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University of Tennessee Agricultural Experiment Station

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Strawberry Mulching

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Summary

1. Mulching strawberries under conditions in the East Tennessee Valley reduces yields somewhat as compared with strawberries not mulched.

2. Mulching delays harvest significantly in most years, usually by at least 10 percent during the first 6 to 7 days of harvest and this difference may be continued through the season. When harvest is prolonged, due to weather conditions, most of the difference occurs early in the season. When the season is short significant differences are observed up to 12 days after harvest begins.

3. Unmulched strawberries produce a larger proportion of cull fruit and diseased berries than mulched strawberries.

4. Apparently the proportion of unsound fruits increases toward the peak harvest, then decreases.

Strawberry Mulching

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and

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Introduction

Pros and Cons.—Whether or not to mulch strawberries under the climatic conditions found over most of Tennessee has been controversial for many years. In 1947, when this project was begun, most strawberries were sold on the fresh market. Two problems posed by this system of marketing seem to indicate different approaches to mulching on the basis of farmer thinking. Many strawberry producers believed that mulching tends to delay harvest. To the grower, this usually meant a lower return for his crop.

However, buyers believed that mulched strawberries were of better quality, so they always recommended mulching to the growers they served. The many successful Tennessee strawberry growers not mulching their plants would seem to indicate that protection from cold was not a primary reason for mulching in the western part of the state, or in the Eastern Tennessee River Valley. With the establishment of a considerable strawberry processing business, the number of cull berries produced with and without mulching may be important.

Study Two Phases.—Consideration of strawberry mulching in general indicated that a study of two phases of the problem should be made. These seemed to be first, a study of the time when mulches should be applied, and second, the effect of mulching on the yield of strawberries, the quality of the berries produced and the date of harvest.

Methods

Location and Analysis.—These experiments were established in plantations on Cherokee Farm at Knoxville. In 1947, 120 plots were set up; mulch was applied at the rate of 1½ tons per acre as

suggested by Armstrong (2), Vaile (4), and Clark (3) to each of four plots at weekly intervals from December 3 through March 10. In 1949 the interval between mulching was extended to 2 weeks using 60 plots. In 1950 and 1951 there were 30 plots. Yields were recorded on each date of harvest. The quality of fruit was noted in terms of cleanliness and freedom from insect and disease damage. Data were analyzed, for the most part, by analysis of variance techniques. Each year's results was analyzed independently from other years, and this is the only other varying factor which may be excluded in the case of yield data with reference to time of mulching. The effects of both the date of mulching on yield and on the amount of harvest on any date of harvest were studied in this way.

The data on quality did not lend themselves to statistical treatment. In 1950 berries were also graded according to U. S. grades for strawberries. The differences were large, but not adaptable to statistical treatment.

Results and Discussion

Data were pooled for each month—December, January, February, and March—without regard to the actual date of mulching during that month. The number of replicates is given for each month. The months mulch was applied and with the mean yields for all years are shown in Table 1.

In order to evaluate the effects of date of mulching on yield, the data were subjected to analysis of variance involving the effect of year and date of mulching on total yield. The data appear in Table 1.

Table 1. Yield of Strawberries Receiving Different Mulching Treatments

Year	Month mulch applied				Not mulched	Month mulch applied				Not mulched
	Dec.	Jan.	Feb.	Mar.		Dec.	Jan.	Feb.	Mar.	
	No. of replications					Mean yield (lb./plot)				
1948	20	16	16	16	58	7.78	7.01	8.44	9.66	10.01
1949	10	10	10	10	40	10.51	9.46	9.06	10.15	11.93
1950	6	6	6	6	6	8.16	9.12	9.64	10.01	9.76
1951	6	6	6	6	6	21.19	18.96	17.70	19.67	23.43
Total or mean	42	38	38	38	110	11.91	11.14	11.21	12.47	13.28

LSD @ .05 = .478 pounds between treatments.

LSD @ .05 = .396 pounds between years.

Yields—Mulched vs. Not Mulched.—Taking an average over the 4-year period, plots which were not mulched produced more fruit than plots which were mulched regardless of the date of mulching. An independent series of analyses of each year shows this to be true in 3 of the 4 years. In 1950 there is no significant difference between the yields from plants mulched in February and March or from plants left unmulched. When the 4 years are considered as a group, it may be seen that none of the mulched treatments outyielded the unmulched treatment. March and unmulched treatments are essentially equal and outyielded December and January and February mulched plots.

