Howard, Here's that list I promised you. It is broken down by counties with the Commercial men at the end. Carl Vaughan asst County Agt
How was your meeting at Hendersonville.

COOPERATIVE EXTENSION WORK

IN

AGRICULTURE AND HOME ECONOMICS

STATE OF NORTH CAROLINA

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING, NORTH CAROLINA COUNTIES AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

EXTENSION SERVICE COUNTY AGENT WORK

NAMES OF THOSE ATTENDING APPLE PEST CONTROL SCHOOL
NORTH WILKESBORO, N. C.
JANUARY 10th & 11th

WILKES COUNTY GROWERS

Jonah A. Parker, Oakwoods, N. C.
Talmadge D. Fletcher, Oakwoods, N. C.
M. Davis, Pores Knob, Rt. 1
John E. Joines, Pores Knob, Rt. 1
Daniel Tedder, Pores Knob, Rt. 1
J. M. Costner, Pores Knob
Greene Bumgarner, Pores Knob
Charlie W. Carlton, Boomer, Rt. 1
Arvil R. Johnson, Boomer
Ralph J. Campbell, Wilkesboro, Rt. 2
Robert L. Morehouse, Oakwoods, N. C.
J. M. Crawford, N. Wilkesboro
Clyde Waugh, N. Wilkesboro
M. V. Robertson, Pores Knob
C. J. Hendren, Pores Knob
W. B. Anderson, Sun Crest Orchard, N. Wilkesboro
C. E. Tharpe, Ronda
S. C. Stewart, Rt. 3, N. Wilkesboro
W. H. H. Waugh, Rt. 3, N. Wilkesboro
J. A. Marlow, Gilreath
Blaine R. Davis, Oakwoods
W. P. Calderon, Oakwoods
Brice Johnston, N. Wilkesboro
D. S. Broyhill, Pores Knob
Ervin Sovert, Pores Knob
Clinton Broyhill, Pores Knob
William F. Steele, Pores Knob
Lloyd Broyhill, Boomer
I. J. Broyhill, Boomer
E. I. Ball, Gilreath
J. W. Andrews, Boomer
Kenneth Broyhill, Pores Knob
J. P. Choplin, County Agent, Wilkesboro
C. E. VanDeman, Wilkesboro

LINCOLN COUNTY

Dale Leatherman, Vale
Hanston, Sain, Vale
B. G. Leatherman, Vale, Rt. 1
J. L. Sain, Vale, Rt. 1
D. Rush Beam, Vale, Rt. 1
L. C. Anosteller, Vale,

ALEXANDER COUNTY

Price Brawley, County Agent, Taylorsville
W. M. Osborne, Box 353, Taylorsville
Lindsay Childers, Rt. 3, Taylorsville

ALEXANDER COUNTY CONT'D.

Vance Childers, Rt. 3, Taylorsville
H. G. Crowgey, Janfu Orchard, Taylorsville
Roscoe T. Lowe, Rt. 2, Pores Knob
Brack Deal, Pores Knob
Lonnie Scott, Taylorsville
Henry G. Lowe, Pores Knob
Boyd Campbell, Janfu Orchard, Pores Knob

YADKIN COUNTY

B. E. Ferguson, Highland Orchard, Jonesville
A. M. Ferguson, Highland Orchard, Jonesville
J. J. Morrison, Jonesville

ASHE COUNTY

Charles E. Gardner, Ass't. County Agent, Jefferson
W. T. Harless, West Jefferson
Quiney H. Ashley, Warrensville
James A. Graham, Upper Mtn. Expt. Station, Laurel Springs

WATAUGA COUNTY

C. H. Kirkman, Jr. Assistant County Agent, Boone
L. E. Tuckwiller, County Agent, Boone
D. T. Brown, Zionesville, N. C.
Albert Watson, 430 Howard St., Boone

IREDELL COUNTY

R. W. Murdock, County Agent, Statesville
F. P. Morrison, Statesville

CATAWBA COUNTY

Ernest Lail, Conover, Rt. 1

AVERY COUNTY

W. L. Franklin, County Agent, Newland
Buster E. Hayes, Elk Park

ALLEGHANY COUNTY

Clifford F. Pendry, Laurel Springs

CALDWELL COUNTY

Max Culp, County Agent, Lenoir
D. A. Smith, Box 603, Lenoir
G. C. Henman, Rt. 8, Lenoir
C. M. Hamlet, Rt. 8, Lenoir
Vernon Hollars, Rt. 8, Lenoir

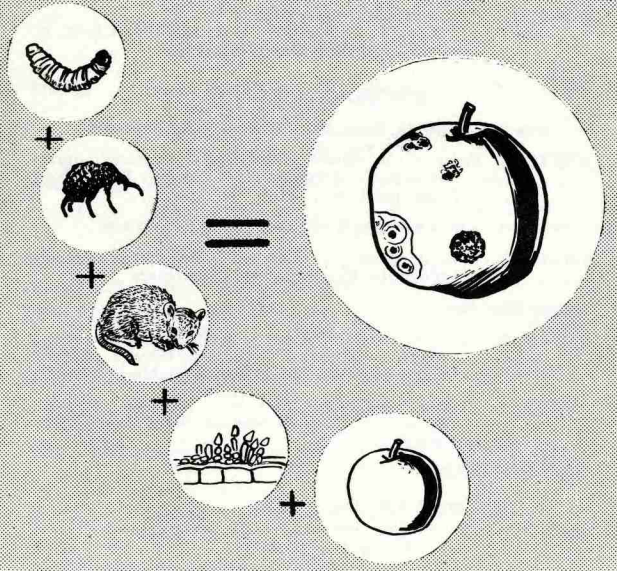
CLEVELAND COUNTY

R. C. White, Belwood, Rt. 1
B. P. Jenkins, Jr., County Agent, Shelby
Herbert F. Grigg, Shelby, Rt. 4
B. I. Towesy, Lawndale, Rt. 1
Everett Lutz, Belwood, Rt. 1
C. J. Dellinger, Cherryville, Rt. 1
Wayne L. Ware, Kings Mtn. Rt. 2

COMMERCIAL MEN

Phil Arey, Montverde, Fla. (U. S. Rubber Co.)
A. N. Pratt, Roanoke, Va. (American Fruit Growers, Inc.)
R. W. Cummings, State College, Raleigh N. C.
C. J. Nusbaum, State College, Raleigh, N. C.
W. E. Akin, Jr. 2294 Cottage Grove Ave. SE, Atlanta Ga. (U. S. Rubber Co.)
James F. White, Denver, Colo. (Julius Hyman & Co.)
Joe E. Micheal, Boone, N. C. (Southern Agric. Insecticides)
David C. Kennedy, 410 Washington Bldg. Wash, D. C. (Buffalo,Turbine)
Robert Tutt, Gowanda, N. Y., (Buffalo,Turbine)
Fred W. Willis, 1319½ Main St., Columbia, S. C. (Willis Chem,, Inc.)
E. H. Brewer, Food Machinery Corp., Niagara Division (No address)
F. H. Blackwell, Roanoke, Va. (John Bean Mfg. Co.)
Leslie Keith, Roanoke, Va. (Growers & Producers Exch.)
H. J. Burnette, Roanoke, Va. (Growers & Producers Exch.)
A. J. Borders, Hickory, N. C. Box 352, Gulf Oil Corp.
S. E. Owen, Jr1,Atlanta, Ga., Gulf Oil Corp.
Gordon A. Brandes, 222 W. Washington Sq. (Rohn & Haas Co.) Phila. 5, Penn.
Lewis Nelson, N. Wilkesboro, N. C. (Esso Standard Oil Co.)
J. O. Rowell, Extension Entomologist, Blackburg, Va.
Edwin Gould, Kearneysville, W. Va.

