

2-1-1965

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### Recommended Citation

Overcash, J. P. and Crockett, S. P., "Soil fumigation increases strawberry yields" (1965). *Bulletins*. 120.  
<https://scholarsjunction.msstate.edu/mafes-bulletins/120>

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# Soil Fumigation Increases Strawberry Yields

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### Summary

At State College tests were conducted with four preplant soil fumigants to determine their effect on subsequent growth and plant survival. Vapam, Mylone and Allyl Alcohol had favorable results: excellent weed control the first spring; increased runner plant formation; and increased yields over non treated plots.

At Holly Springs, Mylone fumigated plots were compared with non treated plots of four varieties. The results from soil fumigation included: control of weeds the first spring; better plant production and survival up to 3 years (especially with the Earlidawn variety); higher yields than check plots; and later ripening. The differences in varieties were: Earlidawn and Blakemore fruits ripened early in the season, whereas, the Massey and Pocahontas varieties ripened late. Yields in descending order from the highest were: Pocahontas, Earlidawn, Blakemore, and Massey. Earlidawn was greater in yield than Blakemore only in fumigated plots.

# SOIL FUMIGATION INCREASES STRAWBERRY YIELDS

By J. P. OVERCASH<sup>1</sup> and S. P. CROCKETT<sup>2</sup>

In central and north Mississippi strawberry growers often have difficulty obtaining adequate runner formation. This results in poor stands of plants and often the yields are unprofitable. An ideal plant stand would be a solid bed of plants 24 to 30 inches wide for each row.

Several factors may contribute to poor runner formation and plant survival. Summer droughts often associated with prolonged high temperatures are not favorable for strawberry plant growth. Many varieties thrive best at 75° F and growth is seriously retarded above 95° F. Soil borne diseases, such as red stele (*Phytophthora fragaria*, Hickman) often attack strawberry roots and impair their effectiveness to support growth. Furthermore, insects and root knot nematodes (*Meloidogyne hapla*, Chitwood) also feed on strawberry roots and weaken the plants.

Because strawberry plants have a very shallow root system weeds are serious competitors for nutrients and water. This competition is especially serious until the newly set plants become well established.

With the advent of a large number of chemical soil fumigants and their successful use in commercial production of many crops it appeared desirable to determine if any of these fumigants might influence strawberry plant survival and runner formation. Fumigants may be of a highly specialized nature such as Nemagon for the control of nematodes or they may be of the broad spectrum type such as Vapam which may kill several soil borne organisms as well as control many weeds.

One experiment was planned at State College with four fumigant treatments.

Another experiment was conducted at the North Mississippi Branch Station at Holly Springs with one broad spectrum fumigant and four varieties.

## Materials and Methods

At State College a site was selected in a field in which strawberries had been grown for several years. Most of the plants died during a summer drought the year preceding this experiment.

The soil was thoroughly pulverized to a depth of 6 inches. Surface water drainage was diverted around the area. A 5 x 5 latin square experiment was arranged with 4 chemical pre-plant fumigation treatments and a check. The area was marked off into 4 x 4 foot plots with 3-foot alleys between all plots. The alleys were sloped to be about 3 inches lower than the plots. Water falling on the plots drained in either of two directions. Water runoff from one plot did not flood onto other plots. The alley drains were kept open throughout the experiment.

The fumigation treatments were applied in November 1958, and the plots were set in March 1959. A stock of virus-free, Blakemore strawberry plants was obtained from a commercial nursery. Plants set in the plots were produced from runners of the virus-free mother plants in a bed in a lath house. They were rooted in 3 inch pots of soil which had been fumigated with Mylone. Nine plants were set in each pot and spaced 12" apart.

The fumigants were furnished gratis by the following companies: DuPont—Vapam; Shell Chemical—Allyl Alcohol and Nemagon; Union Carbide Chemicals—Mylone.

The rates of application per 49 square feet (including 1½ feet of alley around each plot) were Allyl Alcohol 7/8 pint; Mylone (85W) ½ pound; Vapam (32-

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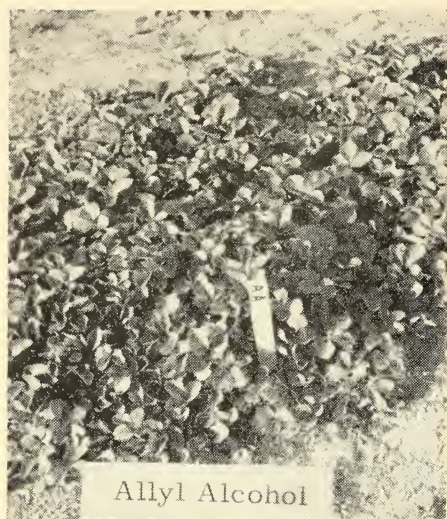


Figure 1. Preplant soil fumigation with Allyl Alcohol, Mylone and Vapam resulted in excellent plant growth after one season. Plots treated with Nemagon and untreated check plots had few runner plants formed.

