

DUSTING AND SPRAYING EXPERIMENTS WITH APPLES AND PEACHES

Major Thesis in Plant Pathology

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By

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Introduction.

In order to obtain more definite information in regard to the advisability of the dusting of apples and peaches and as a supplement to work done in previous years by this experiment station, it was decided to conduct a series of experiments on apples and peaches during the season of 1920; these experiments to be conducted in the commercial fruit sections of the state. The chief concern in these experiments is the comparison of standard sprays with various dust mixtures for the control of summer insect pests and diseases. The orchards selected for this work were fair representatives of commercial apple and peach orchards and any results obtained would be applicable to most of the fruit growing sections of the state.

Materials, equipment and methods of application. The following dust mixtures were used in these investigations:

Sulphur dust (80 - 10 - 10); containing 80 pounds of dusting sulphur, 10 pounds powdered arsenate lead and 10 pounds hydrated lime.

Copper-lime dust (10 - 10 - 80); containing 10 pounds dehydrated copper sulphate, 10 pounds powdered arsenate lead and 80 pounds hydrated lime.

Copper-lime dust (5 - 10 - 85); containing 5 pounds dehydrated copper-sulphate, 10 pounds powdered arsenate lead and 85 pounds hydrated lime.

Potato dust mixture containing: 25 pounds "bordo" (22 % available copper), 10 pounds arsenate lead and 65 pounds hydrated lime.

In all the peach orchards the various applications were made on the same dates. The following table gives materials used and dates of application for the different plots.

Plot No.	Materials used	Date of application							
		1	2	3	4	5	6	7	8
1	Sulfur dust (80-10-10)	Apr. 29	May 15	Jun. 19		July 5		July 17	July 30
2	" " "	Apr. 29	May 15	Jun. 19		July 17		July 17	July 30
3	" " "	Apr. 29	May 15	Jun. 19	Jan. 26	July 5	July 10	July 17	July 30
4	Spray pint *	Apr. 29	May 15			July 5			
C	Check								

Table - 1 Showing dates of applications and materials used in peach orchards.

* Applications made on plot 4 as follows:

App'l. 1 - 1 lb. powdered lead arsenate, 5 lbs. lime 50 gal. water.

" 2 - Self Boiled lime sulfur (8-8-50) with addition of 1 lb. powdered lead arsenate.

" 5 - Self Boiled lime sulfur (8-8-50).

In the liquid plots various strengths of lime-sulfur and Bordeaux sprays were used, these strengths will be shown later under detailed discussion of the different orchards.

In all orchards treated a large Niagara, Model D duster was used. These dusters were driven by gasoline engines and very little trouble was experienced in operating them successfully. One man and a driver was all the labor that was required to manipulate the machine.

Practically all the dust applications were made by the writer. The spray applications were made with a power sprayer. The spray on the peaches were made with a nozzle and usually by the writer. The sprays on the apples was applied with guns by the owners of the orchard but under the supervision of the writer.

The trees in both apple and peach orchards were dusted from both sides. With peaches the machine was driven down the row and the spout was moved from one side of the row to the other and then an up and down motion of the spout was made. Except in cases of engine trouble, the steam was kept in motion all the time and the flow of dust was regulated by hand feeder on rear of duster. Whenever possible dust applications were made early in the morning when the atmosphere was calm so as to lessen the amount of blowing and drifting of dust. It has often been suggested that the dust should be appli-

ed when the dew is on the foliage so as to secure a more even distribution and to cause the dust to adhere to the foliage better but observations have shown that a dry foliage insures more even distribution than a wet one. The only reason for early morning dusting is because of the lack of wind.

Dusting in peach orchards.

Experiments were conducted in the orchards of R. L. Lowery, J. W. Quick and C. F. Ballard, Crozet, Va. These orchards were selected because of the fact that Brown Rot, curculio and scab were severe the previous year and it was thought that a good test could be made on account of this severe infestation.

Lowery orchard.

The orchard was located on a fairly level piece of ground. The air drainage would be considered good and the orchard was well protected on north and west by timber. The orchard was composed chiefly of Libertas, a few other odd varieties were present but our experiments were conducted on Libertas trees only. The trees were about seven years old and vigor was very good as shown in winter by large and numerous buds and in spring and summer by high colored foliage and well developed fruit. The orchard had been well pruned, cultivated and fertilized but the spraying had been neglected. In the season of 1919 practically all the fruit had been lost on account of brown rot and this fact was very evident as shown by the numerous mummies seen on the trees and on the ground. Scab cankers on twigs were also quite numerous throughout the orchard. The trees in this orchard were considerably larger than in the other two peach orchards. Measurements made about mid-season on four trees to a plat of a total of twenty trees showed the average spread to be 15.3 feet and average height 9 feet.

The total number of trees used in the experiment was 125. The number of trees in the different plats varied considerably and reference to map 1 shows arrangement of plats, plat numbers, number of trees in plat and location of count trees in plats. For the purpose of determining whether or not a large number of dust applications would

control brown rot and how few applications could be used to control the disease, the dusted plats were given various numbers of applications.

Flat 5 - Check.

The regular spray treatment used in this state was applied to this orchard. An average for season showed that 1.3 lbs. dust per tree per application were used in dusted plats and 1.4 gal. spray per tree per application were used in spray plats. Table 1 gives materials used and dates of application for the various plats.

A general survey was made on orchards previous to the taking of harvest records and the fruit being so uniformly distributed throughout the orchard it was decided to use six count trees to the plat. The selection of these trees was made with the idea of getting an average sized tree and getting the trees uniformly scattered throughout the orchard. Reference to Map 1 shows count trees indicated by exponents.

The harvest records were taken with as much care as possible and it was decided to classify the fruit as follows: Total fruit, sound fruit, scab, rot, worm and fruit crack. It will be seen by the tables that there are some duplicates in these counts. For example a fruit having brown rot may have scab. Permanent records have been made to show this duplication but in this paper wherever a fruit is effected with two or more diseases it is recorded under each separate head.

The following table gives the outline of treatment of the various plats and also the total number fruits and the percentages of sound and infected fruit.

Materials used	Variety - Elberta - Owner R.L. Lowery, Crozet, Va.									
	Total	Clean	Scab.			Worm	Rot	Sol. Bug	Fruit. Crack	
			Total	Light.	Med. Sev.					
Pl. 1-Sulphur dust (60-10-10) -6	3650	79.69	0.11	0.08		0.03	0.33	0.42	6.67	12.95
Applications.										
Pl. 2-Sulphur dust (80-10-10)-5 App's.	3754	77.99	0.24	0.21		0.03	0.11	0.19	6.6	15.69
Pl. 3-Sulphur dust (80-10-10)-8 App's.	4352	78.71	None			0.11	0.69		5.28	16.08
Pl. 4- Spray Flat*	5347	73.12	15.63	14.94	0.69		1.18	0.17	10.86	0.17
Check	3912	39.54	51.47	44.22	6.08	1.17	0.61	3.73	11.96	0.99

- * Application 1- 1 lb. powdered lead arsenate, 5 lbs. lime to 50 gal. water.
- " 2- Self Boiled lime-sulphur (8-8-50) + 1 lb. lead arsenate.
- " 5- " " " " " (8-8-50).

Table 2- Results of dusting and spraying experiments in the Lowery peach orchard
Gronet, Va.

Applications made as follows: (1) 2-3 days after petals fall, (2) 3 weeks after petals fall, (3) 7-8 weeks after 2, (4) 1 week after 3, (5) 1 week after 4, (6) 1 week after 5, (7) 1 week after 6, (8) 1 week after 7. Flat 1 received applications 1, 2, 3, 5, 7 and 8. Flat 2 received applications 1, 2, 3, 7 and 8. Flat 3 received all applications. Flat 4 received applications 1, 2 and 5.

The season was not a very good one for the development of brown rot, at least there was very little brown rot seen in any peach orchards in the fruit sections, whether they had been sprayed or neglected. Curculio data taken in this orchard resulted in such small counts that conclusions on comparisons were impossible. It will be noted however in table 2 that the percentages of infection was considerably lower on dusted plats than on the check or sprayed plats while the sprayed plat showed a higher percentage of worms than the check, (1.2% for sprayed plat against .61% for check plat). Although the brown rot infection was very light and the above figures are entirely too low to draw any conclusions it will be noted that the sprayed plat gave the best rot control; however there is very little difference between the control by spray and the control by dust. The check plat showed too small rot infection to draw any conclusions as to the comparative efficiency of spray and dust for rot control.

