	206	158	3.8	24.2	7	5	4	15.8	19
Season	14,520	70	9.	806.2	21	14	11	6.7	45

Table 7. Strawberry Varieties — Yield, Size, Picking Time, Costs, Returns. (Two Growers, 1950)
(Based on Considerations Treated in Footnote — See below)

(1) Producer	(2) Variety	(3) Yield Qts. Acre Basis*	(4) Average Size Berries Per Qt.†	(5) Picking Time Min. Per Qt. And Cents Per Qt. At 60c Hour‡	(6) Weighted Price Per Qt.§	(7) Return After Deducting Box Cost, Picking Cost, And Selling Cost¶
					(Cents)	
1	Great Bay	14,520	70	6.7	31.36	$2,636.76
1	Howard 17	14,617	90	7.9	31.64	2,520.51
2	Howard 17	14,707	90	9.2	30.9	2,244.52
2	Catskill	14,383	88	8.6	30.85	2,265.37
2	Sparkle	17,370	104	8.3	32.41	3,038.52
2	Pearl	8,630	78	8.8	35.78	1,767.16

Note: No consideration was given size in pricing. However, Great Bay and Pearl would have a distinct price advantage due to size.

*Test rows were picked clean every other day.

†Size weighted by number of quarts at each picking.

‡Time taken in picking test rows.

§Weighted by number of quarts at each picking times average price that day. Price was figured at 8 cents quart below current N. H. retail prices and weighted by number of quarts at each picking times average price that day.

¶Selling cost at 5 cents quart, box cost 1½ cents quart, and picking cost as shown in column (5) were deducted.

Pick-your-own plans have these attractions:

1. Permit the consumer to obtain more berries for a given expenditure of cash.

2. The berries are fresher than would be obtainable in the markets.

3. Serve as an outing for city folks.

Several growers marketed part of their berries this way in 1949 and 1950.

One grower marketed 73 percent of his crop in this way in 1949, and many of these berries would have been lost had they had not been sold in this way.

Care in Picking Berries

Many growers do not give enough attention to picking the berry crop. They are often so busy getting the crop off and selling it that insufficient time is given to individual pickers in showing them how to pick carefully,

Table 8. Strawberries — Comparative Market Returns and Costs — 1950
(Assuming Two Methods of Marketing)

	Method A	Method B
Market	Portsmouth	On the vines
Variety	Howard 17	Howard 17
Yield per acre	14,617 quarts	14,617 quarts
Market price	29.7 cents quart	18½ cents* quart
Box cost	1.5 cents quart	
Picking cost	9.8 cents quart	
Sales cost	5. cents quart	2 cents quart
Total costs above	16.3 cents quart	2 cents quart
Net per quart	13.4 cents quart	16½ cents quart
Return per acre after picking, box, and sales costs	$1,958.68	$2,411.81

*One-half retail price of 37 cents quart or 18½ cents on the vines.

yet rapidly. Less bruising is caused when berries are held in the hollow of the hand and the stem pinched. Children with small hands often pinch the berries and bruise them.

A large percentage of the berries were found bruised in the baskets of some pickers. These will spoil quickly. Some growers prefer to pay by the hour, placing emphasis on care in picking instead of on volume. A few pay a set rate plus a premium where a good job of picking is done. A method of payment is desirable which will give as much encouragement to care in picking as in the volume picked. Constant emphasis on this point is required.

Spoilage and Damage on the Vines

Spoilage of berries on the vines may increase with wet weather, insects, damage, and careless or infrequent picking. When plants are very thick, spoilage may be worse because more berries are missed by pickers and dampness is held longer. Some varieties spoil worse than others and some are damaged more by insects.

Data were obtained on these different factors in 1949. Weather was sunny and dry for most of the season. Bad berries found on the vines (picked every other day) ranged from 2 to 11 percent and averaged 4 percent.

Markets for Strawberries

One of the problems in shipping late strawberries to markets to the south is that of having enough volume to make full refrigerated truck shipments. If berries are sufficiently high in price, consideration may be given to shipment in refrigerated cases by truck, rail, or plane. Such a shipping case has been developed in California.* It carries four trays of berries and the top tray is used for dry ice. The temperature rise was held to 10°F in 24 hours with 13 pounds of dry ice. As little as seven pounds was used for overnight plane shipments.

