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The effect of certain chemicals on the development of suckers in fire-cured tobacco

Joseph N. Matthews

To the Graduate Council:

I am submitting herewith a thesis written by Joseph N. Matthews entitled "The effect of certain chemicals on the development of suckers in fire-cured tobacco." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agronomy.

Horace C. Smith Jr., Major Professor

We have read this thesis and recommend its acceptance:

L. N. Skold, R. G. Spitze

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

May 26, 1958

To the Graduate Council:

I am submitting herewith a thesis written by Joseph N. Matthews entitled "The Effect of Certain Chemicals on the Development of Suckers in Fire-cured Tobacco." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agronomy.

Horace C Smith Jr.
Major Professor

We have read this thesis
and recommend its acceptance:

R L Hytze

Lawrence N Skold

Accepted for the Council

Dale Nantling
Dean of the Graduate School

THE EFFECT OF CERTAIN CHEMICALS ON THE DEVELOPMENT OF SUCKERS IN FIRE-CURED TOBACCO

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

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by

Joseph N. Matthews

June 1958

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Joseph N. Matthews

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CHAPTER I

INTRODUCTION

In the production of fire-cured tobacco it is necessary to top the plants, leaving twelve to fourteen leaves, in order to produce tobacco of the length, width and body that is in demand. Following removal of the apical bud and upper leaves, lateral branches or suckers develop in axils of the remaining leaves. If these are not removed when small, the leaves of the tobacco are stunted. Usually two suckers develop per leaf axil and because of their irregular emergence, it is usually necessary to sucker tobacco at least three times. This work comes at a time of the year when there is the greatest demand for farm labor.

If some satisfactory method for suppressing growth of suckers could be developed, it would save the farmers of Tennessee both time and money. In 1957 there were 16,900 acres of types 22 and 23, fire-cured tobacco, grown on 8,578 Tennessee farms. Since the average acreage per farm of fire-cured tobacco is larger than with other types of tobacco grown in Tennessee, the labor problem is more acute and there is a great demand for some type of sucker control. Many farmers in this area are now using some form of chemical sucker control although the effect on tobacco is not well understood and varying degrees of sucker control and damage to plants have resulted.

This study was designed to determine the effect of certain chemicals on the development of suckers and the influence of the treatments on yield, value and leaf quality of the tobacco produced and the extent of damage to the plant caused by these treatments.

CHAPTER II

REVIEW OF LITERATURE

Experimental work relating to chemical control of tobacco suckers has been done largely within the past ten years.

Early workers concerned themselves with trying to find a chemical compound that would regulate sucker growth. It is known that terminal dominance is due to growth regulators within the plant. Anderson and Hardesty (1)[1] started using hormone-like substances in North Carolina in 1947, trying to reproduce the terminal dominance effect of these growth regulators on suckers after the tobacco was topped. They had varying degrees of success in controlling suckers, but many of the compounds caused severe damage to the plant. The chemical compounds were dissolved in lanolin and mineral oil for placement on the tobacco. In order to have conditions as uniform as possible, they treated the check plot with mineral oil in 1948, expecting no control of suckers. However, where the mineral oil was allowed to run down the stalk, there was no sucker growth. In 1949, mineral oil alone was tested more thoroughly and was found to control suckers. The work with the hormone-like substances was discontinued. The killing action of oils seems to be due to the unsaturated compounds that react with protoplasm and kill the plant cells.

Steinberg (18, 19) used indolebutyric acid, naphthylacetic acid,

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[1]Number in parenthesis refers to literature cited.

2-4 dichlorophenoxyacetic acid and their derivatives. Naphthylacetic acid or its derivatives gave the best sucker control but more abnormal growth was associated with this material. The other materials did not give as high a degree of sucker control and also caused abnormal growth. Steinberg's work and the later work by Calvert (3), Shaw (17), Thomson (20), and Clark (4) has shown that these substances have little promise for use in sucker control.

Several other substances have been evaluated. Pal and Hadam (12), for example, had considerable success with petroleum jelly, but the difficulty of application was a limiting factor.