Average Yield Most Significant.—When these data are considered on an annual basis, much the same information appears except that it is at times not quite as distinct as when the average of 4 years is considered. As mentioned above, in 1950 the unmulched plots did not yield more than the February and March mulched plots. In this same year, plots mulched in December produced significantly lower yields than any other date of mulching. In 1948, plots mulched in February produced more fruit than those mulched in December or January.

Weather Influence.—A study of the weather data for the 4 years sheds some light on why in 1948 and 1950 there was such marked difference in yields from strawberries mulched on different dates. The coldest recorded temperature for the 4-year period occurred in mid-January of 1948. Weather had been mild until then. According to Brierly and others (1), strawberries lose hardiness as readily as it is gained, and under mulch these plants may not have been conditioned to withstand the low temperatures that occurred. The berries not mulched before the middle of January when the low of 2 degrees F. occurred were as fully hardened as possible, whereas those under the light mulch were not. Injury to blossom buds and consequent reduction in crop may have been more severe in the mulched berries than in unmulched plots.

Early vs. Late Mulch.—In 1950 a cold period with a low of 5 degrees F. occurred during November. The low temperatures were accompanied with considerable snow and it was not possible to mulch the strawberries until after the snow had melted—about the middle of December. In February another period of 5 degrees F. weather occurred. The low temperature occurred before the berries were mulched for this month. It will be noted that the yields for February, March and those not mulched were nearly equal, whereas the plots mulched in December and January show reduced yields.

Mulching Results Vary.—In both 1948 and 1950 yields were significantly lower than in 1949 and 1951 when extreme cold did not occur. Injury, however, is not significantly different whether the berries are mulched or not mulched, although date of mulching does have a direct effect upon the yields produced in these years. In mild years without severe winters, the effect of date of mulching does not seem to be as pronounced although significant differences do occur. The reasons for these significant differences are often obscure. For example, in 1949 berry yields from plots mulched in December were equal to those mulched in March, but when the plots were mulched in January or February, significantly reduced yields occurred. This situation was also true in 1951—another mild year.

Over the 4-year period 1948 through 1951, no significant differences in yields were observed when the mulch was applied in December, January or February (see chart in Figure 1). When the mulch was applied in March, the yield was significantly higher than with either of the other three dates but the yield was significantly

How Date of Mulching Affects Yield of Strawberries Knoxville 1947-51

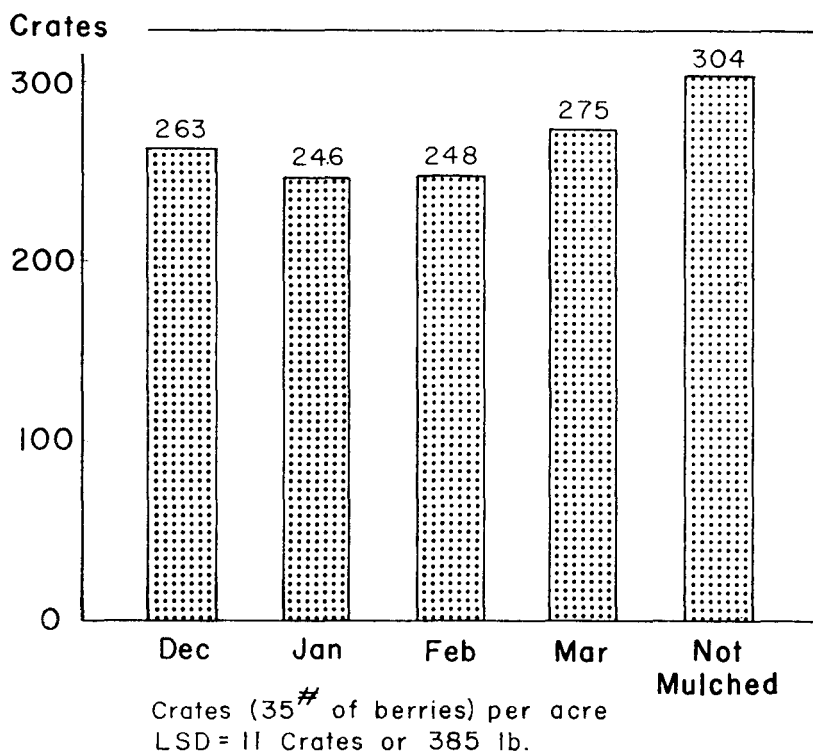


Figure 1. Mulching at any time from December through March significantly decreased yields of strawberries, but mulching in January and February produced the greatest reduction in yield.

less than the yield for those berries that were not mulched. January and February proved to be the least satisfactory months in which to mulch.