An insect pest which has apparently been looked on as unimportant and the control measures for which has been neglected was quite prevalent in this orchard. This insect, known as the Green Soldier Bug, is a sucking insect, it begins its work in June and continues to feed on fruit until harvest season. It causes a sunken portion on the surface of the fruit and renders the fruit uneatable. Figures in table 2 show that there is a slight difference in favor of the dust for the control of this insect but data in other orchards does not confirm this fact. The writer believes that there was very little if any effect from either spray or dust mixtures for the control of this insect.

The two most striking facts brought out in this orchard was the very satisfactory control of scab by dust application and the severe cracking of the fruit caused by the use of dust. The season seemed to be quite favorable for scab infection as indicated by 51.5% infection on check plat. It might be explained at this point that the check plats check A

and Check B. were located in different points of the orchard so as to get an average of the existing disease condition in the orchard. The first infection of scab showed up on check plot as small black specks on fruit about July 10. These spots continued to enlarge and coalesce until harvest season. Three classes of scab were recognized, viz: Light, moderate and severe. Reference to Table 2 shows that the dusted plots have a considerably less percentage of scab than the sprayed plots and the high percentage of total scab in check plot shows beyond a doubt that dust has controlled scab more satisfactorily than the spray material. The average percentage of total scab for the three dusted plots is 12% against 15.6% for the sprayed plot.

A careful examination of orchard about two or three weeks before harvest season disclosed the fact that there had occurred a type of fruit crack which had hitherto been unobserved. Figure 1 shows type of crack caused by dust injury.



Figure 1 - Type of fruit crack occurring on peaches caused by Sulphur dust burning.

Peaches from Lowery Orchard; Photographed August 17, 1920.

A crack was very severe on some fruits and less severe on others but even the fruit which had the slight crack on it was unmarketable. At first there was some uncertainty as to whether this crack was caused by wet weather or dust injury or a combination of the two. In order to get a comparison between plots of this fruit crack it was decided to take counts on the cracked fruit at harvest season. Two classes Light and severe fruit crack were made but as previously mentioned both classes of this fruit were unmarketable so it was decided for presentation in this paper to combine the two under the head of fruit crack. Both percentages of crack and observations show that the crack was very much greater on the dusted plots than on the sprayed or check plots. Reference to Table 1, shows that the average crack for the three dusted plots was 14.9% against .17% and .99% for sprayed and check plots respectively. This fact goes to show and probably proves that the cracking was not caused by wet weather but from dust injury.

Observations during the season and at harvest time showed considerable dust injury on foliage of dusted plots while the sprayed and check plots were practically free from this burning. This injury caused considerable defoliation on the dusted plots which was more in evidence at harvest season than at other times. The condition of the foliage was not as good on dusted plots as on sprayed and checks. Examination at different times during the season showed no signs of foliage infection on any of the plots. It is true however that the color and quality of the fruit was considerably better on sprayed than on dusted plots.

The average fruit ~~drop~~^{drop} for the season was about the same throughout the entire orchard; probably a little more fruit ~~drop~~^{drop} occurred on check plots at harvest season than on the other plots, caused by the premature ripening of fruit on some of the trees. The amount of this dropping however was so slight that it was decided not to make counts on them when harvest records were made.

WICK ORCHARD

This orchard which consisted of only a small number of Alberta trees was situated on a sloping piece of ground with southeastern exposure. The trees were six years old and the orchard had been neglected in previous years. In 1919 practically all the fruit had been lost from brown rot. No spray treatment had been given the orchard for several years and brown rot mummies and scab cankers were prevalent. The size, condition and vigor of trees in this orchard were not near so good as in the Lowery orchard. Measurements made about midseason showed the average spread of trees to be 12.2 feet and the average height to be 6.2 feet.

A total of about 60 trees were used in this orchard. The trees were so irregularly planted and spaced, and the fact that a good many were missing made it impossible to show the arrangement of plots by map. The three dusted plots and one spray plot were composed of single rows having about nine trees to a row. The check plot consisted of about twenty-five trees scattered about over the field and which were not very close to dusted or sprayed plots. This fact made it practically impossible for any spray or dust to drift to the check trees.

The methods of treatment, times of applications, materials used, taking of harvest data, etc., were the same for this orchard as for the Lowery orchard. An average for season showed that about one pound of dust per tree per application was used on dusted plots and one gallon of spray per tree per application used on sprayed plots. Table 1 shows materials used and dates of applications. Six count trees to a plot were selected in this orchard and harvest records made as in the Lowery orchard. There were also some duplicates in this orchard as in the Lowery orchard but these were disregarded for presentation in this paper and a fruit having two or more diseases was recorded under each separate head.

The following table gives outline of treatment of the various plots and also the total number of fruit and percentages of sound and infected fruit.

Materials used.	Variety -		Elberta.				Owner - J. W. Quick, Crozet, Va.			
	Total	Clean	Scab.			Worm Rot	Sol. Bug	Fruit Crack		
			Total	Light	Mod. Sev.					
Pl. 1-Sulphur dust (80-10-10) - 6 Applications.	1630	80.49	1.71	1.71		2.39	0.06	6.1	7.23	
Pl. 2-Sulphur dust (80-10-10) - 5 Applications.	2161	76.15	4.10	3.20	0.9	2.70	0.32	7.42	10.28	
Pl. 3-Sulphur dust (80-10-10) - 8 Applications.	2275	77.30	1.27	1.27		1.36	1.09	5.27	13.71	
Pl. 4- Spray Flat*	1469	88.65	2.11	2.11		2.65	.20	5.92	.54	
Check	1027	.87	94.74	47.13	23.66	23.95	2.53	6.91	5.65	None

*Application 1-1 lb. powdered lead Arsenate, 5 lbs. lime to 50 gal. water.
 " 2-Self Boiled Lime-sulphur (8-8-50) + 1 lb. lead arsenate.
 " 5- " " " " (8-8-50).

Table 3- Results of dusting and spraying experiments in the Quick peach orchard Crozet, Va.

Applications made as follows: (1) 2-3 days after petals fall, (2) 3 weeks after petals fall, (3) 7-8 weeks after 2, (4) 1 week after 3, (5) 1 week after 4, (6) 1 week after 5, (7) 1 week after 6, (8) 1 week after 7. Plat 1 received applications 1, 2, 3, 5, 7 and 8. Plat 2 received applications 1, 2, 3, 7 and 8. Plat 3 received all applications. Plat 4 received applications 1, 2 and 5.

As has been previously stated the season for rot development was not very favorable but reference to table 3 will show that rot was considerably less on the dusted and sprayed plats than on the check. The check plat in this orchard ~~had~~ a higher percentage of rot infection than in the other peach orchards but was much below that of the average year. Both dust and spray gave effective control of brown rot, but the tests were not severe.

Table 3 shows that there was a very satisfactory control of scab in this orchard as well as in the Lowery orchard. The total percentage of scab for the check plat was 94.74; of this amount 47.13% was light, 23.66 was moderate and 23.95 was severe. This high percentage of scab on the check plat and the relatively large portion of severe scab made the test in this orchard a very severe one and the fact that the dusted plats had an average of 3.02% total scab against 2.11% total scab for spray plat proves that scab can be controlled by spray and dust mixtures and that sprays and dusts were both practically equally effective for scab control under the conditions of the experiment.

Again referring to Table 3 we find that fruit crack has also occurred in this orchard. It is however not quite so severe as in the Lowery orchard there being an average of 10.41% on dusted plates for this orchard against 14.9% for the Lowery orchard. Comparisons of percentage of crack on dusted plate with those on sprayed and check plates also confirms the statement previously made that the crack was caused by a burning from the dust rather than by wet weather conditions. The average percentage of crack for dusted plants ran 10.41 against .54 and none for sprayed and check plat respectively.