LET'S GO TO SCHOOL!



HIGH SCHOOL AUDITORIUM—HENDERSONVILLE, N. C.

JANUARY 13-14, 1949

CONDUCTED BY N. C. AGRICULTURAL EXTENSION SERVICE

COOPERATING WITH

THE N. C. AGRICULTURAL EXPERIMENT STATION & U. S. FISH & WILDLIFE SERVICE

DWIGHT W. BENNETT, County Agent,

Henderson County, presiding

Program January 13

9:45-10:00 *Welcome and introduction of guests*— by D. W. BENNETT

10:00-10:15 *Future Apple Research Plans*— RALPH W. CUMMINGS, Associate Director N. C. Agricultural Experiment Station

ENTOMOLOGY SECTION

JAMES T. CONNER, Extension Entomologist, Chairman

10:15-10:30 *Some of the factors which determine insect population*— Z. P. METCALF, Head, Zoology-Entomology Department, N. C. State College

10:30-10:50 *Know your apple insects*—JAMES T. CONNER

10:50-11:20 *Timing of sprays*—EDWIN GOULD, West Virginia University, Kearneysville, W. Virginia

11:20-11:25 *Recess*

11:25-12:05 *Items to consider in the selection and use of spray materials*—WILLIAM A. BAKER, Bureau of Entomology and Plant Quarantine, Washington, D. C.

12:05-12:30 *Testing new insecticides in a problem orchard*— CLYDE F. SMITH, Entomology Dept., N. C. State College

12:30- 2:00 *Lunch*

Insects Affecting the Fruit

2:00- 2:30 Codling moth and apple maggott— WILLIAM A. BAKER

2:30- 2:40 Plum Curculio and Plant Bugs— CLYDE F. SMITH

Insects Affecting Fruit and Foliage

2:40- 3:10 Aphids and red banded leafroller— EDWIN GOULD

Insects Affecting the Foliage, Trunks and Branches

3:10- 3:30 Mites, leafrollers, scales, borers— CLYDE F. SMITH

3:30- 3:55 *Rodent Control*—LARRY C. WHITEHEAD, U. S. Fish & Wildlife Service, N. C. State College

3:55- 4:00 *Recess*

PATHOLOGY SECTION

HOWARD R. GARRISS, Extension Plant Pathologist, Chairman

4:00- 4:30 *Plant Diseases*—how they behave and methods of fighting them—C. JOE NUSBAUM, Plant Pathology Section, N. C. State College

ADJOURN

7:00 til Open Discussion for Individual Orchard Problems, Vegetable Insects and Diseases.

Program January 14

9:45-10:25 *Apple Scab and Blotch*—HOWARD R. GARRISS

10:45-11:00 *Rots and Rusts*—CARLYLE N. CLAYTON, Plant Pathology Section, N. C. State College

11:00-11:05 *Recess*

11:05-11:20 *Fire Blight—What about it?*—CARLYLE N. CLAYTON

11:20-12:05 *Recent trends in the development of fungicides*— LOWELL W. NIELSON, Plant Pathology Section, N. C. State College

12:05-12:50 *Results of fungicidal spray experiments*—CARLYLE N. CLAYTON

12:50- 2:00 *Lunch*

2:00- 2:50 *Maintenance and Care of spray equipment*—F. H. BLACKWELL, John Bean Manufacturing Co., Lansing, Michigan

2:50- 3:35 *General discussion insecticides and fungicides*

3:35- 3:40 *Recess*

3:40- 4:00 *Spray Program for 1949*
Announcements and Adjournment—D. W. BENNETT

COOPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS
STATE OF NORTH CAROLINA

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING, NORTH CAROLINA COUNTIES AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

EXTENSION SERVICE
COUNTY AGENT WORK

Hendersonville, N. C.
January 31, 1949

Mr. Howard Garriss
Extension Plant Pathologist
State College Station
Raleigh, N. C.

Dear Mr. Garriss:

Please allow us to thank you for the excellent Apple Pest School which you put on in Hendersonville on January 13th and 14th. I have heard more apple growers state since the school that this was one of the best that we have had for the apple growers.

We think that yours and Dr. Clayton's part was unusually good. The mimeographed sheets and all you gave out should be of special value to the growers. We will be looking forward to working with you again in the near future.

We hope that you have adapted yourself to your new shoe which you were wearing while here and will soon be able to be out with the County Agents again. We think you are doing one of the finest jobs of any specialist for the farmers of North Carolina.

Looking forward to seeing you again soon, we are

Sincerely yours,

T. N. Renshaw

T. N. Renshaw, President
Blue Ridge Apple Growers Ass'n

D. W. Bennett

D. W. Bennett
County Agent

cc: Dr. Carlyle Clayton

Apple Pest Schools 1949

C. J. Nusbaum

When Mr. Garriss and Dr. Clayton asked me to make this introductory talk on the behavior of plant diseases and ways of fighting them, my first thought was "How in the world can anyone speak on such a broad subject and know where to begin." There are more than 6,000 different diseases of economic plants in the U. S. and, in fact more than a hundred on apple, more than a hundred on corn and nearly a hundred on wheat. Every one of these diseases behaves differently and each one is a separate problem when it comes to control. I don't mean to imply that all of these diseases are serious. As a matter of fact, losses from most of the lesser troubles do not reach high percentages. Like the common cold, they are always with us. They may injure or kill a plant here or there or reduce production by 2 or 3 per cent. Even if the grower is conscious of them, he has come to look upon them as necessary evils to be accepted as part of the gamble in farming. In our experience it has been noted generally that farmers are not concerned with any plant disease until the loss reaches 12 to 15 per cent of the crop, and he rarely is willing to take steps to prevent it until the loss mounts to 20 to 25 per cent. Therefore, our main concern is with those diseases which are capable of causing losses great enought to threaten profitable production. Speaking of profitable production, however, raises a point that many of us may overlook. The American farmer, in contrast to the American businessman, often ignores the small leaks that eat

into his profits. In times of prosperity, of favorable growing seasons, and high prices, such small losses, needless though they may be, can be borne by the farmer without hardship. But in recurring periods of low agricultural prices the farmers plight becomes acute. Although diseases losses are felt at all levels of farm prosperity, they are most acute in those enterprises where the margin of profit is small. In such cases even a moderately small loss may mean the difference between survival and failure.