Maleic hydrazide is a material that has shown considerable promise. Several writers (2, 3, 4, 6, 8, 9, 13, 14, 15, 17, 20, 21) have reported success in controlling suckers with this material. Naylor and Davis (10) did an extensive study to determine whether maleic hydrazide is a hormone-like substance or a growth inhibitor. They stated that hormone-like substances at excessive rates may stimulate growth of some part of the plant while a growth inhibitor does not usually stimulate growth at any concentration. They experimented with Turkish tobacco and ten other crops using six different concentrations of maleic hydrazide. The results were similar for all eleven species. Hormone-like substances would not be expected to give similar results for all species. They reported cessation of activity of the terminal meristem, cessation in elongation of the internodal region, an increase in the diameter of the stem, and no stimulation of growth. Since none of these is typical of the response to a hormone-like substance, they concluded that maleic hydrazide should, for the time being at least, be considered a growth inhibitor.

Bennett, Hawks and Nau (2) described the action of maleic hydrazide as being translocated in the plant to the active growing points where it inhibits further cell division. Darlington and McLeish (5) found this action to be directed at the mitotic cells and studied the action of maleic hydrazide on mitosis. They found recordable frequencies of breakage of chromosomes during mitosis. The degree of inhibition of suckers, therefore, would appear to be due to a reduction in cell division.

In recent years most of the experimental work has been limited to the evaluation of mineral oil, emulsified oil and maleic hydrazide.

Experimental work (1, 8, 9, 11, 16, 17, 22, 23) indicated that considerable damage from soft rot, leaf drop, a condition similar to soreshin and stem girdling at the ground level could be expected from using mineral oil.

Scofield (23), who took over the sucker control work from Anderson in North Carolina in 1951, compared straight mineral oil with oil emulsion. It was found that the damage from mineral oil could be reduced considerably by using oil emulsion.

Wilson, Woltz, and Scofield (23) and Thomson (20) reported successful sucker control on flue-cured tobacco with mineral oil or oil emulsion. Nichols (11) and Shaw (17) reported similar results on burley tobacco. Sears and Mathews (16) reported that the application of 1.0 to 1.5 c.c. of heavy mineral oil per plant controlled suckers to the extent that the labor of suckering dark tobacco was reduced by 60 to 65 per cent. Clark (4) working with flue-cured tobacco and the Kentucky Agricultural Experiment Station (7, 8) working with burley and dark air-cured tobacco reported inconsistent results with oil emulsion. Workers at Kentucky (7) reported control of suckers on 43 per cent of plants treated with seven milliliters of oil emulsion per plant and 24 per cent at five millileters per plant.

Another factor concerning workers has been the effect of oil on yield and quality. The Kentucky Experiment Station (6, 8), reported no significant difference in yield and quality on treated dark air-cured tobacco compared to untreated. Mathews and Matthews (9) reported an increase in yield and value per acre of flue-cured tobacco from oil treatments. Nichols (11) reported a significant increase in yield per acre of burley tobacco in 1951 and 1952 resulting from the use of oil. There was a significant increase in crop index (approximately equivalent to acre value), and price per one hundred pounds in 1951 but no significant difference in 1952. Shaw's (17) experiments on burley tobacco were not designed to obtain detailed data on yield and quality. However, preliminary tests indicated small variations between treated and untreated plots.

Nichols (11) stated that undesirable increases in nicotine and total nitrogen in burley leaves were obtained with oil emulsion. Shaw (17) reported no significant differences from the use of oil emulsion on burley in 1949, but a considerably lower nicotine content in the leaves of the treated plants in 1950. The United States Department of

Agriculture (22) reported changes in chemical content of the leaves of plants treated with oil emulsion. The upper leaves of primed tobacco grown on sandy soils showed an increase in sugar content while the filling capacity for cigarettes was decreased. Stalk cut tobacco grown on fine textured soils and treated with oil emulsion contained more total nitrogen and nicotine than untreated tobacco.

The Kentucky Agricultural Experiment Station (6) reported no appreciable difference in nicotine content due to treatment with maleic hydrazide. Tibbitts and Wedin (21) found an increase of 7 to 10 per cent in total nitrogen content when flue-cured tobacco was treated with maleic hydrazide. However, they quoted research where this same increase had been found in flue-cured tobacco that was hand suckered more than once.