Problems in Selling to Chain Stores

Many chain stores buy part of their strawberry supply locally. As the season advances, berries come in from Cape Cod or areas to the south of New Hampshire. At the time local berries start, prices of shipped-in berries are lower, and the quality is usually not as good. Both types of berries may be available in the store at the same time. Since the local berries will usually out-sell the shipped-in berries, the former may be held back in order to move supplies on hand and those being sent in from the warehouses. If they are put on sale at the same time, a price differential should be made or the shipped-in berries will move too slowly and losses result. But if prices have been advertised, the chain store manager may not wish to sell at two different prices. In such cases the local berries may be sold on a very narrow margin or be held back, at least until the poorer berries are moved.

The local supply at the beginning may be too small to meet the need of large markets. Since Boston prices at the beginning of our season may be out of line with our local prices and since chain store managers may attempt to buy at Boston quotations and/or sell at advertised prices, difficulty may be experienced in arriving at a satisfactory price with the grower. The competition with Cape Cod berries is much greater in some seasons than others.

Processing Strawberries

A market outlet to processors is important in marketing such a highly perishable product as strawberries. A few growers sold to processors at 25 cents per quart in 1950 and at 22 cents in 1951. Locker plants could freeze surpluses, but a considerable investment needs to be made in equipment if low costs in handling are to be realized. A capping machine and a slicer would need to be used, but a considerable volume would be required to justify the expense of purchasing and installing the necessary equipment.

The Sparkle strawberry is an excellent one for freezing, but it does not cap very well in the capping machine. It appears that a combination of qualities, namely, ease of capping, flavor, texture, and color are needed in one variety.

Use of Strawberries by Locker Plants

Some of the freezer locker plants in the state have frozen strawberries for sale. A questionnaire was sent to all freezer plants and some ice cream

*Described by W. R. Barger, Bureau of Plant Industry and Agricultural Engineering, U. S. Department of Agriculture, Fresno, Calif., in November, 1950, issue *Modern Packaging* Magazine.

plants in 1950 to determine interest in this field. A Massachusetts plant paid 25 cents per quart in that year. Results of the survey follow:

No. Answering	No. Making Purchases	Amount Bought	Average Price Paid
18	4	5,120 qts.	24-30 cents quart

Strawberry Purchases in a Supermarket

Observations were made on purchases of strawberries in a large supermarket on June 28, 1950.

Approximately 38 percent of the customers who passed the berry display counter made purchases. Twice as many women bought berries as did men, but the men made one-third larger purchases. The average of all purchases was 1.2 quarts per customer.

In another study of purchases at a supermarket, 75 percent of the customers bought one quart of strawberries each, 21 percent bought two quarts, and 4 percent bought three or more when the price was 39 cents a quart. About 35 percent of the customers who passed the strawberry display bought strawberries. Sales of more than 200 quarts were made that afternoon.

Keeping Quality of Strawberries

Many factors influence the keeping quality of strawberries. They include handling (whether bruised or not), variety, ripeness, temperature, humidity, how well the patch has been kept picked, regularity of picking, insect population, and period in the season. The plant set is also a factor, for if plants

Figure 8. Placing Great Bay strawberries in trays for movement from field to market.

are very thick and leafy more berries are missed and spoil and the vines and berries do not dry off as quickly.

Once mold organisms get a good start in a patch, as in the case where many berries are left in the patch and the humidity is high, heavier spoilage is bound to result.

In selecting samples of the various varieties for this study, stems of all berries were pinched and the berries were handled by stems or calyx as much as possible to avoid bruising. An effort was made to include berries of similar ripeness.

Several tests have been made on spoilage and in different years. The results vary considerably, and the variations between varieties should not be accepted as conclusive. These data do indicate the need for quick handling or refrigeration.

Howard 17 is usually considered a poor keeper and yet in one test it kept very well both at room temperature and under refrigeration. Robinson is usually rated as a soft berry and yet it was one of the best keepers in a test made in June, 1951.