The fact that there are so many diseases on so many different crops has had a great influence on the development of the service of plant pathology. The study of plant diseases began in this country quite recently - in fact, only about 50 or 60 years ago and was brought in by necessity. In this early pioneering period most of the work was done on diseases of orchard fruits because devastating disease epidemics threatened to wipe out the rapidly expanding fruit growing industry in thiscountry about the turn of the century.

Prior to this time there were few orchards. Transportation had not been developed and marketsfor fruit were very limited. In these early days there were few diseases of consequence. However, as the population of our cities grew and transportation facilities increased, markets for fruits expanded and the acreage of fruit increased by leaps and bounds. Large commercial orchards came into being and cultural methods were intensified. The growing canning industry further increased the demand for fruits. Consumers became more discriminating and this brought about improvement in the standards of quality. In fact the culture of fruits became civilized. However,

while all this was going on, plant disease germs were not idle. They found it easy to travel from one part of the country to another in rotten fruits and on diseased nursery stock. Spreading and multiplying unchecked, they went on a rampage and threatened to wipe out the fruit growing industry in many parts of the country. It is not surprising that, in the face of this emergency, some of the first achievements in disease control in this country were made by plant pathologists working on fruit diseases. Since time was an important factor, most attention was given to methods of control which would be reasonably effective or at least effective enough to permit profitable fruit production. Studies of the behavior of the disease organisms and on the seasonal development of the various diseases were not neglected entirely, however. It was necessary to gain some understanding of disease behavior in order to aid the work on control. It was in this period that the use of protective sprays of copper and sulphur was established as standard orchard practice. By about 1910 most of the important fruit diseases had been worked over and control measures had been developed in time to save the fruit industry. Since the pressure was at least temporarily relieved, research on fruit diseases slowed up and plant pathologists turned their attention to serious problems on other crops. You see, in those days there were only a few trained plant disease specialists, not nearly enough to handle all of the problems. The rust epidemic in 1915, which nearly destroyed the wheat crop, gave great impetus to research on diseases of cereal crops. Also such diseases as potato late blight, cabbage yellows, watermelon wilt, bean anthracnose and others stimulated interest in vegetable diseases. Much attention also was given to such devastating diseases as chestnut

blight and white pine blister rust both of which invaded the U. S. from foreigh countries. All of this work served to lay a firm foundation for the study of diseases of all of the groups of economic crops and to pave the way for later accomplishments.

Although most plant diseases are caused by germs, mainly the fungi and the bacteria, each disease situation presents a separate and distinctive problem. Control measures must be designed to suit the conditions of the disease. These conditions are regulated not only by the behavior of the germ but also by the nature of the plant, the place where it is grown and the climate. In searching out and using control measures, we must make use of every factor in our favor and take advantage of every weakness in the cycle of the disease. The fungi and other organisms that cause plant disease are very resourceful. They are very well adapted to the conditions under which they develop. Otherwise they would not have survived in nature. They are actually minature plants which attack and prey upon larger plants. They are so small that it takes a microscope to see them. What they lack in size they make up in numbers. Some of these fungi have acquired the ability to withstand very adverse circumstances in order to perpetuate themselves. Now if we are going to fight these disease organisms successfully, we must know how they are going to behave under all possible conditions. If a general expects to win battles, he must have a good intelligence service so that he might knowthe strength and weakness of the enemy. If the F.B.I. expects to bring criminals to justice, if must use scientific methods of crime detection. Moreover it must constantly strive to improve these methods.

In our fight against plant diseases we are striving to learn more and more about the behavior of the disease germs and to improve our methods of combating them. At the present time there are about 1,000 trained plant pathologists working in the U. S. Because certain diseases or groups of diseases present special problems, these plant pathologists have specialized. At State College we have 12 plant pathologists, each giving attention to the diseases of certain crops such as cotton, tobacco, fruits, peanuts, vegetables, grains, etc. Some of our problems are receiving adequate attention, others are not.

Now as far as fruit diseases are concerned - what are the main considerations.

1. We are working with a long-lived plant that is propagated vegetatively rather than by seed.

   Therefore, the diseases of infancy are not important. This is in contrast to crops that are grown from seed and that suffer from seedling diseases. We are not concerned with seed treatments. With orchard fruits, crop rotation is also out of the question. Since we cannot move away from heavy disease situations, we must give serious consideration to orchard sanitation.

2. Cultural practices, such as spacing fertilization, cover crops, cultivation, pruning, etc. affects vigor and the character of growth and indirectly influences disease development. Many diseases build up quickly in orchards that are overcrowded, neglected, or improperly managed.

3. The fruit portion of the trees is delicate, perishable, and susceptible to fungous attack.

4. Most of the diseases affect the above ground parts of the

plant. In contrast most of the diseases of such crops as tobacco and sweet potato affect the underground parts. The environmental conditions of the atmosphere - that is temperature and moisture - fluctuate more than the environmental conditions in the soil, but they are not as complicated as the soil conditions.

5. There is a rather wide difference in susceptibility to certain diseases by different varieties. Is it possible to breed new disease resistant varieties of fruits. It is possible but is not very promising because of the many hindrances.

a. Plant too long lived. It would take too long to evaluate breeding stocks in generations after making crosses.

b. Too many diseases involved. Its hard enough to breed for for resistance to one disease. Each additional disease complicates the problem manyfold.

c. Commercial value is based upon subtle characters such as color, taste, texture, aroma, keeping quality, etc. Its not a simple matter to make changes. It is possible but would be costly.

6. Eradication. Cannot be accomplished by rotation as mentioned previously. However, new eradicant fungicides are showing some promise as Dr. Clayton will point out later.

7. Protection. This method of disease control is emphasized as far as orchards are concerned.

In the last 20 years or so most of the major fruit diseases have been undergoing a careful working over. Studies of the disease organisms

have been intensified to improve our understanding of disease behavior.

1. Why do we have so much fluctuation in disease severity from season to season? Why is scab worse in some years than others?

2. Why are disease situations worse in some orchards than in others?

3. Why are certain diseases harder to control in some orchards than in others?

4. Will it be possible to forecast epidemic outbreaks through study of populations of disease organisms and through the use of long range weather predictions.

As far as control is concerned we are seeking more efficient methods and materials.

1. More certain in effectiveness
2. Less laborious
3. Less expensive
4. Less injurious totrees or fruits.

There are two important handicaps in putting over a program of protection.

1. The grower can't see what he is fighting against. If the grower has no understanding of some of the fundamental concepts of disease behavior, he may have difficulty in properly using the vast fund of information that is available on plant disease control. We can usually do a job better if we know why we are doing it as well as how to do it.

2. In most cases we can only protect - we can't cure plants of disease If an apple fruit becomes infected with scab, it is a cull for keeps. There is no recovery. We must "beat the disease germs to the punch."