Comparisons of maleic hydrazide with mineral oil and emulsified oil have been made by the Kentucky Experiment Station (6, 7, 8). Dark air-cured tobacco treated with 1.5 c.c. of 30 per cent maleic hydrazide per plant produced only one-fifth as many suckers as did untreated tobacco. This treatment was significantly better than treatments with mineral oil and emulsified oil. With burley tobacco, 74 per cent of the plants treated at the rate of 5.25 quarts of maleic hydrazide per acre were free of suckers. In the same test, treatment at the rate of 3.5 quarts per acre of maleic hydrazide resulted in 66 per cent of the plants free from suckers; 7 milliliters of oil emulsion per plant, 43 per cent; 5 milliliters of oil emulsion per plant, 24 per cent. Mathews and Matthews (9) obtained the following results on flue-cured tobacco:

one-half teaspoon of mineral oil per plant, 67.8 per cent sucker control; three-fourths teaspoon of emulsified oil, 58.7 per cent sucker control, and three quarts of maleic hydrazide per acre, 78.2 per cent sucker control. Thomson (20) reported that one pound and fifteen ounces of suckers were produced on plots of 30 plants, each plant receiving six milliliters of mineral oil. When ten milliliters of 1 per cent maleic hydrazide was used per plant he obtained only nine ounces of suckers per plot of 30 plants. The hand suckered plot of equal size produced eleven pounds and two ounces of suckers.

Quality and yield of tobacco treated with maleic hydrazide varies. Many of the writers (6, 7, 8, 13, 17, 21) report no significant differences between treated and untreated plots when maleic hydrazide was applied at various rates to plants of fire-cured tobacco just after topping. Mathews and Matthews (9) reported a significant increase in yield and quality of treated flue-cured tobacco.

Bennett, Hawks and Nau (3) and Clark (4) reported stunting of the top leaves of the tobacco treated with maleic hydrazide. It was stated that this could be due to applications made before all the cells in the leaf had been formed. Bennett, Hawks and Nau (2) and Shaw (17) cited premature yellowing of the leaves as a disadvantage of maleic hydrazide. Other writers (4, 9, 14) described this as a chlorosis, bleached, or an appearance similar to the physiological disease called frenching. Clark (4) considered the lack of uniform growth of tobacco as a disadvantage of the use of maleic hydrazide, since all of the tobacco may not reach the proper size for treatment at the same time.

CHAPTER III

METHODS AND PROCEDURES

In this study maleic hydrazide, mineral oil and emulsified oil at various rates were applied to fire-cured tobacco grown on the Highland Rim Experiment Station, Springfield, Tennessee. In the tables these materials will be listed as MH30, M.O. and E.O. respectively. Maleic hydrazide is the commonly used name for the diethanolamine salt of 6-hydroxy-(2H)-pyridazinone. It is slightly soluble in water and about the equivalent of acetic acid in acidity. The formulation used in this experiment has three pounds of the active ingredient per gallon and contains a wetting agent.

The mineral oil used was a heavy, white grade. The emulsified oil is a heavy, white mineral oil with an emulsifying agent added to it.

The rates of maleic hydrazide were 150, 200, 250, and 500 mg per plant. One treatment of 200 mg per plant was applied in a split application. Emulsified oil and mineral oil were used at the rates of one-fourth, one-half and one teaspoon per plant. For comparison with usual farm practice, the plants in one group of plots were not treated with any chemical after topping.

The experiment was laid out in a randomized block design with four replications. Each one-fiftieth of an acre plot consisted of four rows, 42 inches apart with 20 plants placed about three feet apart in the row.

The experimental area was located on a Dickson silt loam. Chemical analysis of soil samples showed a pH of 5.0, 20 pounds of available phosphate and 205 pounds of available potash per acre. Ten tons of manure and 1125 pounds of 5-10-15 fertilizer were broadcast per acre before the tobacco was set. Two hundred fifty pounds of ammonium nitrate was applied as a sidedressing three weeks after the tobacco was set.

The plants were topped at a height of 12 to 14 leaves. To avoid the possibility of stunting the top leaves with maleic hydrazide, the plants were not topped until the leaf that would be the upper after topping was at least four inches wide. Due to the irregular growth of the tobacco it was necessary to top the tobacco at three different times to attain this size of the top leaves at the time of treatment. The chemicals were applied immediately after topping, except that in one treatment 100 mg of maleic hydrazide per plant was applied immediately after topping with a second application of 100 mg per plant one hour later. The dates of the different toppings and treatments were July 25, July 29, and August 2, 1957.