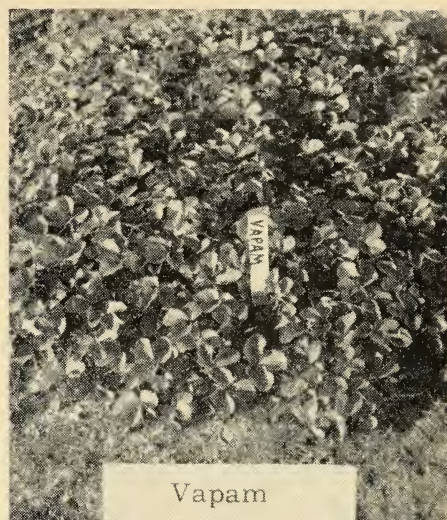


Weed counts were made during the first summer and plant counts were made at the end of the growing season. Total yields were recorded for two seasons.

At Holly Springs the fumigation site was selected in an old strawberry field on the Experiment Station in which many plants had died during the summer droughts the preceding summer. The plots were 6 x 6 with 4-foot alleys between all plots. Surface water drainage from adjacent land was diverted around the test area and the alleys were about 3 inches lower than the plots. All drains from the plots were kept open to prevent flooding of plots.

.7%) 1½ pints; and Nemagon (10% granules) ½ pound. Each material was diluted in 3 gallons of water and applied to the plot and then "watered in" with 7 gallons of water. Within 24 hours after the treatments were applied a rainfall of 2½ inches was recorded.

Mylone was applied as a 50D formulation from W. H. Barber Co. at the rate of .85 pounds actual per 10 x 10 foot area (included 2 feet of alley around plot). The chemical was "watered in" with 10 gallons of water in November 1959. The treatments were arranged in four randomized replicates. Sixteen virus-free



plants, from a commercial nursery, were spaced 18" apart in each plot in March 1960. The number of plants per plot and total yield of fruit was recorded annually.

### Results

At State College the first evident result was the effectiveness of Vapam, Mylone and Allyl Alcohol for weed control during the winter and spring, extending into early summer, see Table 1. In June when weed counts were made there were very few weeds in these plots (4 to 6 per square foot) whereas, the check and Nemagon plots averaged 70 and 88 weeds per square foot. The few weeds which did grow in the Vapam, Mylone and Allyl Alcohol plots were large and therefore, the total weight was large. These weeds could have been easily controlled by hand weeding in April or May.

The second effect of the broad spectrum fumigants was marked increase in the number of runner plants which were formed and rooted, Figure 1. The Vapam, Mylone and Allyl Alcohol plots had three times as many plants at the end of the first growing season as the check or Nemagon plots, Table 2.

Table 1. The influence of application of soil fumigants before setting strawberries on subsequent weed growth. Plants set in March and weeds were recorded in June 1959 at State College, Mississippi.

Soil treatment	No. weeds per square foot	Pounds weeds per plot
None	70	6.1
Allyl Alcohol	4	3.8
Mylone	6	8.2
Nemagon	88	6.7
Vapam	5	5.2

Table 2. The influence of an application of soil fumigants before setting on subsequent growth of strawberry plants of the Blakemore variety at State College, Mississippi.

Soil treated	Number of plants per plot one year after setting
None	31
Allyl Alcohol	122
Mylone	139
Nemagon	37
Vapam	116

Berries were harvested 2 or 3 times per week during the fruiting seasons of 1960 and 1961. Total yields per plot were recorded in grams and are shown in Table 3. Each year the yields from the Vapam, Mylone and Allyl Alcohol plots

were significantly greater than from the check or Nemagon plots.

At **Holly Springs** the first results observed was the effectiveness of Mylone in controlling weeds through the spring following the application of the chemical in the fall.

Four varieties of strawberries were included in this test with a known history of excellent to poor stands of plants at the North Mississippi Branch Experiment Station where these test were conducted. Earlidawn had previously given the poorest record of runner plant formation and survival. Soil borne pests were suspected as being the limiting factor for good survival and growth for this variety at Holly Springs.

**Table 3.** The influence of an application of soil fumigants before setting on the yield of Blakemore strawberry plants at State College, Mississippi. Plants set in March 1959.

