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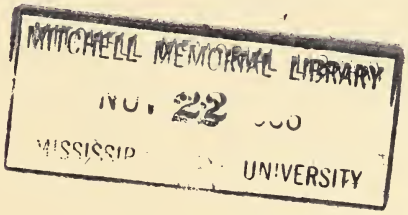
Organic Mulches Improve Strawberry Plant Growth

By J. P. OVERCASH



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Summary

An experiment was conducted to determine the feasibility of permanent mulches for strawberry plants managed by the hill system of culture. Virus-free plants of the Pocahontas variety were used in single rows 36 inches apart with three rows each 20 feet long constituting a plot and records were made only from the center row. Clean cultivation was compared with black plastic, pine straw and sawdust mulches.

1. Plant survival after two years was about twice as good under the organic mulches as for clean cultivation or black plastic mulch. The strawberry plant vigor of surviving plants was much better under organic mulch culture.

2. Yields of berries were about twice as great from plants grown with pine straw or sawdust mulches as for black plastic mulch or clean cultivation.

3. Soil moisture was higher under mulched plots at both 0 to 6 and 6 to 12 inch soil depth than under clean cultivation.

4. Soil temperatures between plants were much higher for clean cultivation and black plastic plots. Even at 6 inches deep in the soil the temperatures were about 10 degrees F. warmer for those plots than for plots mulched with pine straw or sawdust.

5. Plant vigor throughout the experiment was better for organic mulched plots as measured by numbers of leaves and weight and number of runners formed than for clean cultivation and black plastic plots.

ORGANIC MULCHES IMPROVE STRAWBERRY PLANT GROWTH

By J. P. OVERCASH

Strawberries are grown in all the states from Florida to Alaska. They have a wide range of climatic adaptation, even though the fruits ripen and develop their best quality during the cool weather in early spring. In south Mississippi, Florida, Louisiana and the other states bordering the Gulf of Mexico, strawberry plants are grown by the hill system during the winter for fruit production in late winter and early spring. The plants are not carried in the fields during the hot dry summers. The warm winters permit sufficient vegetative growth from plants set in the fall to produce fruit in late winter or early in the spring.

In south Mississippi the strawberries which are grown in the Gulf Coast Area are grown by the hill system, therefore, summer heat and droughts are not a problem. In the central and northern areas of the state, strawberries are managed in the matted row system. Plants are set in rows 3½ to 4 feet apart in the field in late winter or early spring. The plants are spaced 18-24 inches apart in the row. Under favorable weather conditions these plants produce runners which make new plants by rooting when soil moisture and temperatures are suitable and thus matted rows of plants are formed. The matted rows may range from 18 to 30 inches in width at the end of a favorable summer.

When adverse weather conditions prevail, the new runner plants either fail to form or do not develop roots. This results in poor stands of plants in the matted row and subsequent poor yields. Soil as well as air temperatures are often too high for favorable strawberry plant growth for prolonged periods of time during the summers in Mississippi. The most favorable temperature for many varieties of strawberry plants appears to be about 75 degrees F. and as the temperatures rise above this point, the plants grow less.

The studies reported here were conducted to determine the feasibility of using permanent mulches on the soil around the plants on a year round basis for strawberries. The influence of three mulches on plant growth, runner formation, soil moisture and temperatures was studied. Yield and plant survival with various mulch treatments were observed.

Materials and Methods

Three mulching materials were selected for use in these tests. One synthetic material was used, a black polyethylene plastic film of 6 mil thickness. This thickness was selected because of its durability. It lasted two years in the field with very little breakdown. Two organic mulches of local origin were selected because of their availability, freedom from weed seed and durability. One application each of pine straw and sawdust (hardwood) was made and lasted for two years with no replacement.

A site was selected with a sandy loam soil. The slope was about five percent and the water drained in two directions. The soil was prepared by plowing, disking and bedding the rows, which were 36 apart, to a height of about 10 inches. They were then leveled to about five inches of height. When the soil was prepared, two and one half pounds of 8-8-8 fertilizer was applied per 20 feet in the row and mixed with the soil before bedding. This was at the rate of about 1,800 pounds per acre. Dieldrin was included with the fertilizer at the rate of 2 pounds actual per acre for the control of soil borne insects which feed on strawberry roots.