COOPERATIVE EXTENSION WORK

North Carolina State College of Agriculture and Engineering
North Carolina Counties and United States Department of Agriculture Cooperating

IN
AGRICULTURE
AND HOME ECONOMICS
STATE OF NORTH CAROLINA

Extension Service
Plant Pathology

State College Station, Raleigh, N. C.

August 23, 1948

2nd Notice

To: Certain County Agents

Subject: Apple Pest Control Schools

Two Extension Schools on Apple Pests and Their Control have been scheduled for January. One of these will be held in the Wilkesboro area on January 10 and 11 and the other in the Hendersonville area on January 13 and 14. These schools are designed to take care of the many requests we have received from county agents, growers, equipment and material supoliers, and others which we have not been able to take care of otherwise because of limited personnel in our lines of work.

These schools have been arranged at the insistence of the county agents and growers in the major apple-producing areas, especially in the Brushy and Blue Ridge Mountains. These two 2-day schools will be concerned only with the problems of diseases, insects and rodents, and will be designed to bring to all concerned the very latest information available on the control of these pests.

The final program has not been completed as yet, however, as soon as it is you will receive copies to mail out. In the meantime, please indicate to us how many copies of the completed program you would like to have for mailing and announce the schools as often as possible, as we are planning a full program which we think will be well received.

?

Yours very truly,

Howard R. Garriss

Howard R. Garriss
Extension Plant Pathologist

JTC

James T. Conner, Jr.
Extension Entomologist

COOPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS
STATE OF NORTH CAROLINA

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING, NORTH CAROLINA COUNTIES AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

EXTENSION SERVICE
PLANT PATHOLOGY

State College Station, Raleigh, N. C.
Box 5397
December 21, 1948

Dear Friend:

We are enclosing copies of the two Apple Pest Control Schools which will be conducted in January at Wilkesboro and at Hendersonville, North Carolina. If you require additional copies of these programs please let us know immediately.

Reservations for rooms should be made individually or by requesting that they be made through Mr. Carl E. VanDeman, Assistant County Agent, Wilkesboro, for the Wilkesboro school, or Mr. D. W. Bennett, County Agent, Hendersonville, North Carolina, for the Hendersonville school. Regarding rates and reservations in Wilkesboro, they are as follows:

Wilkes Hotel - $3.00
Call Hotel - $1.50 and $2.00
The Greenway Tourist Home
The Midway Tourist Home
The M. W. Green Tourist Home, Highway No. 18 in N. Wilkesboro

Accommodations in Hendersonville include:

Terrace Court Hotel - $3.50 for singles
$2.50 for room with twin beds
Bowen Hotel - $2.00 to $3.50. Two dollar rooms have no bath and double beds where two or more are staying in one room.
Skyland Hotel - $5.00 for room with twin beds
$3.50 for singles
Hendersonville Inn - $2.50 single with bath
$1.50 single without bath

If anyone is desirous of bringing exhibits, equipment, or materials a limited amount of space is available for this purpose. The arrangements for these exhibits should be made through Mr. VanDeman in Wilkesboro and Mr. Bennett in Hendersonville.

We are looking forward to having excellent schools, and we hope that you will give them all the publicity possible in your area.

P. S. Copies previously requested by you will arrive under separate cover.

Very truly yours,
J. T. C

James T. Conner, Jr.
Extension Entomologist
Howard R. Garriss
Howard R. Garriss
Extension Plant Pathologist

Enclosures

COOPERATIVE EXTENSION WORK

North Carolina State College of Agriculture and Engineering
North Carolina Counties and United States Department of Agriculture Cooperating

IN AGRICULTURE AND HOME ECONOMICS
STATE OF NORTH CAROLINA

Extension Service
Plant Pathology

State College Station, Raleigh, N. C.

August 23, 1948

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Yours very truly,

Howard R. Garriss

Howard R. Garriss
Extension Plant Pathologist

JT

James T. Conner, Jr.
Extension Entomologist

OK

One Copy - 5 doubt if we will have any farmers to attend the school Murphy N.C. A.P. Ketner Co Agent

COOPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS
STATE OF NORTH CAROLINA
STATE COLLEGE STATION, RALEIGH, N. C.

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING, NORTH CAROLINA COUNTIES AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

EXTENSION SERVICE

December 3, 1948

The North Carolina Agricultural Extension Service will conduct two Apple Pest Control Schools in January 1949. The first of these will be in Wilkesboro, North Carolina on January 10 - 11 and the second in Hendersonville on January 13 - 14. The program has not been printed as yet, though as soon as it is, we will send one along to you. These schools will be concerned with insects, diseases and rodents.

Knowing of your interest in the new materials especially, as well as equipment for their application, we hope that you will send a representative from your company to attend these two schools. Manufacturers of basic materials certainly should be represented to discuss their products, especially in the open forum period.

Limited exhibit space will be available for the display of materials and small pieces of equipment. If you would like to obtain display space, please get in touch with Mr. Carl E. VanDeman, Assistant County Agent, Wilkesboro, North Carolina and Mr. D. W. Bennett, County Agent, Hendersonville, North Carolina for the arrangements.

When we send you a copy of the program, we will also send hotel reservation information.

Yours very truly,

James T. Conner, Jr.
Extension Entomologist

H. R. Garriss

H. R. Garriss
Extension Plant Pathologist

HENDERSON COUNTY FRUIT GROWERS SCHOOL

Sponsored by the
Blue Ridge Apple Growers Association
and
North Carolina State College
December 9-10, 1948

Hendersonville High School Auditorium (?)

December 9.

Mr. D. W. Bennett, County Agent, Hendersonville, N. C., presiding.

9:00 - 9:05 - Welcome to Henderson County - Mr. T. N. Renshaw, President Blue Ridge Apple Growers Association.

9:05 - 9:15 - Purpose of the Fruit Growers School, and announcements concerning the afternoon meeting. - Professor M. E. Gardner, Head, Department of Horticulture, N. C. State College.

9:15 - 9:45 - The control of poison oak, poison ivy, and honeysuckle in the apple orchard - Professor C. F. Williams, Department of Horticulture, N. C. State College.

9:45 - 10:25- The use of chemical sprays for blossom thinning and the prevention of pre-harvest dropping of fruit - Dr. C. P. Harley, U. S. Department of Agriculture, Beltsville, Maryland.

10:25-11:00 - What's in your fertilizer bag? - Dr. E. R. Collins, Extension Agronomist, N. C. State College.

11:00-11:05 - Recess.

11:05-11:40 - A suggested soil management program for Henderson County fruit growers - Professor J. G. Francis, Department of Horticulture, N. C. State College.

11:40-12:15 - Utilization of off-grade fruit - Dr. Ivan D. Jones, Department of Horticulture, N. C. State College.

12:15-12:30 - Question and answer period.

12:30 - Lunch

2:00 Demonstration to be held in T. N. Renshaw's orchard. Assemble at 7th Avenue E. just west of Mud Creek bridge at 1:30 P. M.

The afternoon demonstration to be held in the Renshaw orchard will be led by some of the speakers appearing on the morning programs and Mr. L. C. Whitehead of the U. S. Biological Survey, Raleigh, N. C.