Soil Treatment	Yields in grams per plot		
	1960	1961	Average
None	1674	3216	2445
Allyl Alcohol	3224	3511	3367
Mylone	3942	3769	3855
Nemagon	1844	2472	2158
Vapam	3948	3710	3829

Plant counts were made in each plot during the dormant season for each year, Table 4. Each year the Earlidawn plots which were treated with Mylone as a preplant treatment had about twice as many plants as Earlidawn plots which received no soil treatment. The most pronounced effects on plant stands were evident after the third growing season. The Mylone treated plots of all varieties had significantly more plants than the plots which received no soil treatment. The soil fumigation treatment had a long lasting effect on plant survival in all varieties. However, it was most pronounced for the variety Earlidawn, which ordinarily is a weak plant producer.

The berries were harvested 2 to 3 times each week during each fruiting season. Total yields were recorded in grams per plot and the summary is shown in Table 5. The largest increase in yield was shown by the Earlidawn variety in Mylone plots. The average yield for three years was more than twice that for the check plots of this variety. During the third fruiting season the yields from Mylone treated plots of all varieties were significantly larger than the check plots.

**Table 4.** Influence of soil fumigation before setting the plants on number of plants per plot of four varieties of strawberries at Holly Springs, Mississippi.

Variety	Soil Treatment	Number of plants per plot			Average	
		1961	1962	1963		
Blakemore	None	90	136	94	107	
Blakemore	Mylone	40	80	184	101	
Earlidawn	None	26	68	58	51	
Earlidawn	Mylone	47	107	172	109	
Massey	None	39	102	196	112	
Massey	Mylone	34	108	260	134	
Pocahontas	None	67	154	150	124	
Pocahontas	Mylone	52	137	214	134	
<b>Summary by varieties</b>						
Blakemore	.....	65	108	139	104	
Earlidawn	.....	37	87	115	80	
Massey	.....	36	105	228	123	
Pocahontas	.....	59	145	182	129	
<b>Summary by treatment</b>						
	None	.....	56	115	98	
	Mylone	.....	43	108	207	119

Strawberry yields are often closely related to the number of plants in the plot or bed. This correlation is upset however, when the number of plants per square foot becomes so large that plant competition for nutrients and moisture is severe.

Each fruiting season the variety Pocahontas produced more berries than any other variety. The three-year average yield for all Pocahontas plots was twice as great as for all Earlidawn. However, the average yield for 3 years for Earli-

dawn from all Mylone plots was about two thirds as large as Pocahontas yields from Mylone plots.

The berries on plants in the Mylone treated plots ripened later than berries on plants in check plots. Table 6, Earlidawn is the earliest variety to ripen followed by Blakemore. Massey and Pocahontas produced only about one third of their fruits during the first half of the harvest season and are normally classed as late ripening varieties.

Table 5. Influence of soil fumigation before setting the plants on subsequent yields of four varieties of strawberries at Holly Springs, Mississippi.

Variety	Soil treatment	Grams of fruit per plot			Average
		1961	1962	1963	
Blakemore	Check	3325	1452	1368	2048
Blakemore	Mylone	1647	1529	3434	2203
Earlidawn	Check	1640	1762	1616	1672
Earlidawn	Mylone	2888	3259	4069	3405
Massey	Check	940	888	1962	1263
Massey	Mylone	1046	834	2344	1408
Pocahontas	Check	6268	3576	4970	4938
Pocahontas	Mylone	6001	3092	6403	5165
Summary by varieties					
Blakemore	-----	2486	1491	2401	2126
Earlidawn	-----	2264	2493	2843	2533
Massey	-----	993	861	2153	1336
Pocahontas	-----	6135	3334	5688	5052
Summary by treatments					
	Check	3043	1910	2480	2475
	Mylone	2895	2178	4062	3045

Table 6. Influence of soil fumigation before setting the plants on earliness of ripening of fruits of four varieties of strawberries at Holly Springs, Mississippi.

Variety	Soil treatment	Percent of yield in first half of season			Average
		1961	1962	1963	
Blakemore	None	71	64	66	67
Blakemore	Mylone	61	51	56	56
Earlidawn	None	81	72	71	75
Earlidawn	Mylone	69	71	64	68
Massey	None	38	42	25	35
Massey	Mylone	17	43	28	29
Pocahontas	None	46	37	36	40
Pocahontas	Mylone	28	40	25	31
Summary by varieties					
Blakemore	-----	66	57	61	61
Earlidawn	-----	75	71	71	72
Massey	-----	28	42	27	32
Pocahontas	-----	37	33	30	33
Summary by treatment					
	None	59	54	51	55
	Mylone	44	48	43	45