The Sparkle variety, in several tests made, kept much better than Howard 17 at room temperature. While it may turn a bit dark, it is well accepted when consumers come to know it.

In tests made on 13 varieties in 1951, July Morn and Elgin kept best after being held two days at room temperature, while Howard 17 and Pathfinder kept least well. Under refrigeration Robinson and Maytime kept best.

Keeping Quality Under Cellophane

A number of tests were made on the keeping quality of strawberries under cellophane and not under cellophane, both in and out of a refrigerator. The results were not conclusive but the following facts were noted.

Berries under cellophane did not dehydrate as much as those not covered, so they were firmer and fresher in appearance after a week in the refrigerator. If berries started to mold, it seemed to spread faster under cellophane and spoilage was higher. But if mold did not start, they kept better under cellophane.

When berries were held in a warm room under cellophane, they usually kept less well than when not cellophaned. This is especially true where mold organisms exist and grow rapidly in the moist warm air. (See Table 9.)

Table 9. Keeping Quality of Strawberries under Cellophane

No. Sample Lots	Treatment	Period	Percent Good Berries Remaining
4	Room Temperature Cellophaned	3 days	23%
4	Room Temperature Not Cellophaned	3 days	48%
4	Refrigerator Cellophaned	6 days	77%
4	Refrigerator Not Cellophaned	6 days	81%

Shrinkage of Strawberries When Held

Three varieties of strawberries were held for 27 and 51 hours in a warm room (summer temperature of 64-87° range) and in a refrigerator at 42-45°F. Shrinkage in weight in the refrigerator was a little more than one-half the shrinkage outside. At the end of 27 and 51 hours, shrinkage was

6.6 percent and 9.7 percent in a warm room, compared to 3.8 percent and 5.2 percent in the refrigerator.

Sale of Strawberries Under Cellophane

Strawberries were sold in a display containing both cellophaned and uncellophaned fruit in a supermarket in July, 1948. Reactions of consumers to the sale of strawberries under cellophane were not conclusive. First reactions indicated skepticism on the part of the consumer. A large percentage of consumers examined the berries in a box and often shook them in an attempt to see what was underneath. Since they could not do this when cellophaned, some seemed to wonder whether the purpose was to prevent examination.

Uncellophaned berries outsold cellophaned berries about 7 to 1. The comparison was not entirely accurate since there were usually more uncellophaned berries in the display than cellophaned. However, there was always a sufficient number of good cellophaned berries to readily facilitate selection of either.

Quality of Berries Sold in Retail Stores

Strawberries are a highly perishable product and daily purchase and sale is advisable wherever possible. Moving left-over berries from a warm storeroom into refrigeration and back out again is not a satisfactory solution. If the berries had been picked the first day and were not bruised, a fairly good product should be available the second day. But in many cases, berries had been held overnight before being brought into the store and they were often bruised. So by the third day considerable spoilage often occurred. Some stores with refrigeration space placed the berries there on arrival and drew from the refrigerator as needed. This works out quite well, especially if received the day picked.

Prices of Strawberries

PRICE DATA on strawberries were obtained from these sources: (a) direct from producers; (b) direct from retail stores; (c) wholesale and jobbing quotations published by New Hampshire Weekly Market Bulletin, Department of Agriculture, Concord, N. H.; (d) U. S. Census data: (e) Farmers Produce Market Reports, Massachusetts Department of Agriculture, Boston, Mass.; (f) Bureau of Agricultural Economics, Daily Fruit and Vegetable Report, Boston, Mass.; and (g) Producers Price Current, New York City.

Prices for strawberries are reported by the New Hampshire Weekly Market Bulletin each week of the season. In the six years, 1946-1951 inclusive, average wholesale prices (simple averages) ranged from 25 cents per quart in 1950 to 46 cents in 1946. Averages of jobbing prices ranged from 31 cents in 1950 to 49 cents per quart in 1946.