In order to reduce the possibility of root knot nematodes and root rot diseases, as well as to control early spring weeds, the

rows were treated with a preplant soil fumigant, sodium m-methyl dithio carbamate, which was applied as a Vapam formulation. This fumigant was applied at the rate of 1 quart in two gallons of water sprinkled 18 inches wide on each 100 feet of row on March 23, 1961. The soil was immediately rebedded on top of the treated area.

Nineteen days after the Vapam soil treatment, the beds were flattened to a settled height of about 6 inches. The plots were then laid out and set with virus-free plants of the Pocahontas variety obtained from a commercial nursery. Alleys, 5 feet wide, were left between replicates. Water drainage from each replicate was arranged so that each alley served as a drain and water from each plot ran into the alley.

The four treatments (check, black plastic, pine straw, and sawdust) were arranged in a 4x4 latin square. Each plot consisted of three rows, 20 feet long and the plants were spaced 12 inches apart in the row. All records were made on the center row in order to minimize border effects between plots.

Two months after the plants were set in the plots, they were cultivated to remove weeds and to thoroughly pulverize the soil before the mulches were applied. The black plastic film was stretched over each of four plots and slits cut to pull the plants through. Holes were then punched in the film between the plant rows to permit rainfall penetration. The holes were ¼ inch in diameter and spaced about 6 inches apart.

For the organic mulch plots, pine straw and sawdust were applied around the plants and in the middles between rows to a uniform depth of about 3 inches. After settling, these materials remained about 2 inches deep throughout the remainder of the first season. All mulches remained effective through the second summer.

Temperature data were recorded once each season on the soil or mulch surface in the sun between plants, in the shade of plants and at three depths in the soil between plants, by the use of soil thermometers which had been checked for accuracy with a mercury thermometer. Soil moisture was determined by collecting samples from 0 to 6 inch and 6 to 12 inch depths by using a soil auger. These samples were placed in small cans and weighed, then oven dried at 220 degrees F. for 48 hours, then reweighed and their percentage moisture calculated on a dry weight basis.

Vegetative growth was recorded by counting the leaves per plant and the runners formed. Leaves were counted monthly the first season and once in mid-summer of the second season. Runners were removed monthly and the number as well as total weights of runners removed per row were recorded. Yields were recorded in pounds of fruit per row. The number of live plants per plot was recorded throughout the experiment as a measure of plant survival.

Results

The influence of mulch treatments on leaf formation and retention is shown in Table 1. At the end of the first summer the plants in the mulched plots had more leaves than plants in the check plots under clean cultivation. These differences were accentuated by mid-summer of the second year. There were more than twice as many leaves per plant in the pine straw plots than in the clean cultivated plots. Furthermore, the leaves were much larger and healthier as shown in Figure 1.

Runner formation was influenced by the mulch treatments. Only minor differences in numbers of runners existed at the end of the first season, however, significant differences in weights of runners were recorded, Table 2. Runners produced by plants with pine straw or sawdust mulches were larger and heavier than runners from plants in check or plastic mulch plots.

Table 1. The influence of permanent mulches on the number of leaves per plant of the Pocahontas strawberry.

	First Summer				Second Summer
Soil Treatment	July 15	Aug. 15	Sept. 15	Ave.	July 2
Check	17.9	16.3	16.4	16.9	17.3
Black Plastic	19.8	19.3	19.5	19.5	19.4
Pine Straw	18.6	22.5	22.2	21.1	42.2
Sawdust	19.1	20.8	19.7	19.9	28.2
L.S.D. Treatment means		.05		3.1	6.0
		.01		4.7	9.1

Table 2. The influence of permanent mulches on runner formation by Pocahontas strawberry plants during their first summer in the field.