Demonstrations will include rodent control, bridge and top grafting, and a pruning clinic.

December 10.

T. N. Renshaw, President, Blue Ridge Apple Growers Assqciation, presiding.

9:00 - 9:05 - Announcements.

9:05 - 9:35 - Some problems involved in the marketing of Henderson County apples - Mr. A. N. Pratt, American Fruit Growers, Inc., Roanoke, Virginia.

9:35 -10:05- Some causes contributing to the failure of trees to bear fruit - Professor M. E. Gardner, Head, Department of Horticulture, N. C. State College.

10:05 -10:45- Strawberry production - Professor E. B. Morrow and H. R. Niswonger, Department of Horticulture, N. C. State College.

10:45-11:15 - Dewberry and raspberry production - Professor C. F. Williams, Department of Horticulture, N. C. State College.

11:15-11:20 - Recess.

11:20 -11:40 -Attractive packaging as a means of increasing sales - Carl E. Van Deman, Assistant County Agent of Wilkes and Alexander Counties.

11:40-12:15 - Apple varieties - Mr. Carl E. Van Deman, Assistant County Agent, Wilkesboro, N. C.

12:15-12:30 - Question and answer period.

12:30 - Adjournment

BRUSHY MOUNTAIN FRUIT GROWERS SCHOOL

Sponsored by the
Brushy Mountain Fruit Growers Association
and
North Carolina State College
December 7-8, 1948

Community House, Pores Knob, N. C.
(On Route 16 between Wilkesboro & Taylorsville)

December 7.

Mr. H. G. Crowgey, President of the Brushy Mountain Fruit Growers Association, presiding.

9:00 - 9:05 - Welcome to the Brushy Mountains - Mr. Tom S. Jenrette, Secretary of the North Wilkesboro Chamber of Commerce.

9:05 - 9:15 - Purpose of the Fruit Growers School and announcements concerning the afternoon meetings in Wilkes and Alexander counties - Professor M. E. Gardner, Head Department of Horticulture, N. C. State College.

9:15 - 9:45 - The control of poison oak, poison ivy, and honeysuckle in the apple orchard - Professor C. F. Williams, Department of Horticulture, N. C. State College.

9:45 - 10:15 - The utilization of off-grade fruit - Dr. Ivan D. Jones, Department of Horticulture, N. C. State College.

10:15 - 10:50 - The possibilities for the production of strawberries as a supplementary crop in the Brushy Mountains - Professors E. B. Morrow and H. R. Niswonger, Department of Horticulture, N. C. State College.

11:00 - 11:40 - Some problems involved in the marketing of Brushy Mountain apples - Mr. A. N. Pratt, American Fruit Growers, Inc., Roanoke, Virginia.

11:40 - 12:10 - Apple varieties - Mr. Carl E. Van Deman, Assistant County Agent of Wilkes and Alexander counties.

12:10 - 12:30 - Question and answer period.

12:30 - Lunch served by the Pores Knob Home Demonstration Club.

2:00 - Demonstrations to be held in the ABC orchard. Assemble at the packing shed.

December 8.

Mr. Howard Gryder, Vice-President, Brushy Mountain Fruit Growers Association, Taylorsville, N. C., presiding.

9:00 - 9:05 - Remarks - Alexander County fruit grower.

9:05 - 9:35 - What's in your fertilizer bag? - Dr. E. R. Collins, Extension Agronomist, N. C. State College.

9:35 - 10:15 - A suggested soil management program for the Brushy Mountains - Professor J. C. Francis, Department of Horticulture, N. C. State College.

10:15 - 10:55 - Lessons we have learned in the organization and operation of Appalachian Apple Service, Inc. - Mr. Carroll Miller, Secretary-Manager, Appalachian Apple Service, Inc., Martinsburg, West Virginia.

10:55 - 11:00 - Recess.

11:00 - 11:40 - The use of chemical sprays for blossom thinning, and the prevention of pre-harvest dropping of fruit - Dr. C. P. Harley, U. S. Department of Agriculture, Beltsville, Maryland.

11:40 - 12:00 - Attractive packaging as a means of increasing sales - Mr. Carl E. Van Deman, Assistant County Agent of Wilkes and Alexander counties.

12:00 - 12:20 - Question and answer period.

2:00 - Demonstrations in the Janfu orchard in Alexander County. Assemble at the orchard on Route 16 between Wilkesboro and Taylorsville.

The afternoon demonstrations in the orchards will be led by some of the speakers who have appeared on the morning programs, and Mr. L. C. Whitehead of the U. S. Biological Survey, Raleigh, N. C.

Demonstrations will include rodent control, top and bridge grafting, and a pruning clinic.

APPLES - FUNGICIDAL SPRAY EXPERIMENT

C. N. Clayton, N. C. Agr. Exp. Station, Raleigh, N. C.

Delicious, Broyhill Orchard, Boomer, N. C.

Spray Programs	Fruits affected with				Russet Index	Fruit on ground Aug. 26	Defoliation on Aug. 26
	Bitter rot	Black rot on tree	Scab	Russet			
	%	%	%	%		%	%
Lime sulfur, 2-100, 3 sprays; Bordeaux 4-8-100, 4 sprays	0	3.5	1	0.5	0.2	29	35
Phygon, 3/4-100, 7 sprays	0.3	2.2	0	41.5	19.5	20	5
Fermate, 11/2-100, 7 sprays	0.2	2.6	1	0.1	0	20	3
None	4.7	---	7	---	---	41	---

Beginning at the pink stage, seven applications were made: 3/28, 4/12, 4/26, 5/10, 5/24, 6/9, 7/1.

Golden Delicious, McCuller's Orchard, Raleigh, N. C.

Spray Programs a/	Apples affected by		Foliage on trees Nov. 18
	Bitter rot a/	Black rot	
	%	%	%
Dry Lime-Sulfur, 6-100, 3 sprays; Bordeaux, 4-8-100, 5 sprays	1	27	4
Phygon, 3/4-100, 8 sprays	1	32	74
Fermate, 1.5-100, 8 sprays	4	39	70
Puratized, 1 pt.-100, 3 sprays; Zerlate, 1.5-100, 5 sprays	7	34	68
Bioquin 50W, 1-100, 8 sprays	3	39	29
Wettable sulfur, 6-100, 8 sprays	20	33	26
None	26	52	5

a/DDT (50%) 2-100+Parathion 1-100 in calyx: DDT, 2-100 in first and fifth covers.

b/Five bitter rot apples were suspended near the top of each tree on June 14 to furnish inoculum of the bitter rot fungus.

Bioquin caused leaf injury, resulting in more than 20% defoliation by June 4. Later in the fall more copper injury resulted on Bioquin and Bordeaux - sprayed trees. Bordeaux-sprayed fruits were considerably russeted. No injury resulted from use of Parathion plus DDT with the fungicides in the calyx application.