Prices in New Hampshire Retail Stores, 1950

The County Extension Agents obtained strawberry prices in towns in the various counties in 1950. These were obtained from 34 stores in 13 towns and cities. The lowest price reported was 25 cents per quart, the highest 59 cents. The daily prices ranged from 37 cents to 47 cents per quart

Table 10. Shrinkage of Strawberries in Warm and Cold Storage (Picked July 7, 1950)

Variety	Count Per Quart	Gross Weight Quart Box	Net Weight Quart Box	Total Loss in Weight at End		
				3 Hours	27 Hours	51 Hours
				Percent	Percent	Percent
		(ounces)			(Held at Temperature Range 64-87°F)	
Catskill	143	24.86	23.44	2.	7.2	10.5
Pearl Late	75	23.02	21.64	1.6	6.2	9.2
Sparkle	131	23.35	22.	1.3	6.3	9.2
Average	116	23.74	22.36	1.6	6.6	9.7
					(In Cooler, Temperature 42-45°F)	
Catskill	137	22.96	21.52	1.9	4.1	5.8
Pearl Late	60	23.64	22.39	1.4	3.8	5.1
Sparkle	128	22.48	21.08	1.3	3.	4.8
Average	108	23.03	21.66	1.5	3.7	5.2

Table 11. Strawberry Prices in Four New Hampshire Cities — 6-Year Period, 1946-1951
(As reported in New Hampshire Market Bulletin)

Year	Lowest Wholesale Price	Average Wholesale Price	Average Jobbing Price	Highest Jobbing Price
	(cents per qt.)	(cents per qt.)	(cents per qt.)	(cents per qt.)
1946	35	46	49	50
1947	12	35	41	58
1948	25	35	41	52
1949	15	32	37	45
1950	15	25	31	35
1951	18	32	40	55

Note: Most strawberries are jobbed to stores in small lots. A few are wholesaled to truckers and wholesale firms. There is no sharp line between jobbing and wholesale sales.

and averaged 39 cents for the season. These prices were higher than wholesale prices for nearby berries in Boston, although lower than for some of the Maine berries sold on that market.

Retail Margins on Strawberries

Data were obtained in 26 retail stores in 11 towns in 1950 on strawberry prices and margins. The average selling price was 39 cents per quart and the average margin 7.4 cents or 19 percent of the selling price. Margins ranged from 3 cents to 13 cents per quart. Although selling prices were highest in fruit stores, percentage margins were the lowest for the three groups of stores.

Chain stores had the lowest margin in cents per quart. but were about average in terms of percentage of the selling price. These data are shown in Table 12.

Table 12. Buying Prices, Selling Prices, and Margins on Strawberries Sold in 26 Retail Stores in 1950

Type of Store	Number Stores	Selling Price	Price Paid	Margin	
				Cents Per Quart	Percent
		(cents)	(cents)		
Chain	12	37.	30.	7.	18.9
Markets	9	39.2	31.5	7.7	19.6
Fruit	5	43.4	35.7	7.7	17.7
Total or Average	26	39.	31.6	7.4	19.

Prices of Tray and Crate Berries — Boston Market

Most of the strawberries sold in New Hampshire markets are sold in trays of from 18 to 24 quarts. During June, 1951, almost 80 percent of the strawberries on the Farmers Produce Market (Boston) were in trays.

Tray berries are subject to less buising. On the average they are subject to shorter hauls and should be fresher. They bring a premium over crate berries. Over a period of 15 years this premium averaged approximately 3 cents a quart and ranged from minus 4 cents in 1945 to 9.6 cents per quart in 1946, as reported in the Farmer's Produce Market Report (Boston).

Figure 9. A 20-quart tray of Great Bay strawberries.

Premiums for Berry Quality

There is increasing evidence of sufficient interest in berry quality by consumers to result in premiums to growers.

In 1949, on the Boston market, the New Jersey Sparkle variety brought premiums of from 5 to 15 cents per quart. The average premium over one week was more than 10 cents per quart. A Belknap County grower received premiums of at least 5 cents per quart on Sparkle in 1950. A Strafford County grower was able to command a premium on the Great Bay variety. Size was undoubtedly a factor here.