Dust injury and slight burning on foliage causing considerable defoliation ~~at~~ harvest time was noticed on the dusted plate, but no attempt was made to get any figures showing the amount of defoliation ^{on} ~~the~~ dusted plate as compared with sprayed or check plates. It may be said however that observations show that defoliation was considerably greater on dusted than on sprayed or check plates. There was practically no foliage infection observed on any of the plates during ~~the~~ season. Abnormal fruit ^{drop} ~~drops~~ occurred only on the check plat and this was caused by premature ripening of fruit on some of the trees. These drops however were negligible and no counts were made on them in taking harvest data.

As observed in the Lowery orchard the color and quality of fruit on dusted plate was not so good as on the sprayed plates.

BALLARD ORCHARD.

This orchard which was composed of six year old trees was located on a high piece of ground which had a slope in two directions. The orchard had a southern exposure and was slightly protected on the northwest by a narrow strip of woods. The air drainage was only fair. There was a frost pocket in the extreme west part of the orchard but this portion was not in our plate. The orchard was composed of several varieties of peaches but Alberta and Wonderful were the only varieties which occurred in our plate.

The trees were in a very unthrifty, unhealthy condition. Pruning had been neglected and most of fruit and foliage was on end of limbs, rather than evenly distributed over the trees. Diseased dead limbs were prevalent throughout the orchard and brown rot

mummies were quite numerous. The Wonderful variety showed decidedly less vigor and more unthrifty condition than the Elbertas. Prospects for fruit were not very promising at beginning of season but at harvest there was more than had been expected. The orchard received good cultivation. No fertilizer had been used to any extent until this year when nitrate of soda was applied at beginning of season; the effect of this fertilizer upon the trees was readily apparent about mid season as indicated by the increase in vigor of trees, improvement of foliage color and better development of fruit. Spray applications had been made in previous years in this orchard but the wrong materials had probably been used and the applications had ~~been~~ more than likely been made at the wrong time; at any rate the sprays used had failed to control diseases and insects and in 1919 the entire crop was practically lost from brown rot. The trees were not quite as large as those in the Quick orchard and the foliage not being very thick a smaller amount of dust and spray material per tree was used in the applications. An average for the season showed that about .8 pound of dust per tree per application was used on dusted plots and about one gallon of spray per tree per application was used on sprayed plots.

The number of trees in different plots varied considerably and map 2 shows arrangement of plots, plot numbers, number and variety of trees in plot and location of count trees in plot. The total number of trees used in these plots was 177, 69 of which were Elbertas and 98 Wonderful.

On account of rush work in the other two peach orchards it was impossible to take harvest records on Elbertas in the Ballard orchard. It may be said however that observations during the season showed about the same insect and disease conditions existing in this orchard as in the Quick orchard and about the same measure of efficiency for the dust and spray application.

The methods of treatment, materials used, time of application, etc., were the same for this orchard as for the other two peach orchards. The taking of harvest data was practically the same as in the other orchards the only difference was that instead of examining the fruit after it had been picked the fruit was examined on the tree and recorded under the different classes as previously shown in the other orchards. Duplicate

were recorded under each separate head as in the other orchards. The following table gives outline of treatment of various plats and also the numbers of total fruit and percentages of sound and infected fruit.

Variety - Wonderful - Owner C. F. Ballad, Crozet, Va.									
Materials used.	Total	Clean	Scab.			Worm	Rot	Sol. Bug	Fruit Crank
			Total	Light	Med. Sev.				
Pl. 1-Sulphur dust (80-10-10) - 6 Applications.	1259	65.52	3.4	3.09	.31	2.53	.63	3.55	24.47
Pl. 2-Sulphur dust (80-10-10) - 5 Applications.	1249	75.66	3.44	3.38	.16	2.65	.72	2.86	15.66
Pl. 3-Sulphur dust (80-10-10) - 8 Applications.	1232	70.29	1.70	1.70		4.05	1.29	3.41	21.26
Pl. 4-Spray Plat*	1114	69.57	19.02	18.76	.26	6.19	.53	2.42	1.93
Check	1036	15.63	78.68	56.27	13.82	8.59	4.25	2.99	3.47

*Application 1- 1 lb. powdered lead Arsenate, 5 lbs. lime to 50 gal. water.
 " " 2- Self Boiled lime-sulphur (8-8-50) + 1 lb. lead arsenate.
 " " 3- " " " " (8-8-50).

Table 4- Results of dusting and spraying experiments in the Ballad peach orchard Crozet, Va.

Applications made as follows: (1) 2-3 days after petals fall, (2) 3 weeks after petals fall, (3) 7-8 weeks after 2, (4) 1 week after 3, (5) 1 week after 4, (6) 1 week after 5, (7) 1 week after 6, (8) 1 week after 7. Plat 1 received applications 1, 2, 3, 5, 7 and 8. Plat 2 received applications 1, 2, 3, 7 and 8. Plat 3 received all applications. Plat 4 received applications 1, 2 and 5.

Reference to table 4 shows that there is not enough difference between dusted, sprayed and check plats for worm, rot and soldier bug control to draw any comparisons as to the effectiveness of the various materials; the chief trouble being the small percentage of the above pests occurring in the check plat.

As in the other orchards the striking things brought out in this orchard are the satisfactory control of Scab and the severe injury caused by dust. Table 4 shows that the total percentage of scab in check plats was 78.68; of this amount 56.27% was slight,

13.02% was moderate and 8.59% was severe. The scab was not quite as severe in this orchard but was considerably more severe than in the Lowery orchard. An average of dusted plate showed 2.65% total scab against 19.02% for sprayed plate. The control in the sprayed plate in this orchard was considerably less than in the dusted plate and was also less than the sprayed and dusted plate in the other orchard. It will be noted however that this was mostly light scab. The reason for this comparatively high percentage of scab infection on the sprayed plate cannot be explained. Considering the severity of scab on the check plate and the relatively high percentage of scab on the sprayed plate it may be concluded that Dust gave better control for scab in this orchard than did the spray.

The fruit crack in this orchard was considerably more than in the other two orchards, running on average of 20.5% for dusted plate against 14.9% and 10.41 for the Lowery and Ballard orchards respectively. The type of injury was the same as in the other orchards but was decidedly more severe on fruit and occurred on more fruit than in other orchards. The average percentage of crack for dusted plate ran 20.5 against 1.93 and 3.47 for sprayed and check plate respectively. This again confirms the conclusions previously drawn that the injury was caused by dust rather than by wet weather.

The amount of defoliation and spray and dust injury to foliage was about the same as in the other orchards. Defoliation being greater on the dusted plate than on the sprayed or check plate. The size, color and quality of fruit was practically the same in all plates. The fruit however was not near so large and did not have the color and quality that the fruit in the Lowery and Quick orchard had. However the Alberta Variety was considerably larger and showed better quality and color than the Wonderful.

Summary of Rusting in Peach Orchards.

Scab was satisfactorily controlled by dust and spray applications in all orchards.

Brown rot was controlled practically as well by the dust mixture as the spray but the test was not a severe one and the drawing of conclusions as to the efficiency of the dust is unwarranted.

in the sprayed, dusted or check plots that it is believed that there was very little effect from either the spray or dust mixtures for the control of these insects.

A type of fruit crack which had hitherto been unobserved, occurred in the dusted portion of the orchards. It was shown that this crack was caused by dust injury. The fruit was unmarketable when burned with the dust. This fruit cracking puts a decided limitation on the use of dust mixtures on peaches.

It will be noted, by reference to tables 2, 3 and 4, that there were not enough differences in insect and disease control in the three Sulphur plots to draw any conclusions as to the number of dust applications which give best control for the above mentioned pests. Plot 2, which received five dust applications, showed practically as good disease control as plot 3 which received eight dust applications. It is evident, therefore, that the three extra applications were unnecessary and that five applications or probably fewer will give as good disease control as a greater number of applications.

Experiments in Apple Orchards.

Experiments on apple dusting were conducted in three orchards. Two orchards at Creset, Va. owned and operated by Gentry Bros. and one orchard at Harrisonburg, Va. owned and operated by T. H. Thompson were used in this work. The orchards at Creset were of the Albermarle Pippin and Ben Davis variety and the chief concern in these orchards was the control of bitter rot on the Pippins and the control of Blotch on the Ben Davis. The Thompson orchard at Harrisonburg was composed of Stayman and Winesap varieties and the chief concern in this orchard was the control of Scab on the above mentioned varieties.