Apple Scab

Scab is one of the most serious diseases of apple. Only in well-sprayed orchards is scab kept at a low level year after year. In 1945 and 1946 scab was very serious. In one county alone it was estimated to have caused in 1946 a loss of $150,000 or more.

Apple scab affects fruits and leaves of all varieties of apple and closely related crab apples. The scab on pear, peach, and pecan are different being caused by distinctly different fungi. It is well-known that some apple varieties are more liable to scab infection and are more seriously affected by scab infection than are others. In North Carolina Red Delicious is probably the worst for scab; next in order are Rome, Limbertwig, Stayman, Black Twig, Bonum, Golden Delicious, Grimes, and Jonathan. No variety escapes scab in all seasons and under all conditions.

1. How does scab cause a loss to the orchardist?

   A. It reduces the quality of the fruit. The attractiveness of the fruit is destroyed. The size of the fruit is reduced. Scabbed apples shrivel quickly and do not keep well in storage. Scab spots often are places for entrance of rot fungi.

   B. Scab on the blooms and particularly on the stems of the young fruits cause them to drop, thus reducing the set of fruit.

   C. Scab infections on leaves cause stunted growth of twigs and fruits. Scabbed leaves often are deformed and frequently drop early in the season.

   D. Spraying for scab control always entails considerable expenditure of funds and labor.

2. What does scab look like?

   On leaves -- First lesions that appear early in the spring on the upper or lower surface of the leaf appear as dark blotches that become darker with age. The fewer the lesions the smaller they are. When the spots are numerous the leaves frequently are curled and dwarfed and often turn yellow and drop. Infections on the underside of the leaves during late summer and fall usually are small and rather indistinct. These are the sources of overwintering of the fungus.

   On blooms -- On the calyx and pedicels (stems) of the young fruits dark blotch-like spots result from infection by the scab fungus. Once these parts are infected the result is either a fallen fruit or a scabby one.

On twigs -- Lesions on twigs are uncommon. However shallow, small blister-like lesions do occur at times on vigorous young shoots.

On fruits -- Scab spots on fruits usually have a definite margin and are nearly black in color. They frequently show a whitish margin which is formed by pushing up the cuticle of the fruit. The center of large old spots may be quite cracked and corky in appearance. The fruits are often deformed on the side on which large scab spots are present. Late seasons infections usually are small. On very susceptible varieties scab infection may continue to develop and show up in storage.

3. How does the scab fungus overwinter?

The scab fungus overwinter in scab infections in overwintered apple leaves. Infected twigs are not believed to be important in the life history of the scab organism.

4. Why is early season control of scab so important?

It is important for if one fails to control it then, it is too late. The reason for this is that the spores of the fungus in overwintered leaves become mature and are discharged during rainy weather during the 4 to 6 weeks period from the time the apple buds are in the delayed-dormant stage of development until about 2 weeks after petal-fall. Usually the majority of the spores mature between the pre-pink and calyx stages. If this so-called primary infection is prevented from happening there are no further crops of spores to cause scab infection. However, where there is a heavy carry-over of scab inoculum in overwintered leaves, it is practically impossible to prevent all primary infection.

5. What conditions are necessary for an apple leaf or fruit to become infected by a scab spore?

In order for a spore to germinate and cause infection, it must be on a continuously wet plant part for 4 to 20 hours, the length of time depending on the temperature. The shortest time is when the temperature is around 65° to 75° F. A cold wet spring is most favorable for the development of an epidemic of scab. After an infection period in early spring, scab spots usually do not appear until about 8 to 14 days. On older leaves and fruits this period of incubation is longer. Abundant production of spores takes place on all scab spots.

6. How are scab spores spread?

The ones from overwintered leaves are discharged forcibly into the air and carried by wind to considerable distances.

The ones produced on leaves and fruit scab spots on the

tree are spread by wind-blown rain primarily within the tree on which the spot occurs.

Insects are not important in spreading scab.

7. How long are spores produced on scab spots in the orchard?

They are produced throughout the growing season and continue to spread infection.

8. How can scab be controlled?

In order to control scab successfully the orchardist should first learn to recognize the disease. He should learn about how the causal fungus behaves in order to know at what stages he can best break the life cycle of the fungus.

The orchardist should be thoroughly familiar with the development of the disease in his orchard each year. This will guide him in formulating his control program the next year.

Spraying with protective fungicides is the most important control measure for orchardists to consider. Under favorable conditions for scab to develop the disease cannot be controlled otherwise.

Other factors that the orchardist should consider in controlling scab are:

1. Good orchard location and proper spacing of trees to facilitate quick drying conditions.

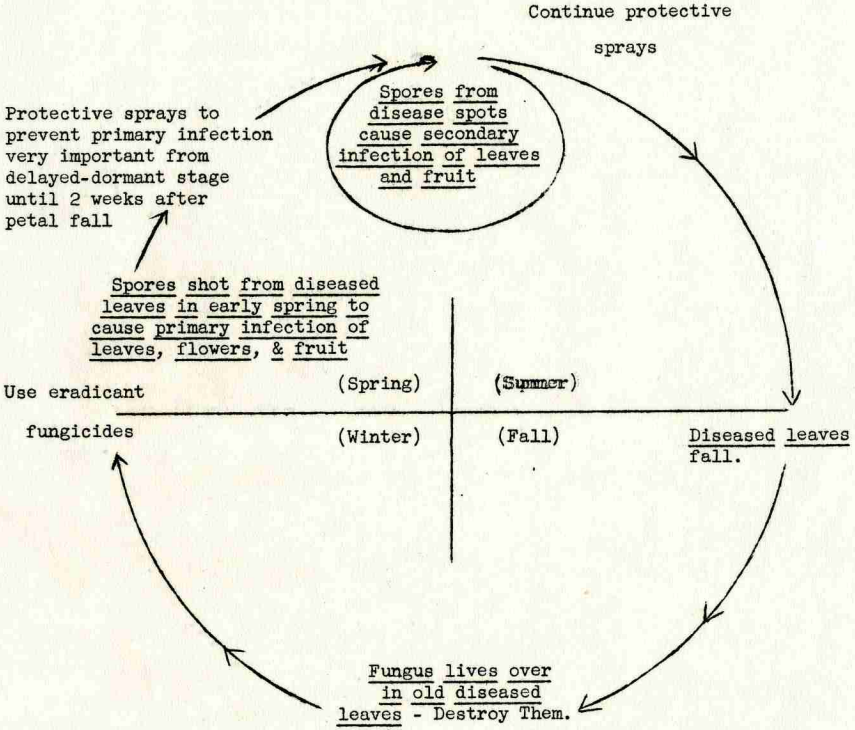
2. Proper pruning to promote quick drying of foliage and to allow thorough coverage of spray materials on all parts of the tree.

3. Spraying of young orchards to prevent build-up of scab before trees are in commercial production.

4. Destroying sources of infection in old diseased leaves.

5. Use of axe on old neglected trees.

Life Cycle of Scab Fungus and Control Measures



Prepared by: C. N. Clayton, Plant Pathology Section
N. C. Agricultural Experiment Station
and Howard R. Garriss, Extension Plant Pathologist
N. C. State College.