The maleic hydrazide was applied with a sprayer using a regulated pressure of 20 pounds per square inch. The maleic hydrazide used contained three pounds of active material per gallon or 100 mg per .28 c.c. The maleic hydrazide required for all the plants in each treatment was mixed with one gallon of water. The sprayer was regulated to apply 10 c.c. of this mixture to each plant in two seconds. The mixture was applied to the top leaves of the plant with the operator spraying from one side of the row. The appropriate amount of mineral oil was applied to the tip of the stem after topping. Equal amounts of emulsified oil and water were mixed and the appropriate amount of this mixture was applied in the same manner as with mineral oil.

All of the suckers produced on the plants in each plot were pulled and counted when the suckers on the no chemical plots were approximately six inches long. This number was divided by the number of plants per plot to determine the number of suckers per plant. The tobacco was suckered three times, August 8, August 19, and August 29, 1957.

The two center rows of each plot were harvested to determine yield, quality and value per acre. The tobacco was cured in the conventional manner and graded into farm grades. The farm grades were placed in federal grades by a licensed federal tobacco grader. The yield of tobacco per plot of each treatment was calculated by adding the pounds of tobacco in each grade. The value per plot was calculated by multiplying the pounds of each grade by the average price of that grade and adding the values for all grades. Average prices used were for the period 1946 through 1952 and for the period 1952 through 1956. The yield and value per acre were computed by multiplying the plot yields and values by 100 since the harvested portion of each plot was .01 of an acre. The yield and value for each treatment are given as averages of four replications.

Field examinations at each time of suckering were made to determine the extent of damage to plants from the materials applied.

Analyses were made of the leaves of selected treatments to determine the effect of maleic hydrazide, mineral oil and emulsified oil on the chemical content of leaves. Samples of leaves in each grade were taken from two replications of the plots receiving the highest rate of maleic hydrazide, emulsified oil, mineral oil, and from the no chemical treatment. These samples were analyzed for nicotine and total nitrogen in the United States Department of Agriculture laboratory at the University of Tennessee.

CHAPTER IV

RESULTS

Sucker Control

The data for sucker control are presented in Table I and Figure 1. All of the emulsified oil, mineral oil and maleic hydrazide treatments caused a highly significant decrease in the number of suckers per plant in comparison with the no chemical check. Each increase in the amount of maleic hydrazide applied per plant gave a highly significant decrease in the number of suckers per plant compared to the next lower rate. There was no significant difference between 200 mg per plant applied immediately after topping and 200 mg per plant applied in a split application. There was no significant difference between 200 mg per plant applied in a split application, and 250 mg applied immediately after topping.

There were no significant differences among the rates of application of emulsified oil.

One teaspoon of mineral oil per plant resulted in significantly fewer suckers per plant than one-fourth teaspoon, but not significantly different from one-half teaspoon per plant.

In comparing the different treatments used in the experiment, 250 mg of maleic hydrazide per plant, 500 mg of maleic hydrazide per plant, and 200 mg of maleic hydrazide per plant in a split application, each gave a highly significant decrease in the number of suckers per plant in