Albermarle Pippin Orchard.

This orchard was located on a sloping piece of ground at the foot of the mountain, had excellent air drainage and was ideally located as far as climatic and soil conditions were concerned. The trees were about 25 years old, were well pruned, well fertilized and were very healthy and vigorous as indicated by their size and by the color and quality of foliage and fruit. Regular spray treatment had been practiced in this orchard but considerable fruit had been lost in previous years from bitter rot. Examinations, however, were made several times during the season to see if any bitter rot cankers could be found on limbs and twigs but these were in vain, there is no doubt however, but that these cankers were present but were so small and were so situated as to be inconspicuous. Measurements of eleven trees taken about midseason showed an average spread of 29 feet and an average height of 19 feet for Pippin trees.

The total number of trees used in this orchard was 30. As in the peach orchards the number of trees in the different plots varied considerably and reference to Map 3 shows arrangements of plots, plot numbers, number of the trees in plot and location of count trees in plot.

The chief concern in this orchard was to see whether or not bitter rot could be controlled by copper-lime dust and to test the comparative efficiency of this dust with the regular spray treatment for the control of the above disease.

An average for season showed that 2.4 pounds of dust per tree per application was used on dusted plats and 8 gals. spray per tree per application were used on spray plats. The following table gives dates of applications and materials used on the various plats.

Plat No.	Materials	Application Dates.					
		1	2	3	4	5	6
1	Copper-lime dust (10-10-80)	May 3	May 17	June 23	July 14	July 29	Aug. 26
2	Copper-lime dust (5-10-85)	do	do	do	do	do	do
3	Check						
4	Spray plat*	May 3	May 17	June 23	July 14	July 19	Aug. 26

Table 5- Showing dates of applications and materials used in the Albermarle Pippin orchard of Gentry Bros., Crozet, Va.

- *Application 1- con. lime-sulphur, 5 quarts to 50 gal. water + 1 lb. powdered lead-arsenate.
- " 2 + 3 - Bordeaux Mixture (4-5-50) + 1 lb. powdered lead arsenate.
- " 4 + 6 Bordeaux " (4-5-50).

Upon examination of orchard at harvest season it was decided on account of the few number of trees in the plats to make counts on all the fruit occurring on dusted and check plats; except in the case of several trees where the number of fruits was so small that these were eliminated. On account of the fruit on the sprayed plat being so clean it was decided to make counts ^{on} only 1000 fruits on each of four trees on this plat. Reference to Map 3 shows location and numbers of count trees in the various plats. The harvest records were taken with as much care as possible and the fruit was classified as follows: Total fruit, clean fruit, Bitter rot and worm (codling moth). As in the case of the peach orchards there was considerable duplication of fruit. It was decided that if a fruit was effected with two or more pests it was recorded under two or more heads.

The following table gives the outline of treatment of the various plats and also the numbers of total fruit and percentages of sound and infected fruit

Figures show percentages.

Variety -- ALBEMARLE PIPPIN.

Materials used	Total Fruit	Clean Fruit	Bitter Rot	Worm
Pl. 1-Copper-lime dust (10-10-30)	15,769	63.6	30.7	7.6
Pl. 2-Copper-lime dust (5-10-35)	7,336	53.7	41.5	6.3
Check Plat	1,977	47.0	29.5	29.6
Pl. 4-App'l 1- lime-sulphur; 2-6 Bord. Mix. (4-5-50)	4,019	96.3	1.4	2.5

Table 6- Results of dusting and spraying experiments in the orchard of Gentry Bros.,
Gronet, Va. Season 1920.

Applications made as follows: (1) Calyx cup, (2) 2 weeks after 1, (3) 5 weeks after 2,
(4) 3 weeks after 3, (5) July 29, (6) Aug. 26. All six applications were made in each
plat. Arsenate of lead added to spray mixtures for applications 1, 2 and 3.

The first occurrence of rot in the plats in this orchard was about August 1 and was
very slight it being found on one fruit only. From this time on, however, the disease spread
rather rapidly and by the middle of August it was quite uniformly distributed over the dusted
and check plats. This uniform distribution over dusted as well as check plats showed to a
casual observer that the dust was as ineffective for rot control as no treatment at all.
Reference to Table 6 shows the percentages of infection to be 30.7 and 41.5 for 10-10-30 and
5-10-35 copper-lime dust respectively against 29.5 for check plat. The fact that the amount
of rot occurring on the spray plat was almost negligible shows that the disease can be con-
trolled almost perfectly by spray materials and a comparison of this control with that ob-
tained in the dusted plats puts a decided limitation if not a total bar on the use of copper-
lime dust where bitter rot is the chief concern.

It was observed during the season and the percentages show that codling moth can be
effectively combatted by the use of dust. It cannot be said, however, that the dust
mixtures gave as good control for worm as did the sprays, the percentage of worm being 7.6
for the 10-10-30 dust and 6.3 for the 5-10-35 dust against 2.5 for the spray mixture.

The occurrence of blotch, aphid scale etc. in this orchard was very slight and records on these pests were not taken when counts were made.

The only disease of any consequence occurring during the season on the foliage was frog eye leaf spot and this was uniformly distributed over dusted, sprayed and check plots so no records were taken as to its control. Slight russeting of fruit occurred on sprayed and dusted plots alike about mid-season but by harvest season had almost entirely vanished and was of no commercial importance. Defoliation and fruit drop were very slight in this orchard and could be attributed to normal causes only.

Ben Davis Orchard.

This orchard, which was adjacent to the Pippin orchard, had practically the same location, climatic and soil condition and the air drainage was excellent. The trees were about 25 years old but were not near so healthy and vigorous as the pippin trees. Cultivation, spraying and pruning had been neglected. Dead, diseased limbs were very prevalent and there was a large number of blister cankers throughout the orchard. Examinations were made throughout the season for blotch cankers on the twigs; these cankers were found several different times and almost invariably the fruit on the cankered twig would be infected with blotch.

The total number of trees used in this orchard were 62. Map 4(a) shows arrangements of plot, plot numbers, number of trees in plot, location of count trees and variety.

Investigations in this orchard were for the purpose of determining whether blotch and codling moth could be controlled by copper-lime dust and ^{Reds}potato dust mixture and if so which applications if any could be omitted and still get as good control; also to test the comparative efficiency of these dusts with the regular spray treatment for the control of the above mentioned ~~plots~~. An average for season showed that 2.5 pounds of dust per tree per application were used on dusted plots and 7.5 gals. spray per tree per application were used on spray plot. Six plots were used in this experiment. The treatment and dates of application are shown in the following table.

Application Dates.

Flat No.	Materials	1	2	3	4
1	Copper-lime dust (10-10-50)	May 3	May 17	June 23	July 14
2	Do		do	do	do
3	Do	May 3		do	do
4	Potato Dust Mix. (25-10-55)	do	May 17	do	do
5	Unogk				
6	Spray plot*	do	do	do	do

Table 7- Showing dates of applications and materials used in Gentry Bros. Ben Davis orchard, Crozet, Va.

Appl. 1- Cop. Lime Sulphur 5 qts. to 50 gal. water + 1 lb. powdered lead arsenate.

" 2 & 3- Bordeaux Mix. (4-5-50) + 1 lb. powdered lead arsenate.

" 4 " " (4-5-50)

At harvest season it was decided to make examinations on 1500 apples on each of four trees to a plot. It sometimes happened that there were not as many as 1500 apples on some of the count trees selected, in these cases all the fruit on the tree was counted. Only the plot totals will be shown in this paper. Reference to Map 4(a) shows location of count trees in the orchard. In taking the harvest data the fruit was classified as follows: Total fruit, clean fruit, blotch and worm. Duplications, as previously mentioned for other orchards, occurred in this orchard also and a fruit effected with two or more pests was classified under each separate head. Table 8 gives outline of treatment of therapeutic plots and also the numbers of total fruit and percentages of sound and infected fruit.

Figures show percentages.

Variety -- Ben Davis.