The Effect of Mulching on Date of Harvest.—The effect of mulching on date of harvest is also modified by the time of mulching. Data from the years 1948, 1950, and 1951 were analyzed to determine the possible response of strawberries to the time when the mulch was applied. The information is presented in Table 2. The date of mulching appears across the table including—in the sixth column under each date—the significant difference at the .01 level. The figures used in this case are the relative amount of crop harvested on each date of harvest for each treatment. Thus, while a treatment might have produced 20 percent fewer berries than another treatment, the amount of the crop harvested on any one date carries the same weight in both treatments.

In order to demonstrate the effect of mulching on date of harvest, Figure 2, the second bar chart, was developed. The proportions of crop harvested through the first 7 days of the harvest season are shown for the years 1948, 1950, and 1951. In each of those 3 years the unmulched treatments had produced a considerably larger proportion of their crop during this period than any of the mulched treatments.

Effect of Mulching on Date of Harvest at Knoxville

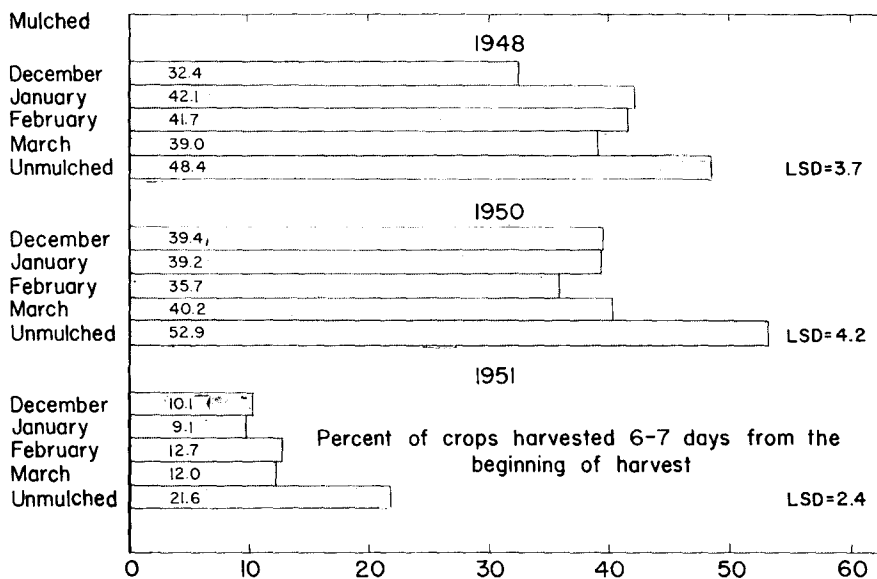


Figure 2. In 1950, the amount of crop harvested in the early part of the season was 12.7 percent more when plots were unmulched than when mulched. As much as 52.9 percent of the crop was harvested from unmulched plots during the first 6 or 7 days of harvest when unmulched.

Table 2. Cumulative Yield of Strawberries at Each Harvest Date

Days after first Harvest	Date of mulching																				
	1948						1950						1951								
	Plots mulched in:				Plots not mulched	Difference required for sig. at .01	Plots mulched in:				Plots not mulched	Difference required for sig. at .01	Plots mulched in:				Plots not mulched	Difference required for sig. at .01 level			
Dec.	Jan.	Feb.	Mar.	Dec.			Jan.	Feb.	Mar.	Dec.			Jan.	Feb.	Mar.						
0	3.8	4.9	5.0	6.1	8.7	—									1.5	1.4	1.8	.9	2.3	—	
1																					
2	8.6	10.9	12.6	17.1	22.1	6.1									2.4	2.6	2.6	2.2	4.0	—	
3							7.5	7.2	7.6	8.7	13.3	3.02									
4	15.6	18.6	19.7	22.4	36.0	3.4									6.1	5.2	7.1	6.6	10.0	3.7*	
5							21.2	19.9	19.5	21.2	30.2	5.00									
6	32.4	42.1	41.7	39.0	48.4	3.7															
7							39.4	39.2	35.7	40.2	52.9	4.15			10.1	9.6	12.7	12.0	21.6	2.4	
8	59.9	64.0	61.0	71.7	70.0	4.4									12.6	12.4	15.3	14.9	26.3	3.0	
9							54.0	55.9	52.0	57.1	67.3	5.37									
10	72.2	73.6	70.1	77.1	82.8	4.2															
11							71.6	74.4	72.0	74.5	84.4	4.76									
12	No significant differences after this date.														31.0	22.6	35.8	29.6	45.5	8.1	
13																					
14							89.6	90.5	88.6	90.0	94.5	3.04	No significant differences beyond this date.								
15																					
16																					
17																					
18																					