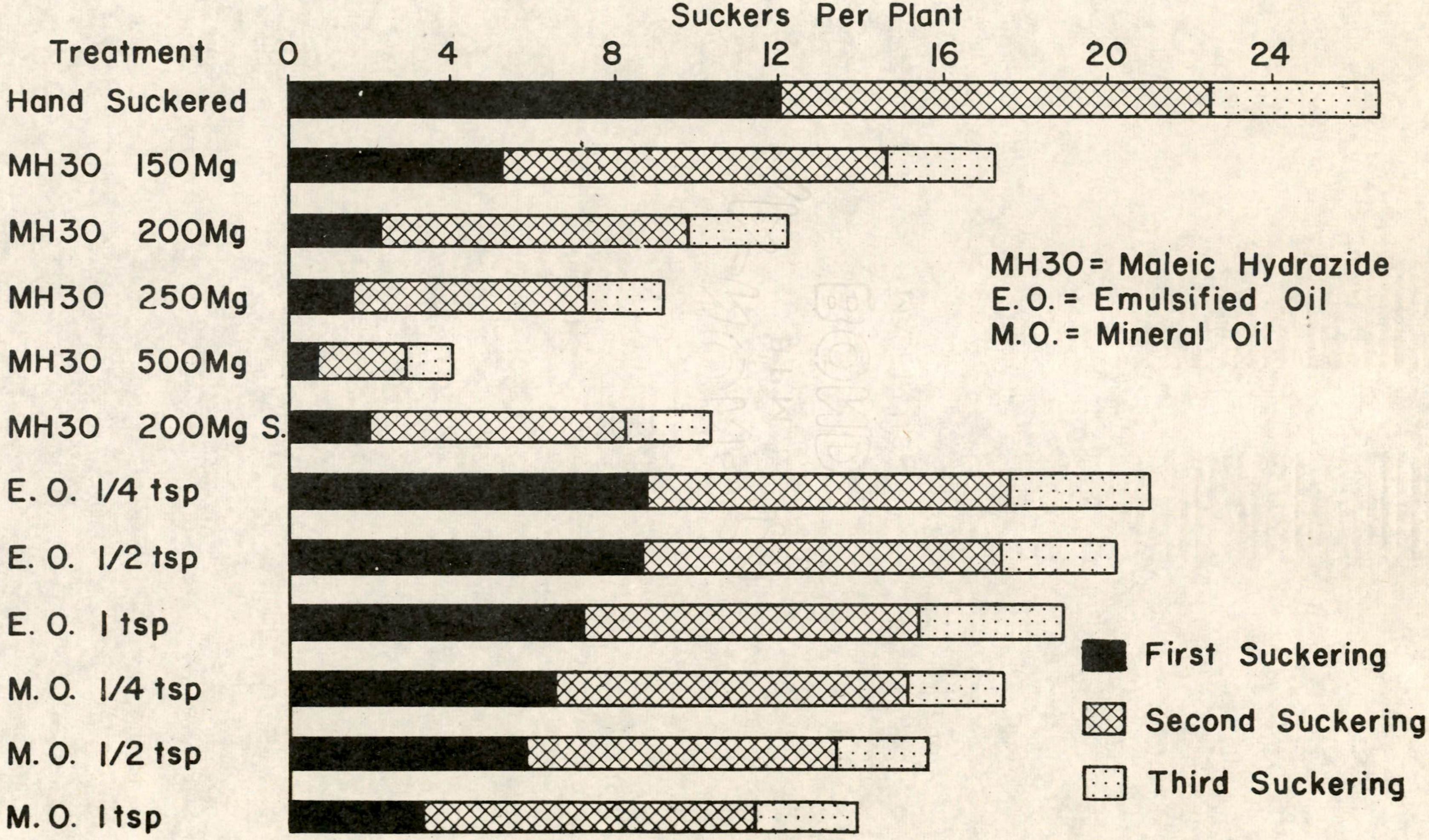
TABLE I

NUMBER OF SUCKERS PER PLANT AND PER CENT SUCKER CONTROL WITH VARIOUS SUCKER CONTROL TREATMENTS, SPRINGFIELD, TENNESSEE, 1957

Treatment	Rate of Treatment per Plant	Suckers per Plant	Per cent Control
No chemical	---	26.6	0
E. O.	1/4 tsp.	20.9	21.4
E. O.	1/2 tsp.	20.1	24.4
E. O.	1 tsp.	18.8	29.3
M. O.	1/4 tsp.	17.4	34.6
M. O.	1/2 tsp.	15.5	41.7
M. O.	1 tsp.	13.8	48.1
MH30	150 mg	17.2	35.3
MH30	200 mg	12.2	54.1
MH30	200 mg*	10.3	61.3
MH30	250 mg	9.1	65.8
MH30	500 mg	4.0	85.0
L.S.D. (.05)		2.1	
L.S.D. (.01)		2.8	
C.V. %		9.4	

*Split application. For this treatment, 100 mg was applied after topping and 100 mg one hour later.

Figure I. Suckers Per Plant, Total and Number Per Suckering, Fire – Cured Tobacco, 1957.



comparison with each of the emulsified oil and mineral oil treatments. The treatment of 200 mg of maleic hydrazide per plant decreased the number of suckers per plant significantly more than any oil treatment except one teaspoon of mineral oil per plant.

In comparing the two types of oil, one-half teaspoon of mineral oil and one teaspoon of mineral oil per plant gave better sucker control than any emulsified oil treatment. One-fourth teaspoon mineral oil per plant was more efficient than either one-fourth or one-half teaspoon emulsified oil per plant. There was no significant difference between one-fourth teaspoon of mineral oil per plant and one teaspoon emulsified oil per plant.