Date runners removed	Check	Black Plastic	Pine Straw	Sawdust	Total
		Number of runners removed per plant			
July 15	7.4	8.0	7.3	7.7	30.4
August 15	8.8	8.0	11.3	10.9	39.0
September 15	1.6	.3	2.0	1.1	5.0
Totals	17.8	16.3	20.6	19.7	74.4
L. S. D. Treatment means for season totals		.05 — 2.6, .01 — 3.9			
		Weight (grams) of runners removed per plant			
July 15	36.8	33.9	35.4	46.9	153.0
August 15	28.2	26.1	67.0	45.3	163.6
September 15	2.6	.7	8.4	4.6	16.3
Totals	67.6	60.7	107.8	96.8	332.9
L.S.D. Treatment means for season totals		.05 — 21.7, .01 — 32.9			

Table 3. The influence of permanent mulches for strawberry plants on average soil temperatures in degrees Fahrenheit.*

Place temperature recorded	Check	Black Plastic	Pine Straw	Saw-dust	Aver-age	L. S. D. for Treatment Means	
			Degrees F.			.05	.01
Soil or Mulch surface in sun	116	118	113	116	116	8.0	12.1
Soil or Mulch surface in shade	105	102	99	99	101	4.7	7.1
1" deep between plants	103	98	85	89	94	3.4	5.2
3" deep between plants	94	96	84	85	90	3.6	5.4
6" deep between plants	90	91	79	83	86	4.7	7.2
Average	102	101	92	94			

*Average temperature at two PM for two dates: Sept. 22, 1961 and July 9, 1962.

Variations in plant performance may be partly explained by the temperature data shown in Table 3. The temperatures recorded for the soil or mulch surface in the sun or shade far exceed the desirable temperatures of about 75 degrees F. for the best strawberry plant growth. The average temperatures were progressively lower as the recording points were moved from the surface to one, 3 and 6 inches below the surface. The average temperature at 6 inches deep between plants was about 15 degrees F. cooler than the soil or mulch surface in the shade of the plant.

Soil temperatures for plots mulched with black plastic were about equivalent to those for check plots. The temperatures at various depths under the organic mulches were always cooler than the check or black plastic plots. These differences were usually 10 or more degrees F. These cooler temperatures were conducive to better plant growth and survival in the organic mulched plots.

Soil moisture normally is higher under organic mulches when drought conditions

prevail. This condition was observed in these strawberry plots, as shown in Table 4. The moisture content of the soil under the plastic mulch tended to be higher than in the soil with clean cultivation.

Generally, fruit yields are directly proportional to plant size and vigor for strawberry plants grown by the hill system of culture. This was true for the plants in these mulched plots, Table 5. The highest yields were obtained from plants grown with organic mulches and the lowest yields were produced by plants with clean cultivation or black plastic mulch. The average berry size was largest for the plants grown under a pine straw mulch. Earliness as measured by the percentage of the total yield which was picked during the first three harvests indicated that the pine straw mulches resulted in later ripening.

The mulches had a marked influence on plant survival, as shown in Table 6. After two years in the field there was a heavy mortality of the plants in plots which received clean cultivation or were mulched with black plastic. At this time, less than half of the plants under these treatments were alive and even these surviving plants were low in vitality as shown in Figure 1. Both pine straw and sawdust mulches were beneficial to strawberry plant growth and survival. There were over 80% of the plants in these plots still alive and healthy at the end of the experiment.

Table 4. The influence of permanent mulches for strawberry plants on the percent of soil moisture in an area six inches from two live plants.

Depth of soil sample	Treatments				L. S. D.	
	Check	Black Plastic	Pine Straw	Sawdust	.05	.01
1961 0-6"	11.91	13.51	15.23	12.97	3.4	5.2
6-12"	12.84	14.34	14.79	15.16	3.7	5.6
1962						
0-6"	10.84	13.54	10.98	12.03	3.3	5.1
6-12"	12.29	15.11	12.03	13.20	2.6	3.9
Average						
0-6"	11.37	13.52	13.10	12.50	2.8	4.2
6-12"	12.58	14.72	13.41	14.18	2.7	4.1

Soils were sampled on: September 19, 1961, following a 14 day period with .8 inch rainfall and a mean temperature of 72° F; and on July 9, 1962 following a 14 day period with .93 inch rainfall and a mean temperature of 81° F.

Table 5. The influence of permanent mulches on the yield of Pocahontas strawberry plants from May 2 to June 2 of first fruiting season.

Soil Treatment	Earliness Percent*	Yield Lbs. per row	Berries per Qt.
Check	73.5	5.0	124
Black Plastic	66.3	3.9	139
Pine Straw	33.6	9.4	93
Sawdust	56.7	8.7	110
L.S.D. .05	17.4	1.5	18.6
.01	26.4	2.3	28.1

*Earliness is expressed as the percent of the total which was picked on the first three harvest dates.