Strawberries for Late Markets

GROWERS HAVE A distinct market advantage in having quantities of large strawberries available late in the season. Great Bay has been one of the few varieties that combine lateness and size. Pearl Late is large but the yield is much lower than for Great Bay.

In 1950, two growers had peak yields of Howard 17 on June 24 and 26, and on June 21 and 27. Two growers of Great Bay had peak yields on July 1. The percent of the total crop coming at various dates is shown in Table 2.

Size of Great Bay for one grower was 50 percent larger than Howard 17 on July 1 and 25 percent larger on July 5.

A southern New Hampshire grower in 1950 had 89 percent of the Great Bay ripen after July 1, compared to 23 percent of the Howard 17.

A northern New Hampshire grower in 1951 had 91 percent of the Great Bay ripen after July 9, compared to 49 percent of the Howard 17.

Late Markets

Prices for strawberries usually rise near the end of the season. Thus late varieties or berries grown farther north sell advantageously in the Boston market.

In 1950, Maine berries averaged more than 7 cents per quart more than those from Cape Cod. Some New Hampshire growers received prices as high as 40-50 cents per quart late in the season of both 1949 and 1950.

At the height of the Cape Cod season, Boston prices are likely to be much under those in New Hampshire. For example, on June 27, 1950, New Hampshire jobbing prices were 25-30 cents per quart, while Boston prices were 15-18 cents per quart. Later (July 6), New Hampshire prices were 30-35 cents per quart, while Maine berries were bringing 35-40 cents in Boston with Cape Cod berries at 18-25 cents.

On July 19, Great Bay strawberries at Colebrook, N. H., were about two-thirds picked. At that time jobbing prices were 45 cents per quart in Colebrook and wholesale prices were 40 cents per quart in Boston. In New York City, California berries were quoted at 35-40 cents per pint box.

Late Strawberries for Boston

Most of the strawberries shipped to Boston in July, 1951, came from Maine. More than 70 percent of Maine's shipments to this market were made in that month. The July average price exceeded that for June by 11.6 cents per quart.

The first Maine shipments were sent on June 21 and the last on July 23. New Hampshire could make shipments during this period. A Coos County grower started picking the Great Bay variety on July 6. 1951, and continued

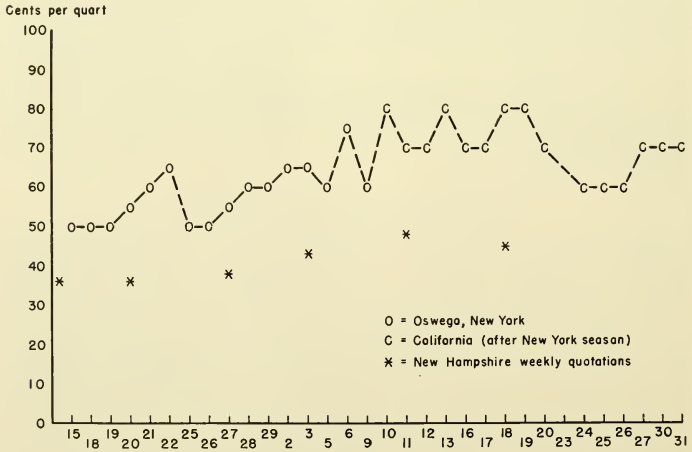

Figure 10. Top wholesale quotations in New York City as compared to prices paid to growers by retailers in Manchester during the 1951 season.

picking through August 2. The average price received was about 47 cents per quart. It was advantageous for this grower to sell on the local market. But if he had had a surplus, he would have found a good outlet in Boston and New York City.

Sale of Everbearing Strawberries

Small quantities of everbearing strawberries have been sold in New Hampshire, but they have not been of much commercial importance. They have been grown largely for home use and for sale at roadside stands. A few have been handled by retail stores. Most of these have been sold in pints. They have been often less attractive than June berries because of smaller size, poorer coloring, and are more likely to be soiled since they are less frequently mulched.

There is a good potential demand for the berries as they would ordinarily fruit from August on and should be available at the height of the summer resort season. They serve as an attractive item on stands since they are not readily available in stores and are well liked as a fruit.