The number of suckers removed at each suckering (Table II and Figure 1) further emphasizes the effectiveness of the higher rates of maleic hydrazide. This is especially true of the first suckering. The number of suckers per plant removed at the second suckering increased but this material was still better than the oils. There were no significant differences among any of the treatments at the third suckering. The high rates of maleic hydrazide still resulted in the highest percentage sucker control. It should be noted, however, that there were few suckers at this time even on the plants that received no chemical treatment.

TABLE II

NUMBER OF SUCKERS AND PER CENT SUCKER CONTROL FOR EACH SUCKERING OF FIRE-CURED TOBACCO WITH VARIOUS SUCKER CONTROL TREATMENTS, SPRINGFIELD, TENNESSEE, 1957

Treatment	Rate of Treatment per Plant	First Suckering		Second Suckering		Third Suckering	
		Suckers Per Plant	Per cent Control	Suckers Per Plant	Per cent Control	Suckers Per Plant	Per cent Control
No chemical	----	12.0	0	10.4	0	4.2	0
E. O.	1/4 tsp.	9.1	24.2	8.8	15.4	3.4	19.0
E. O.	1/2 tsp.	8.5	29.2	8.7	16.3	2.8	33.3
E. O.	1 tsp.	7.0	41.7	8.2	21.2	3.5	16.7
M. O.	1/4 tsp.	6.1	49.2	8.6	17.3	2.4	42.9
M. O.	1/2 tsp.	5.6	53.3	7.5	27.9	2.3	45.2
M. O.	1 tsp.	3.3	72.5	7.9	24.0	2.6	38.1
MH30	150 mg	5.0	58.3	9.4	9.6	2.6	38.1
MH30	200 mg	2.3	80.8	7.3	29.8	2.6	38.1
MH30	200 mg*	2.0	83.3	6.2	40.4	2.1	50.0
MH30	250 mg	1.6	86.7	5.6	46.2	1.9	54.8
MH30	500 mg	.7	94.2	2.2	78.8	1.1	73.8
L.S.D. (.05)		1.26		1.12		N.S.	
L.S.D. (.01)		1.69		1.49			
C.V. %		16.6		10.2		1.2	

*Split application. For this treatment, 100 mg was applied after topping and 100 mg one hour later.

Yield

The relative yields are summarized in Table III. There were no significant differences in yield per acre among any of the treatments. However, the no chemical treatment yielded 250 pounds less per acre than the average of all other treatments. The average yield of the maleic hydrazide treatments was higher than the oil treatments.

Quality

A statistical analysis of the quality data was not attempted in this experiment. The best indication of quality is found in the value per 100 pounds (Table III). An examination of these data shows that there was a range in value per 100 pounds for the period of 1946 through 1952 from $32.24 to $35.94, with an average for all treatments of $34.57. For the period of 1952-1956, the range in value per 100 pounds among treatments was from $38.76 to $41.74, the average being $40.47. These small variations would indicate that there were no appreciable differences in quality.

To further evaluate quality, the percentage of the tobacco in each of the different leaf groups from each treatment was calculated (Table IV). Some of the treatments gave a high percentage of thin leaf and a low percentage of heavy leaf and wrapper. The reason for this is unknown.

TABLE III

YIELD PER ACRE, RELATIVE VALUE PER 100 POUNDS AND RELATIVE VALUE PER ACRE OF FIRE-CURED TOBACCO WITH VARIOUS SUCKER CONTROL TREATMENTS, SPRINGFIELD, TENNESSEE, 1957

Treatment	Rate of Treatment per Plant	Yield per Acre Pounds	Average Price 1946-1952		Average Price 1952-1956	
			Value per 100 lbs.	Value per Acre	Value per 100 lbs.	Value per Acre
No chemical	---	2175	$34.12	$742	$40.05	$870
MH30	150 mg	2436	34.40	838	40.45	984
MH30	200 mg	2490	35.94	895	41.69	1038
MH30	250 mg	2460	35.28	868	40.79	1004
MH30	500 mg	2450	33.31	816	39.54	969
MH30	200 mg*	2479	35.34	876	41.08	1018
E. O.	1/4 tsp.	2321	35.20	817	41.12	956
E. O.	1/2 tsp.	2370	32.24	764	38.76	919
E. O.	1 tsp.	2475	35.39	876	41.09	1017
M. O.	1/4 tsp.	2502	34.49	863	39.15	980
M. O.	1/2 tsp.	2421	33.62	814	40.13	969
M. O.	1 tsp.	2275	35.38	805	41.74	950
Average		2404	34.57	813	40.47	973
L.S.D. (.05)		N.S.		N.S.		N.S.
C.V. %		4.6		11.8		10.9

*Split application. For this treatment, 100 mg was applied after topping and 100 mg one hour later.