Materials used	Total Fruit	Clean Fruit	Blotch	Worm
Pl. 1-Copper-lime dust (10-10-20)	5147	33.0	60.0	11.2
Pl. 2-Copper lime dust- (10-10-20)	6000	41.6	43.4	31.6
Pl. 3-Copper-lime dust- (10-10-20)	5700	63.8	21.8	12.0
Pl. 4-Potato dust mix. (25-10-25)	5500	78.4	7.7	13.9
Check Plot	5755	66.4	10.4	24.4
Pl. 5- App'l. 1 Lime-sulphur; 2-4 Bord. Mixture. (4-5-20)	5075	26.8	.7	12.6

Table 8- Results of dusting and spraying experiments in the orchard of Gentry Bros.,
Grenet, Va. Season 1920.

Applications made as follows: (1) Calyx cup, (2) 2 weeks after 1, (3) 5 weeks after 2,
(4) 3 weeks after 3. All four applications were made in each plot except No. 2 where
application 1 was omitted and No. 3 where application 2 was omitted.
Arsenate of lead was added to spray mixtures for applications, 1, 2 and 3.

Due to the uneven distribution of blotch in this orchard as shown by Map 4(b) the
results with reference to blotch control are inconclusive but several points of interest
were brought out throughout the season. As previously mentioned it was almost always the
case that fruit on a twig having a blotch canker was infected with the blotch disease. The
first appearance of blotch was observed June 25 and from then on to harvest the disease
spread over the orchard. It was noticed during the season that the disease did not seem
to be evenly distributed, later in the season there appeared to be more severe infection on
certain trees toward the north corner of the orchard than in the other portion of the
orchard. This could not be attributed to any soil or climatic condition or to any differ-
ence in topography because it would be expected that the lower parts of the orchard would
have ^{had} more severe infection than the higher parts and this region of severest infection was
the highest part of the orchard. It was decided to make examinations of trees and mark
them on the map of the orchard according to their severity of blotch infection. Map 4 (b)
shows results of this examination. Trees marked S indicate severe infection; H moderate
infection; L light infection, O no infection. The area enclosed in black lines at north

corner of orchard indicates region of severest infection. Flat numbers and percentages of infection are shown at side of plot. The map shows, very well, the differences in regional severity of infection and on account of these differences no conclusions as to the comparative efficiency between the different dust and spray plots for blotch control can be drawn, of the blotch application, but plots 1 and 2 showed decidedly more infection than plot 3. Plot 4, on which 4 applications of potato dust mixture was made, showed a relatively low percentage of blotch infection being only 7.7. The spray plot gave almost complete control for blotch being only .7 percent infection.

The codling moth data obtained in this orchard is more conclusive than the blotch data. The dusted plots 1 and 4 on which all applications of the two dust mixtures were made, showed practically the same worm percentage as the spray plot. The percentages were 11.3, 12.0 for dusted plots 1 & 4 respectively and 12.6 for the sprayed plot. The percentage of worms in the check was high enough to get fairly good comparison being 21.6 percent. In plot 2, on which the codling moth application was omitted, we had practically the same percentage of worms as in the check plot which shows that if the codling moth application is omitted other applications will not control worms. Again, plot 3 in which the blotch applications was omitted, we have practically the same worm control as in the spray which shows that the blotch application is not necessary for worm control. It will be noted however, by reference to Table 8, that neither the dust nor the spray gave as good control for codling moth as they should have given but the figures are rather consistent and it can be concluded that both the copper-lime dust and the potato dust mixture are as equally effective for worm control as the spray treatment.

The reason for the seemingly high percentage of infection on the dusted and sprayed plots may probably be explained by reference to Fig. 2, which shows the occurrence of codling moth larvae. It will be noted that the time of the occurrence of the maximum number of larvae was about July 6. The vertical lines show dates of applications that were most important for the control of the second brood of codling moth. It is probable that if application No. 3 (June 23) had been applied about July 2 and that if arsenate had been put

in spray mixture for application No. 4 (July 14) the codling moth injury would have been considerably lessened. However there is no way of telling at what part of the season the maximum number of larvae will be found and times for spray and dust applications can only be learned by experience.

The amount of russeting on fruit caused by dust and spray mixtures was considerably larger in this orchard than in the pippin plate. About the middle of June it was noticed that russeting was present on all dusted and sprayed plats. The copper-lime dust plats showed only slight russeting, the potato dust mixture was a little more severe and the spray plat was very severe. This was the case throughout the season but along toward harvest season most of the injury on the copper - lime dust plats had disappeared but there was still a small amount on the potato dust mixture plat and it was quite severe on the sprayed plat. It was practically impossible to make counts on the russeted fruit at harvest season but observations showed that it was practically of no commercial importance except on the spray plat and it was estimated that a loss of about 20% was caused by this severe russetting on this plat.

There was considerable foliage injury noticed at beginning of season but this was caused by the rather late application of dormant spray which was applied when the pink was showing in the buds. Slight defoliation occurred in orchard during the season but was about evenly distributed throughout the plats and was only due to normal causes. It was noticed throughout the season that there was considerable fruit drop in the various plats but counts could not be made on account of hogs in the orchard. The hogs were taken out about two weeks previous to harvest season and observations showed that dropping occurred more on plats 1 & 2 where blotch infection and codling moth injury was most severe. It was decided however that harvest records would not be taken on this dropped fruit but only on the picked fruit. Practically the only foliage disease which occurred in the orchard was Frog-eye leaf spot and this was uniformly distributed over all plats.

Codling Moth Band Records.

In order to get some data concerning the time that the larvae of the first brood of moth leaves the apple and establishes itself on the tree trunk to develop into the second brood moth, a number of trees in the Ben Davis and Pippin orchard were banded with burlap and records taken throughout the season. This was done with the view of correlating the time of the second brood codling moth application with the time when the greater number of larvae were under the bands but as the application dates had previously been outlined it was decided to make applications as had hitherto been planned. It is, however, of interest to note the results of these records. The bands were made of burlap sacks which were split and folded three times, making them about 12 inches wide. These were placed around trunk of trees, middle way and were numbered consecutively 1 to 32. Band Nos. 1 to 17 inclusive were placed on Ben Davis trees and 18 to 32 were placed on Pippin trees. Examinations of weekly intervals were made and the number of larvae under each band was recorded; the larvae found at each examination were killed. No larvae were found until the week of June 21. Table 9 shows the number of larvae found under each band and the total number found for the respective dates.

Band No.	June 21 No. Larvae	June 28 No. Larvae	July 6 No. Larvae	July 13 No. Larvae	July 19 No. Larvae	July 27 No. Larvae
1-17 incl. (Ben Davis)	1	11	26	20	4	3
18-32 incl. (Pippin)	6	2	13	2	1	3
Total	7	13	39	22	5	6

Table 9- Showing codling moth band records in Gentry Bros. orchard, Creset, Va.

It will be noted that there were considerably more larvae in the bands on the Ben Davis trees (1-17) than there were in those on the Pippin trees (18-32) the reason for this probably being that the spraying in the Ben Davis orchard had been neglected in previous years and the insect had gotten well established. Fig. 2. shows quite a uniform curve representing the occurrence of the larvae at weekly intervals.