Apple Blotch

Blotch is one of the most destructive fungus diseases of apple on susceptible varieties when not held in check by good orchard management. It attacks the fruit, leaves, and twigs of apple, pear, and crab apple. It is the injury to the fruit which is the chief source of financial loss to apple growers. According to a U.S.D.A. survey in 1921, 10% of the crop or 89,000 bushels of apples were destroyed by blotch in North Carolina. In recent years losses from blotch in commercial orchards have been kept at a low level by the use of fungicidal sprays and the growing of more resistant varieties such as Staymen and Delicious.

In uncared-for orchards or in orchards in which the disease has not been held under control an entire crop of susceptible fruit may be rendered unmarketable. Many twigs and fruit spurs may be killed in such orchards. Unprotected trees of susceptible varieties may even be killed by repeated attacks on twigs and leaves. The disease also attacks underground parts of the plant. Blotch attacks nursery trees and may be introduced into the orchard on diseased stock.

1. How does blotch cause losses to the orchardist?
   a. It blemishes the fruit severely affecting quality. Severe infection renders fruit unmarketable. Less severely infected fruits bring a much reduced price. Blotch spots promote easy entrance of rot-producing fungi.
   b. Extensive cankering of twigs weakens the trees and affects future fruit set.
   c. The leafspot phase does not ordinarily cause serious damage. However, severe cases may cause defoliation with weakening of trees resulting.
   d. Spraying for blotch control necessitates considerable expenditures.

2. What does blotch look like?
   On the fruit -- "Blotch" describes the characteristic spot. They first appear about June as small, dark, somewhat raised or blister-like areas. These enlarge slowly and by mid-summer may be $\frac{1}{4}$ to $\frac{1}{2}$ inch or more in diameter. A characteristic spot at this time is slightly raised, dark-colored, and with irregular margins giving the "blotch" a fringed or "star-like" appearance.

   A later stage is the running together of several spots and a change in color to a dark brown or black. A three-directional cracking from a central point is often seen in these diseased areas.

   The blotches vary somewhat with different varieties. For example, on Limbertwig fruit the young spots are usually much raised, or blister-like. On fruit of Ben Davis, the spots at picking time are often smooth-margined depressions of dark-brown, hard, dry tissues. On yellow apples the spots may be bordered with red. Light-colored fruits show blotch lesions most conspicuously, while those on dark-colored varieties are less conspicuous.

   On the bark -- On the current year's twig and spur growth young cankers appear in late summer. The young cankers first appear as dark, purplish, or black, raised or blister-like spots. As the twigs become older the spots become lighter in color and take on a tan color the following year. During the third year the cankers become roughened because of a sloughing off dead bark. Cankers

may increase in size for several years. Many of them may fuse together forming large, roughened areas on twigs and small branches.

On leaves -- Very small (less than the thickness of a dime in diameter) nearly white spots occur on leaf blades. Usually one tiny black dot is found in the center of each spot. Spots on veins and stems of leaves are much larger than those on the blade -- they are dark, sunken, and oval in shape.

3. How does the blotch fungus overwinter?
The chief means of overwintering is in cankers on diseased twigs. The fungus may remain alive for as long as 7 or 8 years in infected bark.

4. How is blotch spread?
Fruiting bodies of the fungus called "pycnidia" are formed in cankers on twigs. In the spring the pycnidia produce spores which infect the new growth and especially the fruit. The newly infected parts soon start producing spores which spread the disease farther.

Infected nursery stock is the leading means of introducing the disease into new localities. Old neglected trees serve as reservoirs from which the disease may spread to nearby orchards year after year.

5. When do most infections take place?
The first infections in the spring may occur shortly after blossoming time. Few infections occur earlier than two weeks following petal-fall. Most infections occur within a period of about seven weeks after the petals have fallen.

After midseason the growing fruit becomes resistant so that few new infections occur. New leaf and twig growth, especially water sprouts, are susceptible after this time.

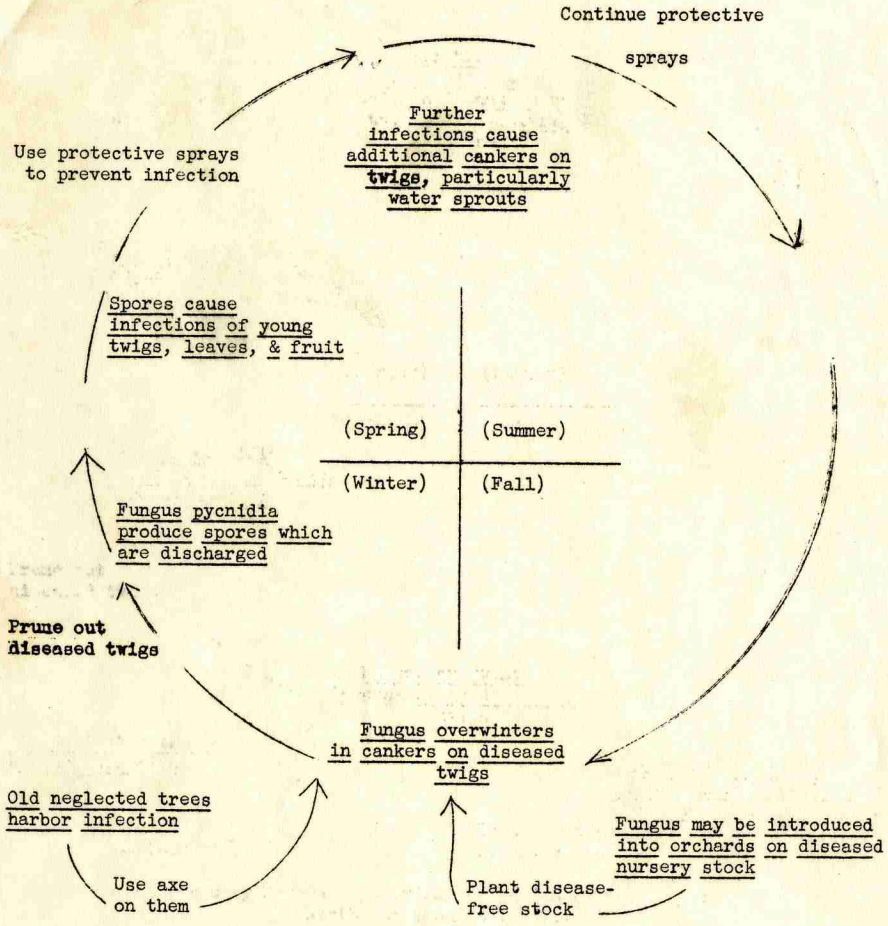
6. What conditions are most favorable for spread of blotch?
Abundant rains are necessary for pycnidia to swell and discharge the spores. A temperature of 77° to 86° Fahrenheit is best for the germination of the spores. However spores will eventually germinate at lower temperatures. Infection may, therefore, occur during long, cool, wet spells or during shorter periods of wet weather if the temperature is higher.