TABLE IV

LEAF GROUP DISTRIBUTION OF FIRE-CURED TOBACCO WITH VARIOUS SUCKER CONTROL TREATMENTS, SPRINGFIELD, TENNESSEE, 1957

Treatment	Rate of Treatment per Plant	Leaf Groups			
		Wrapper	Heavy Leaf	Thin Leaf	Lugs
		Per cent	Per cent	Per cent	Per cent
No chemical	---	13.1	-	71.9	15.0
MH30	150 mg	1.9	-	82.8	15.3
MH30	200 mg	21.3	12.9	38.0	27.8
MH30	250 mg	33.9	-	49.8	16.3
MH30	500 mg	5.4	19.1	56.3	19.2
MH30	200 mg*	27.5	5.5	42.9	24.1
E. O.	1/4 tsp.	11.4	14.7	60.7	13.2
E. O.	1/2 tsp.	11.4	-	74.3	14.3
E. O.	1 tsp.	33.1	-	48.5	18.4
M. O.	1/4 tsp.	28.2	-	57.0	14.8
M. O.	1/2 tsp.	9.7	0.5	74.7	15.1
M. O.	1 tsp.	20.9	15.6	43.0	20.5

*Split application. For this treatment, 100 mg was applied after topping and 100 mg one hour later.

Value per Acre

The data presented in Table III indicate that there were no significant differences in value per acre among the twelve treatments. This value is a reflection of both yield and quality. The no chemical treatment returned the least value per acre of any of the treatments.

Damage to Plants

There was very little damage to the plants from the maleic hydrazide or oil treatments. One plant in one plot treated with one teaspoon of mineral oil developed soft rot. Two plants in a different replication of the same treatment were girdled at the ground level. These plants wilted and died. These three plants were the only damaged ones in the mineral oil and emulsified oil treatments.

All of the maleic hydrazide treated plots developed a chlorotic appearance in the top leaves. The intensity of this condition increased as the amount of maleic hydrazide applied per plant increased. The leaves also appeared to be narrower and shorter than those receiving no chemical treatment. These conditions did not make any apparent difference in the final quality of leaf as indicated by the federal grades.

Chemical Analysis

The nicotine and total nitrogen content are given in Table V. The nicotine content varied from 5.02 per cent for the leaves receiving

TABLE V

NICOTINE AND TOTAL NITROGEN CONTENT OF FIRE-CURED TOBACCO WITH VARIOUS SUCKER CONTROL TREATMENTS, SPRINGFIELD, TENNESSEE, 1957

Treatment	Number of Grades Sampled	Average of Grades Sampled: Nicotine	Average of Grades Sampled: Total Nitrogen
		Per cent	Per cent
No chemical	9	5.68	4.71
MH30 500 mg per plant	10	5.02	4.66
E.O. 1 tsp. per plant	9	5.10	4.69
M.O. 1 tsp. per plant	10	5.31	4.78
Average		5.22	4.71

500 mg of maleic hydrazide per plant, to 5.68 per cent for the no chemical treatment. Other treatments were intermediate. The variation in total nitrogen content was very small, 4.66 per cent for maleic hydrazide treatment to 4.78 per cent for one teaspoon of mineral oil treatment.

CHAPTER V

DISCUSSION

Maleic hydrazide was the most effective material for sucker control, and the highest rate used, 500 mg per plant, was more effective than lower rates. In this treatment, the suckers were small and abnormally stunted. It is likely that one suckering just previous to harvest would have been enough with this treatment. In usual farm practice, the first suckering of all the maleic hydrazide treatments probably would have been omitted. Plants treated with 500 mg of maleic hydrazide per plant showed more of the chlorotic appearance of leaves than those receiving any other treatment. Even though this effect was not apparent in the cured leaf, it is likely to be an important factor in influencing the widespread use of this material.

Another disadvantage of maleic hydrazide is the necessity for the top leaves to be at least four inches wide before treatment. In this experiment it was necessary to top the tobacco at three different times. A thorough understanding of the effect on leaf size, when applied too early, is necessary before this material should be used.