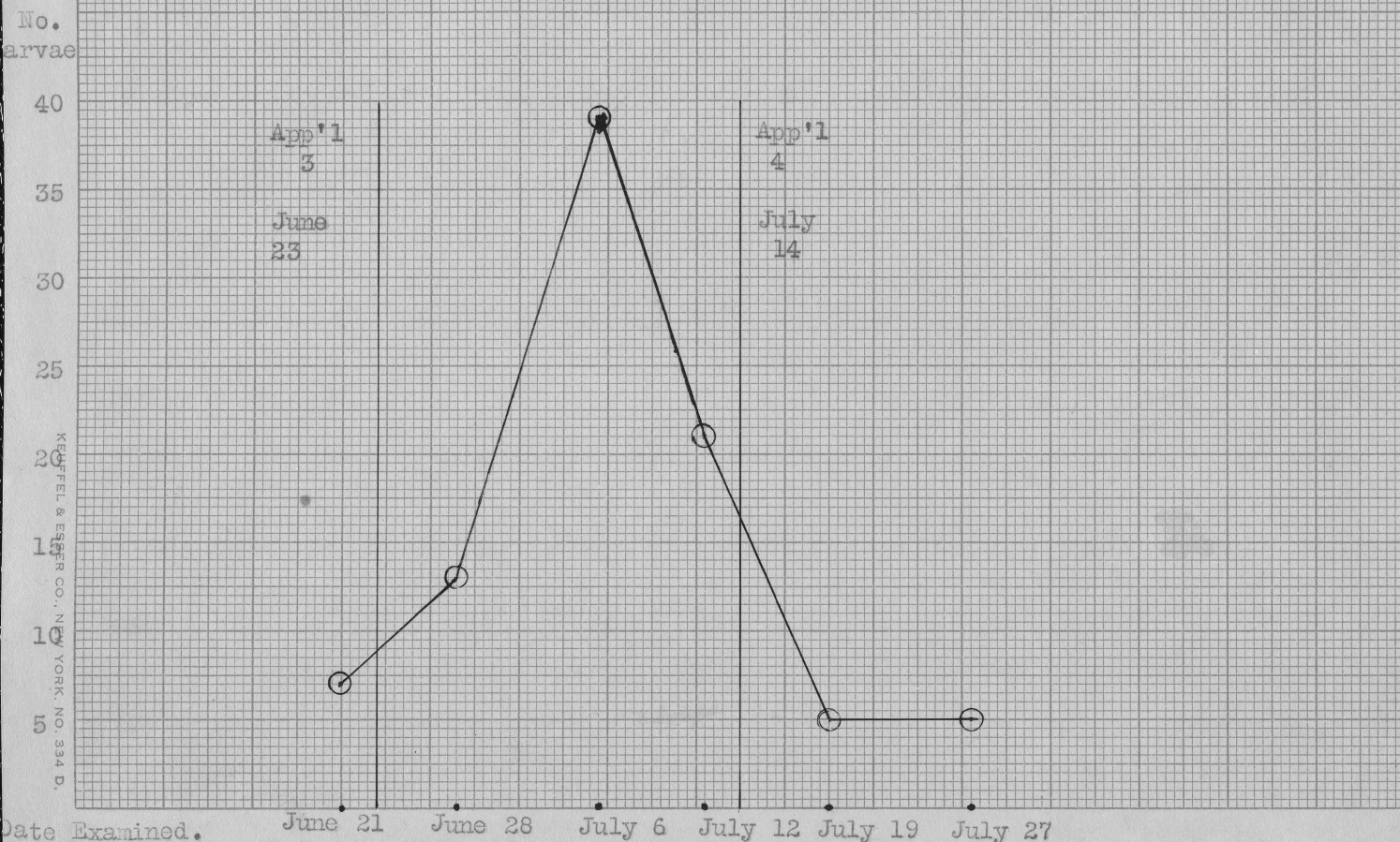


Fig. 2- Showing occurrence of codling moth larvae in Gentry Bros. orchard, Crozet, Va.

T. N. Thompson Orchard.

This orchard is an example of one of the well cared for orchards of the state. The location and air drainage were ideal and a type of soil well adapted for fruit growing was present. The trees which consisted chiefly of Winesaps and Stayman were about eleven years old, had been well pruned, cultivated and fertilized. Regular spray applications had been made in previous years but these seemed to be ineffective for the control of apple scab, this disease being very severe during the 1919 season. The trees however were very vigorous and if they had been properly sprayed would have yielded good fruit.

The total number of trees used in this orchard were 200. An average of 52 trees for season showed the spread to be 17.2 feet and height to be 14.9 feet. Map 5 shows arrangement

of plats, plat numbers and numbers and variety of trees in plats.

Investigations in this orchard were carried on for the purpose of determining whether scab and worm could be controlled by the various dust and spray mixtures, which dust applications if any could be omitted and still get as good control, and which dust application was the most important for the control of the above mentioned pests; also to test the comparative efficiency of the dusts with the various spray mixtures for scab & worm control. An average for the season showed that 1.5 lbs. dust per tree per application were used in dusted plats and 6.4 gal. spray per tree per application were used on spray plats. Fourteen plats were used in this experiment. The following table shows materials used and dates of applications for the various plats.

Plat No.	Material	Application Dates.						
		1	2	3	4	5	6	7
1	Copper lime dust (10-10-00)	Apr. 9	Apr. 23	May 15	May 24	June 4	June 30	July 15
2	do		do	do	do		do	do
3	do			do	do		do	do
0A	Check							
4	Copper-lime dust (10-10-00)		do		do		do	do
5	Do		do	do	do		do	do
6	Do		do	do	do			
7	Do		do	do	do			do
8	Spray plat 1	do	do	do	do	do	do	do
C-3	Check							
9	Spray plat 2	do	do	do	do	do	do	do
10	Potato dust mixture (25-10-68)	do	do	do	do	do	do	do
11	Sulphur dust (80-10-10)	do	do	do	do	do	do	do
12	Spray plat 3	do	do	do	do	do	do	do

Table 10- Showing materials used and dates of applications on plats in Thompson orchard, Harrisonburg, Va.

- 1-Pl. 8-App'l. 1-3 Bord. Mix. (3-10-50)
 " " 5-7 " " (4-5-50)
 2-Pl. 9- " 1-3 Lime Sulphur, App'l 4-7 Bord. Mix. (4-5-50).
 3-Pl 12- " 1-3 dry lime sulphur spray (3-50), App'l 4-7 Bord. Mix. (4-5-50)
 1 lb. powdered lead arsenate to 50 gal. water added to all spray mixtures for applications 3, 4, 5 and 6.

At harvest season a survey of the plots was made and there being such a small number of apples on the trees it was decided to make counts on all the fruit occurring in the plots. Reference to Map 5 indicates number and variety of trees in the various plots. It was impossible to keep the fruit from each individual tree separated but each plot was counted separate and records taken accordingly. Records were taken first on the Stayman variety and then on the Winesap.

In taking harvest data the fruit was classified as follows: Total fruit, Sound fruit, Total scab, Severe scab, light scab, aphid & scab and wormy. Duplicate fruit were classified as in the other orchard, under their respective heads. As plots 1 to 7 were treated with the same material it was decided to select, for comparison with the spray, check and other dusted plots, only one of these plots, plot number 2, was used for this comparison as it seemed to be a fair representative of this series of copper-lime dust plots. The following table gives outline of treatment of the various plots and also the number and percentages of sound and infected fruit:

Materials used	Total Fruit	Variety	Winesap			Aphis	Worm	
			Sound Fruit	Total	Sev.			Light
Pl. 2-Copper-lime dust (10-10-50)	3026		61.6%	31.1%	10.2%	19.6%	1.1%	3.0%
Pl. 8-App'l. 1-4 Bord. Mix. (3-10-50), 5-7, Bord. Mix.	1222		99.9%	4.7%	1.6%	3.3%	0.0%	0.4%
Pl. 9-App'l. 1-3 Lime Sulphur; 4-7, Bord. Mix. (4-5-50).		NO FRUIT.						
Pl. 10- Potato dust mixture (25-10-65)	619		66.5%	34.2%	5.7%	17.1%	1.5%	4.5%
Pl. 11- Sulphur dust (60-10-10)	471		65.3%	8.1%	2.5%	4.7%	0.0%	2.1%
Pl. 12-App'l 1-3 dry lime-sulphur spray. 4-7 Bor. Mix (4-5-50)	68		96.9%	2.9%	0.0%	2.9%	0.0%	1.5%

Insecticide used	Total Fruit	Sound Fruit	Scab				
			Total	Sev.	Slight	Aphis	Worm
Check - A.	2151	28.0%	69.9%	25.2%	41.2%	2.6%	1.2%
Check - B.	536	24.5%	62.1%	22.8%	41.0%	6.2%	0.7%
		Variety --	Stayman.				
Pl. 2-Copper-lime dust	3833	79.3%	9.3%	1.9%	6.2%	1.0%	2.6%
Pl. 6-Bordeaux Mix.	3123	92.6%	1.6%	0.6%	1.1%	0.2%	0.9%
Pl. 9-Lime Sulphur & Bor. Mix.	2516	97.1%	0.9%	.0%	.9%	0.0%	1.0%
Pl. 10-Potato dust	3304	61.7%	9.4%	1.3%	7.4%	0.7%	3.5%
Pl. 11-Sulphur dust	1708	93.5%	1.6%	0.2%	1.2%	0.1%	0.4%
Pl. 12-Dry lime sulphur & Bor. Mix.	2117	96.9%	0.7%	0.1%	0.5%	0.1%	0.1%
Pl. Check A-	592	76.3%	15.7%	2.6%	12.5%	0.7%	5.6%
Check - B #	1716	74.6%	21.5%	3.5%	16.4%	1.6%	1.6%

Table 11- Results of dusting and spraying experiments in the orchard of T.H. Thompson, Harrisonburg, Va. 1920.