Table 6. The influence of permanent mulches on the survival of Pocahontas strawberry plants after two years.

Soil Treatment	Average Number of Plants per row	Percent Alive
Check	7.8	39.2
Black Plastic	9.0	45.0
Pine Straw	17.6	87.8
Sawdust	16.8	84.2
L.S.D. .05	4.5	20.9
.01	6.7	31.6

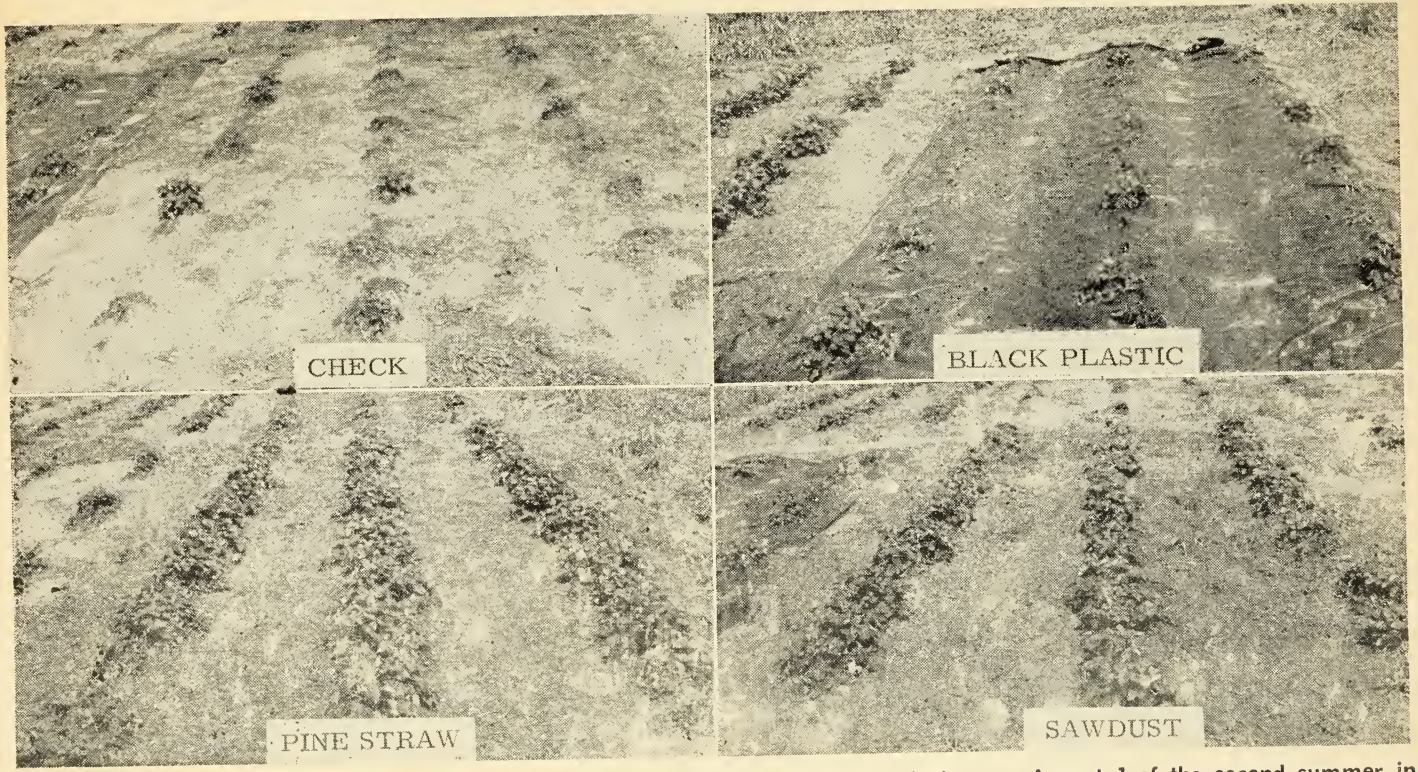

Figure 1. The influence of permanent mulches on strawberry plant survival and vigor on August 1 of the second summer in test.