* at the .05 level

No Mulch, Heavy Early Production.—In 1948, unmulched berry plots had produced significantly more of their crop 3 days after harvest began than any of the mulched treatments except those mulched in March. By the fifth day of harvest, the unmulched treatment had produced significantly more than any other treatment. This continued true through the seventh day. On the ninth day the March-mulched plots had produced as much as had the unmulched plots. At the thirteenth day there was no significant difference in the proportion of berries produced by any of the plots, and this remained true through the harvest season.

In 1950, 5 days after harvest began, unmulched plots had produced 30.2 percent of the annual crop as compared with 21.2 percent for March and December mulched plots. Unmulched berries continued to produce significantly more of their crop earlier through the first 15 days of harvest than any of the mulched plots. By the fifteenth day of harvest all plots were producing at essentially the same rate. There was no difference in the time of harvest of any of the mulched plots in 1950.

In 1951, 6 days after harvest began, unmulched plots had produced significantly more crop than plots mulched in January. Nine days after harvest began, unmulched plots had produced 21.6 percent of the crop—as compared with 12 percent for March-mulched plots and 12.7 percent for berries mulched in February, and also significantly more than from plots mulched in December and January. Forty-five percent of the crop from the unmulched plots was harvested by the fourteenth day of the season as contrasted with 31 percent from the December-mulched plots. There were no significant differences in strawberry yields after the harvest on the fourteenth day.

The Effect of Mulch on Berry Quality

Sounder, Cleaner, Less Disease But More Insect Damage from Mulching.—For purposes of this study, quality was considered to be affected by cleanliness, insect damage and disease of fruit. It was found that the data from this part of the study were not susceptible to statistical treatment and are, therefore, to be considered only as descriptive. Table 3 contains the results of this study.

Table 3. Quality Factors for Mulched and Unmulched Strawberries

Year	Unmulched plots				Mulched plots			
	Sound berries	Clean berries	Insect damaged berries	Diseased berries	Sound* berries	Clean berries	Insect damaged berries	Diseased berries
1948	.792	.923	.012	.208	.930	.982	.016	.070
1949	.800	.168	.189	.200	.840	.681	.249	.160
1950	.569	.805	.098	.431	.638	.951	.087	.362
1951	.880	.988	.044	.120	.922	.997	.038	.078
Mean	.761	.721	.088	.239	.832	.903	.098	.168

*Sound berries were berries with no blemishes other than dirt; size was not considered a quality factor.

Over the 4-year period, unmulched berries produced 76 percent sound berries as contrasted with 83 percent when mulched—a difference of 7 percent. Insects damaged 10 percent of the berries when the berries were mulched and 9 percent when they were not mulched. Also, 24 percent of the berries were diseased on the unmulched plots and 17 percent when the berries were mulched. There were 90 percent clean berries when the plots were mulched and 72 percent when they were not mulched.

In general, mulching increases the quality of the strawberries produced. A study of berries as related to U. S. Standard Grades was made in 1950. Mulched plots produced 47.4 percent U. S. No. 1's as compared with 24.9 percent from unmulched plots. A study was made to determine the effect of time of harvest on quality based on sound berries for the 4 years. It was found that the proportion of unsound fruits increases toward the peak of harvest and is less at both the beginning and the end of the season.

The data discussed above indicate that if mulching is to be used as a cultural practice in the production of strawberries either for fresh market or for processing in Tennessee, the mulching material should be applied as late in the season as possible—preferably about 2 weeks before bloom time. In most of the state this is about the middle of March. The mulch should be applied in such a way as to protect the expected fruit from dirt splashed on the strawberries by rain. It seems probable that a ton to a ton and a half of clean straw per acre is sufficient.

If it is essential to produce strawberries for the earliest possible market, mulches should not be applied.

If high quality berries are required for market then mulching is essential.

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