The aphis column includes apples effected with both ^{aphis +} scab and aphis.

Applications made as follows: (1) delayed dormant, (2) pink stage (3) Calyx cup, (4) 10 days after 3, (5) 3 weeks after 3, (6) June 30, (7) July 15, all seven applications were made in each plot except No. 2, where applications 1 and 5 were omitted. Arsenate of lead added to spray mixtures for applications 3, 4, 5 and 6. Figures show percentages.

Discussing the plots in order named above, we first observe the results obtained on plot 2. The dust did not seem to give very good control of scab on this plot the total percentage being 31.1 for the Winesaps and 9.5 for the Stayman. It will be noticed also that a large percentage of this infection for Winesaps was under the Severe class being 10.3 but the Staymans showed only 1.9%. Unfortunately there was no Winesap fruit on Plot 9 (the regular spray treatment plot) and it was thought that comparisons for this variety could not be made on this account. However a fairly good comparison can be made with plot 12 which received dry lime-sulphur spray for the first three sprays instead of commercial lime sulphur. The almost perfect control in this plot shows that it would almost certainly have been equally as effective as the regular spray treatment. Compared with plot 12 the copper-lime dust seemed to give only slight control for scab. The amount of scab infection in the check plate was relatively high on Winesaps but not so on the Stayman, being 69.9 and 15.7 respectively.

fection for both varieties were practically the same. It may be said however that the dry lime sulphur plat gave slightly better control than the other two spray plats. It is concluded, however, that either of the three spray treatments, if properly applied, will give satisfactory control for scab.

The next material to be considered is the potato-dust mixture. Reference to Table 11 shows that the percentage of total scab was about the same for this dust as for the copper-lime dust on the Stayman variety and was slightly less on the Winesaps. A comparison of the potato dust plat with the sprayed plate shows that this dust was ineffective for scab control for both the Winesap and Stayman variety.

The sulphur dust gave best scab control of any of the dusts, as shown by the general appearance of fruit and also the percentages of infection. The condition of the foliage and color and quality of fruit was better on the fruit dusted with sulphur than on any of the plats; there seemed to be no burning or russeting whatsoever resulting from this dust.

The percentages of worms were so small and so uniformly distributed over all plats alike that a detailed comparison of the different plats is impossible.

For the purpose of determining which applications were most important for scab control and which ones, if any, could be omitted and still obtain as good control, a series of seven plats were treated with copper-lime dust (10-10-00). Plat 1 was given all seven applications and in the other six plats various applications were omitted. The material used was too ineffective for scab control to warrant any conclusions, however, the data obtained will be given in this paper. The following tables show plan of experiment, ^{numbers of total} fruit and percentages of sound and infected fruit, variety treated and material used.

Plat No.	Application No.							Sound	Scab.			Aphis	Worm
	1	2	3	4	5	6	7		Total	Sev.	Light		
1	X	X	X	X	X	X	X	70.1%	25.0%	5.1%	16.9%	5.0%	3.1%
2		X	X	X		X	X	61.6%	31.1%	10.2%	19.6%	1.1%	2.9%
3			X	X		X	X	61.4%	33.4%	9.4%	20.5%	2.6%	1.7%
4		X		X		X	X	54.1%	40.8%	24.0%	24.7%	2.0%	2.3%
5		X	X			X	X	54.3%	62.2%	10.6%	42.3%	3.1%	1.0%
6		X	X	X				57.5%	57.7%	14.1%	33.6%	5.0%	2.0%
7		X	X	X			X	44.8%	50.6%	10.6%	37.2%	2.9%	1.6%
C- A								38.0%	69.9%	26.2%	41.3%	2.6%	1.2%
C- B								34.6%	62.1%	22.8%	51.1%	6.1%	0.7%

Table 12- Results of dusting and spraying experiments in the orchard of T.N. Thompson, Harrisonburg, Va. Applications made as follows: (1) - Delayed dormant; (2) Pink Stage; (3) Calyx cup; (4)-10 days after 3, (5) 3 weeks after 3; (6) June 30; (7) July 15. Plats 1-7 inclusive copper-lime dust (10-10-80). C-A and C-B check plats. X, application made, blank, application omitted. Variety Winesap. Aphis column includes apples effected with both scab and aphis.

Plat No.	Application No.							Sound	Scab.			Aphis	Worm
	1	2	3	4	5	6	7		Total	Sev.	Light		
1	X	X	X	X	X	X	X	72.1%	3.6%	1.1%	1.6%	1.5%	16.8%
2	X	X	X	X		X	X	73.3%	11.8%	1.9%	6.2%	1.7%	2.6%
3			X	X		X	X	73.4%	19.0%	2.2%	14.7%	2.1%	1.6%
4		X		X		X	X	65.7%	10.1%	2.5%	7.2%	0.4%	1.7%
5		X	X			X	X	80.3%	15.1%	3.2%	10.7%	1.2%	0.9%
6		X	X	X				79.9%	13.0%	1.8%	9.8%	1.4%	1.8%
7		X	X	X			X	79.3%	14.5%	1.3%	11.6%	1.6%	0.8%
C- A								76.4%	15.7%	2.6%	12.3%	0.7%	5.6%
C- B								74.6%	21.5%	3.5%	16.4%	1.6%	1.6%

Table 13- Results of dusting and spraying experiments in the orchard of T.N. Thompson, Harrisonburg, Va. Applications made as follows: (1) - Delayed dormant; (2) Pink Stage; (3) Calyx cup; (4)- 10 days after 3, (5) 3 weeks after 3; (6) June 30; (7) July 15. Plats 1-7 inclusive copper-lime dust (10-10-80). C-A and C-B check plats. X, application made, blank, application omitted. Variety Stayman. Aphis column includes apples effected with both scab and aphis.

Practically no scab was seen on foliage or fruit of the sprayed plots at this time. Considerable spray burn occurred on the foliage and fruit of the three sprayed plots this probably being due to the delayed dormant application of 1-9 lime sulphur. All dusted plots showed very slight scab infection on foliage and the fruit infection showed up to be moderate. The potato dust and copper lime dust caused a slight russetting of fruit and the foliage was burned slightly while the sulphur dust seemed to have no injurious effect either on the fruit or foliage; in fact the fruit and foliage on this plot showed better quality finish and color than any of the sprayed, dusted or check plots. The tow check plots showed severe scab infection on the Winesap fruit and moderate infection on Stayman fruit. Moderate infection was shown on the foliage of the two varieties. No appreciable amount of fruit drop or defoliation occurred on any of the sprayed, dusted or check plots. Foliage infection at harvest season was about the same for the plots as described for Mid-season. The russetting, which occurred most severe on sprayed plots and slight on dusted plots, had about disappeared by harvest season and there was practically no commercial loss from this injury.

For the purpose of determining the time that the maximum number of ascospores of the scab fungus were discharged a number of spore traps were placed in the Thompson orchard. Examinations were made of leaves at beginning of season and over those, that were found to have scab perithecia on them, were placed glycerine coated glass slides. The slides were kept about 1/8 inch above the leaf by the use of short pieces of glass rods which were laid on leaf. In order to protect these slides and also to keep a moist condition for the discharge of the ascospores, petri dish tops were placed over the leaf and slide. These slides were taken up and others replaced several times during the first of the season and microscopic examinations were made of them. This method was not very satisfactory for catching the spores, however, a few were caught on several of the slides. Work in the orchard at Grosset made it impossible to make as frequent examinations of the spore traps as should have been made thus precluding good results in this phase of the work. The total number of traps used were 26 and these were distributed throughout plots showed in Map. 5. Two traps were placed in each row. The following table shows relative numbers of spores found on the slides.

Examination No.	Date Examined	No. slides on which spores were found	Relative number of spores on slides.
1	Apr. 22	13	very few
2	May 22	0*	
3	May 25	16	few

Table 14- Showing ascospore discharge data.