Retail prices in the summer of 1948 were largely 35-39 cents per pint, and in most seasons bring about twice as much as June berries.

Why Few Everbearing Strawberries Are Sold

Since a large potential demand exists for strawberries in August and September, particularly in August, we may well ask why so few are grown? In general, other crops may be more profitable and few growers know how to obtain good yields. Here are some of the difficulties:

1. Yields are lower in any given period.

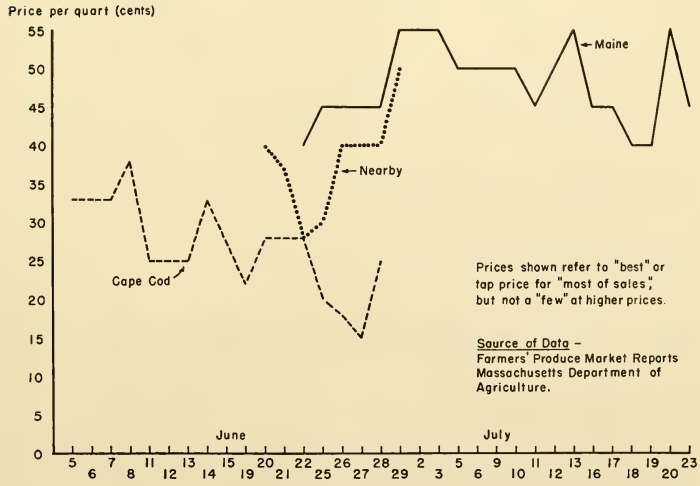

Figure 11. Strawberry prices on the Boston wholesale market during the 1951 season.

2. Only the plants set give appreciable yields in the same year set. Thus, many more plants must be set to give yields comparable to June berries where many plants have been established in the fruiting row between the period when set (such as April) and the picking period, June-July of the following year.

3. Picking and growing costs are higher.

4. Berries ripen in a dry period of the year and plants often suffer from lack of moisture unless in a moist location or unless irrigation is practiced.

5. The period between setting and fruiting is very short, such as May 1-August 1 (three months), and unless carefully handled, plants may lack size and strength for heavy fruiting. Optimum conditions are needed.

6. Crickets and grasshoppers do great damage, especially if the patch is surrounded by grass. Frequent use of poison bran or application of other methods of control are desirable.

7. Because of the short period between setting and bearing, restriction of runner production is essential for good yields. This is much more important for some varieties, such as Gemzata, than others like Twentieth Century.

Conclusions

1. Markets are more fully supplied with strawberries in Rockingham and Hillsborough counties than in other areas.

2. Particularly good opportunities exist for production of more late strawberries, both for sale locally and for markets to the south.

3. The strawberry season can be lengthened about a week by the use of early, midseason, and late varieties.

4. Yields of between 10,000 and 20,000 quarts per acre are possible and practicable.

5. Much more attention to supervision in picking should be given to improve quality and reduce losses.

6. Sparkle, Great Bay, Pathfinder, Howard 17, and Catskill are all good commercial varieties and the first two named are high-yielding late varieties which can return substantial profits.

7. The size and lateness of the Great Bay strawberry are factors which increase returns. But selection of insect- and disease-free stock and fertile soil are especially essential for maximum production and quality.

8. Large yields and large berries result in higher prices, a larger gross, and lower picking costs.

9. Where pickers are hired on piece work, prices should be advanced through the season as size and yield decrease in order to maintain a reasonable hourly wage and hold a satisfactory picking force.

10. Sale of strawberries on the patch is practicable if rows are numbered, pickers are placed on definite rows, markers are used where picking ends, careful supervision is given, berries are priced so some savings accrue to pickers, follow-up pickers are used, and good picking is made available.

11. Sales of strawberries to markets should be planned well in advance and more understanding reached on margins or the prices at which purchases will be made.

12. Everbearing strawberries sell well in August and offer an opportunity for roadside stand sales.

13. Wastage of berries on many patches is heavy. Assignment of pickers to certain rows with incentive payments could increase interest in clean picking and reduce losses.

14. Pre-cooling of strawberries is important, particularly if they are to be held overnight or shipped a distance.