The large amount of rainfall (Appendix A) soon after topping caused early development of suckers. This is indicated by the low number of suckers at the third suckering. The favorable growing season for suckers probably accounts for the poor sucker control of some of the treatments.

Better methods of applying these materials are desirable. The calibration of the sprayer used for applying maleic hydrazide was difficult, and very careful timing was necessary to apply the desired amount per plant. Before general use of this material is recommended, careful study should be devoted to the method of application. A sprayer with a constant pressure is a necessity.

From observations made during this experiment, it appeared that if mineral oil or emulsified oil got into each leaf axil, suckers would not develop. The application of oil to the top of the stem of burley and flue-cured tobacco after topping has usually resulted in a uniform flow down the stem with some oil lodging in each axil. The angle between the leaf and stem of fire-cured tobacco is greater than in the above types of tobacco. This may partially account for the lack of uniformity in the flow of oil down the stem to the low axils in this experiment. Since most of the tobacco in the oil treated plots had good sucker control in the top three or four leaf axils and poor control near the ground level, the top axils may have intercepted most of the oil. This would indicate the advisability of evaluating heavier rates of the oils. While the oils gave relatively poor sucker control, the decrease in sucker numbers as the rate of oil increased would indicate the need for evaluating heavier rates.

Damage from soft rot and leaf drop in burley and flue-cured tobacco observed by many workers during humid years was not present in this experiment. This could indicate that fire-cured tobacco is more resistant to the oils than other tobacco types. The absence of stem girdling at the ground level was probably due to failure of the oils to reach this level. As the rates of oils are increased, this undoubtedly would be a greater problem.

There were no significant differences among treatments in yield per acre or in value per acre at the 5 per cent level. However, in both cases the no chemical treatment ranked the lowest of any of the treatments. If the plants are not damaged from oil or maleic hydrazide and produce fewer suckers, one might expect higher yields from the treated tobacco because of more water and nutrients available for leaf production.

CHAPTER VI

SUMMARY

Maleic hydrazide, emulsified oil, and mineral oil were applied to fire-cured tobacco at various rates following topping to compare their influence on sucker development, yield per acre, quality, value per acre, damage to plant, nicotine content and total nitrogen content. The results on sucker control were obtained by hand suckering the no chemical treatment and by pulling the suckers that were not controlled on the treated plants each time the no chemical treatment was suckered.

The results were as follows:

1. Five hundred milligrams of maleic hydrazide per plant gave the best sucker control.

2. Maleic hydrazide at all rates, except the lowest, 150 mg per plant, gave better sucker control than mineral oil or emulsified oil at any rate. Maleic hydrazide at 150 mg per plant was slightly better than emulsified oil at all rates and mineral oil at one-fourth teaspoon.

3. Mineral oil was more effective in decreasing the number of suckers per plant than emulsified oil.

4. Sucker control was more effective as the rate of each material was increased.

5. The effectiveness of the materials was most pronounced early in the season as indicated by the sucker control at the first suckering. The sucker control was not as effective at the second suckering, and there were very few suckers on any of the plots at the third suckering.

6. There were no significant differences in yield per acre among any of the treatments. However, tobacco receiving no chemical treatment yielded considerably less than other treatments.

7. There were no appreciable differences in the quality due to treatment.

8. There were no significant differences in value per acre among any of the treatments. Tobacco receiving no chemical treatment returned the least value per acre.

9. There was no appreciable damage to the plants in the field from the use of oils and maleic hydrazide.

10. There was no appreciable difference in the nicotine content or the total nitrogen content of the leaves among the treatments evaluated.

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APPENDIX

APPENDIX

APPENDIX A

INCHES OF DAILY RAINFALL RECEIVED AT THE HIGHLAND RIM EXPERIMENT STATION DURING THE TOBACCO GROWING SEASON, 1957

Date	May	June	July	August
1				
2	.06	.81		
3		.02		
4				1.04
5		.22		
6				
7				
8		.27		
9		.11	.53	
10	.11	.01		
11				
12				.04
13	.08			.02
14	.55		.08	.62
15				
16				
17				
18			.08	.28
19	2.11			
20	.01			
21				
22	2.10	.18		
23	.13	.10	.25	
24		.45		
25				.07
26	.55			
27				
28		.98	.65	
29			.07	
30		.20	.95	
31				
Total	5.70	3.35	2.61	2.07