* The reason that no spores were found at this examination was because of the very dry condition of the slides due to the fact that they had been in orchard for about one month before they were examined.

The above table does not give enough data to warrant any conclusions as to the time of maximum ascospore discharge but it may be approximated that this date was sometime about the middle of May. The times of application for the different dusts and sprays however were not regulated by these spore discharges because the various application times had been previously

decided on

Codling Moth Band Records.

Codling moth bands were placed on fifty trees in this orchard the type of band and method of banding was the same as in the Gentry Bros.' orchard. Examinations were made several times during the season and no larvae were found under any of the bands. As the results in this orchard were negative in regard to codling moth it is unnecessary to tabulate any data obtained. The/ very small percentages of worms occurring in the different plots correlated with the fact that no larvae were found in the bands shows that this orchard was almost entirely free from codling moth infestation.

Results obtained in this orchard show that scab was effectively controlled by the spray applications. Of the three dust mixtures used the sulphur dust was most effective. This gave practically as good control of scab on the less susceptible variety, Stayman, as the spray mixtures, but was less effective on the more susceptible variety, Winsap^c. Worm percentages in this orchard were too small and too uniform for all plots alike to draw any comparative conclusions. The modified bordeaux mixture (3-10-50) which was used for the first three spray applications on plot 8 instead of commercial lime-sulphur spray caused considerable burning of the foliage and fruit and its use at this time does not seem desirable. The dry lime sulphur spray gave almost perfect scab control.

Summary of Experiments in Apple Orchards.

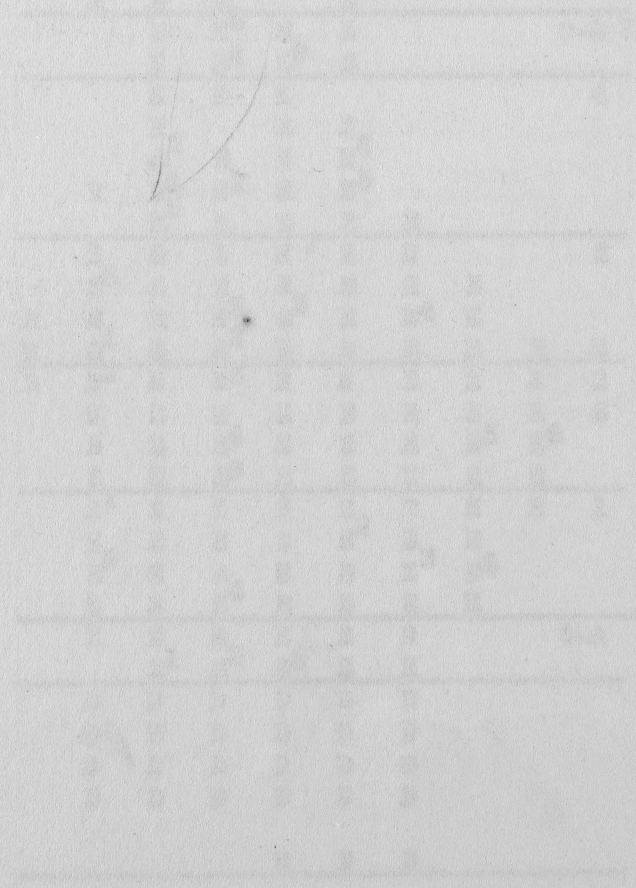
Results obtained with the (5-10-55) and the (10-10-50) copper-lime dusts for bitter rot control on pippins were decidedly unsatisfactory and neither material apparently gave any measure of control, while the spray applications of Bordeaux mixture gave very satisfactory control.

The distribution of blotch in the Ben Davis orchard was not uniform enough to draw any conclusions as to the comparative effectiveness of dust or spray for the control of this disease.

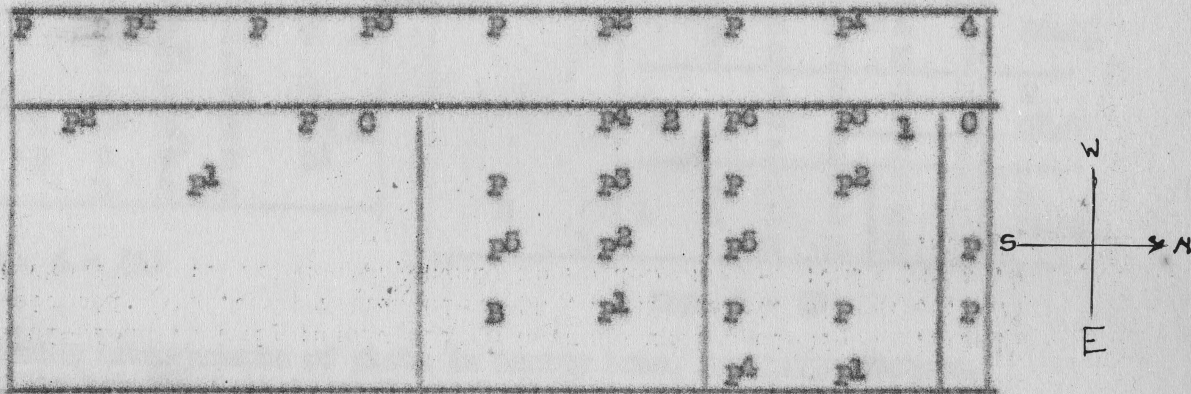
Neither of the three dusts gave satisfactory control of scab in the Thompson orchard on the Winsap variety. The sulphur dust gave considerably better control, however, than

either the copper-lime or the potato dust mixture and was practically as good as the spray mixtures on the less susceptible variety, Stayman. On account of the ineffectiveness of the copper-lime dust mixtures for the control of scab it was impossible to get any definite information as to which applications were most important for scab control.

The different dust mixtures gave as effective control for codling moth in all three orchards as the standard sprays.



The following table shows the results of the various treatments in the different orchards. The results are given in percentages of fruit affected by scab and by codling moth. The results are given for the different varieties of apples and for the different treatments. The results are given for the different orchards and for the different years. The results are given for the different treatments and for the different varieties of apples. The results are given for the different orchards and for the different years. The results are given for the different treatments and for the different varieties of apples.



Map 3. Plan of experiment conducted in Gentry Bros. Pippin orchard Crozet, Va. Trees inclosed in black lines include the various plots; plot numbers in upper right hand corner of plots. The exponents represent the count trees in plots and are given in the order that the counts were taken.

Plot 1. Copper-line dust (10-10-50)

Plot 2. Copper-line dust (5-10-55); C, check plots; 4, spray plot; P, Pippins, B, Ben Davis.

S	S	S	S	S	S	S	S	11
S	S	S	R	S	S	S	S	W
S	S	S	V	R	S	S	V	S
V	S	S	S	Y	Y	X	S	10
S	S	S	S	H	S	S		9
S	S	R	?	S	S	R		
Road	S	V	S	S	W	V	X	C-B
S	V	W	S	W	?	W	W	0
S	S	S	S	S	W	V	W	
V	S	W	S	S	W	S	W	X
S	S	S	S	S	S	W	W	W
V	W	S	W	S	W	W	W	W
Road	V	S	W	W	W	R	V	V
S	S	R	W	S	W	W	S	S
V	S	W	W	W	S	S	W	W
S	V	W	W	S	W	S	W	W
V	S	W	W	W	W	S	W	R
S	S	W	W	W	?	W	W	W
S	S	W	W	S	S	W	W	R
Road	V	W	W	W	S	S	S	X
V	W	W	S	S	S	W	H	W
W	S	W	X	W	S	W	W	X
V	W	W	W	W	W	W	W	S
V	H	W	W	W	W	W	W	W
O	O	O	O	O	O	O	O	O

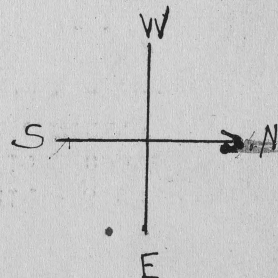


Fig 5. Plan of experiment conducted in the Thompson orchard, Harrisonburg, Va. Trees included in black lines represent the various plots; plot numbers shown at side of plot. S, Stayman; W, Winesap; H, Harroth Blk. Twig; Y, York; X, missing trees; R, replants; ?, unknown variety; O, trees not in plot.