7. How can blotch be controlled?
It is evident from the nature of this disease and the life cycle of the causal fungus that four chief lines of attack should be considered:

— Bordeaux - Fermate offers some protection

1. Protective sprays - the surest and most practical.
2. Use of resistant varieties.
3. Pruning to remove diseased twigs and open up trees for better spraying. Keep water sprouts removed from limbs and trunk of tree.
4. Use of disease-free nursery stock.

LIFE CYCLE OF APPLE BLOTCH FUNGUS & CONTROL MEASURES



Prepared by Howard R. Garriss, Extension Plant Pathologist
North Carolina State College

RELATIVE SUSCEPTIBILITY OF APPLE VARIETIES TO DISEASES AND SPRAY INJURY IN NORTH CAROLINA

In selecting varieties of apples for planting, factors such as market demands, fruit quality, color, etc. are often necessarily the deciding ones. However, the relative susceptibility of varieties to the important diseases and to spray injury may be the difference between profit or loss. The ratings of some of the varieties grown in North Carolina are presented here. These are to be taken as relative and not absolute, for susceptibility often changes as the plant parts increase in age.

Variety	Scab	Bitter Rot	Blotch	Fire Blight	Cedar-apple rust[a]	Bordeaux russet	Lime-Sulfur injury
Ben Davis	xxx	xxx	xxx	xx	xx	xxxx	xxx
Delicious	xxxxx	xx	x	xx	x	x	x
Golden Delicious	x	xxxx	x	xxxx	xxx	xxxxx	xxxx
Grimes	x	xxxx	x	xxxx	xx	xxx	xxx
Jonathan	x	xxx	x	xxxx	xxx	xxx	xxx
Rome	xxxx	xx	xxx	xxx	xxxx	x	xx
Stayman	xx	x	x	xx	x	xx	xxx
Yellow Transparent	xx	x	x	xxxx	x	x	x
Limbertwig	xxxx	xxxx	xxxxx	xx	x	xx	xx
Black Twig	xx	xxx	xx	xxxx	x	xxx	xxx
Bonum	xxx	xx	xx	xx	xxx	xx	xx
Red Winesap	xxxx	xx	x	xx	x	xx	xx

x = Somewhat resistant; xxx = Moderately susceptible; xxxxx = Very susceptible.

a/ Delicious, Stayman, and Winesap are quite susceptible to quince rust.

THREE RUST DISEASES OF APPLE

APPLE RUST, QUINCE RUST, AND HAWTHORN RUST

In North Carolina rust diseases of apple are not nearly the widespread problem that they are in some states. However, where cedar trees are numerous and are close to apple trees these diseases are serious. In 1948 the one called quince rust caused a loss of more than a third of the apples in some orchards. These diseases are more prevalent in the Piedmont than in the Mountain area of North Carolina because of the greater prevalence of cedar trees in the former area.

The fungi that cause the above diseases are alike in that they require both cedar and apple or related trees in order to complete their life cycle. Apple rust affects apple fruits and leaves; quince rust affects only fruits; and hawthorn rust only apple leaves. Some of the most conspicuous characteristics of the 3 diseases are listed below:

	Apple rust caused by *Gymnosporangium juniperi-virginianae*	Hawthorn rust caused by *G. globosum*	Quince rust caused by *G. clavipes*
On red cedar	Greenish-brown round gall up to 1/3 inch in diameter produces spores for only 1 year	Reddish-brown round gall up to 1/5 inch in diameter produces spores for 3 to 5 years	Bark colored spindle-shaped swelling up to 2 feet long on limbs produces spores for many years
On apple leaves	Yellowish-orange spots with yellow margin up to ½ inch in diameter	Light yellowish-orange spots up to 1/6 inch in diameter	No lesions on leaves
On apple fruits	Orange or yellow spots with yellow or light margin average from ¼ to 3/4 inch in diameter. Spores are shallow usually not over 1/16 inch deep with no internal necrosis	No lesions on fruit	Green spots about 3/4 to 1½ inches in diameter with distortion of fruit. Deep spots with necrosis extending to core.

These diseases on apple only come from the red cedar trees. Spores from the yellowish-orange jelly-like galls on cedar trees are blown in wet weather in early spring by wind to full-sized apple leaves and young apple fruits. Thus, the most critical time for development of rust infections on apple is in the pink stage of development, during bloom, and during the 2 or 3 weeks after bloom. Spores from rust spots on apple leaves and fruits are spread to cedar trees where infection occurs and galls result in the following year. These galls produce spores in the next spring that can infect apples.

Varieties of apple vary in their susceptibility to infection with the 3 rust disease fungi. The leaves of some varieties become resistant much earlier than do others. The fruits of some varieties may be quite susceptible while the leaves may be quite resistant. Wealthy is quite susceptible to all 3 diseases. Delicious, Stayman, and Winesap are resistant to all except quince rust. Maiden Blush is susceptible to hawthorn rust but resistant to the other two rusts. Rome, York, and Ben Davis are susceptible to apple rust and hawthorn rust but resistant to quince rust.

Rusts of apple will be greatly reduced and usually well controlled by eradication of all cedar trees within a mile of the apple trees.

Until about 5 years ago no satisfactory fungicidal spray of dust for control of rust had been developed. Then, an iron carbamate spray material, now sold under the trade names of "Fermate" or "Karbam black," was found to be very effective against rust.

Varieties of apples resistant to rusts should be planted in places where these diseases will be a problem.

Prepared by: C. N. Clayton, Plant Pathology Section, N. C. Agricultural Experiment Station, and
Howard R. Garriss, Extension Plant Pathologist, N. C. State College.

Black Rot and Bitter Rot of Apple in North Carolina

1. What disease affecting apple fruits causes the greatest loss?

In some seasons apple scab is the most important, but year after year black rot is a disease that takes an annual toll and probably causes the most loss to commercial apple growers. A rotten apple is worthless, while a scabby one, unless badly affected, still has some value. In addition to black rot, several other rots occur on apples. Of such rots in commercial orchards bitter rot is probably second in importance. In some well-sprayed commercial orchards in 1946, '47, and '48 the loss from black rot was estimated to be 20 to 40 per cent of the fruit. In 1948, on unsprayed trees in experimental plots, 40 per cent of the fruit dropped prior to harvest. Nearly 2/3 of such apples were affected with black rot. Black rot is not a new disease. It probably rotted the first apple that dropped from the first apple tree planted in America.

Black rot also occurs on pears, quinces, and crabapples.

2. What causes black rot?

This disease is the result of infection by the fungus (Physalospora obtusa) which enters the apple thru wounds or natural openings. This fungus also infects apple leaves causing the frogeye leaf-spot disease.

3. What is "frogeye" leaf-spot?

Infection of apple leaves by the black-rot fungus appears as round, necrotic spots that often become lobed and irregular in shape as they age. Leaf spots usually appear about a week after infection. Diseased leaves turn yellow and drop. By the last of June, 1946, nearly one-half the leaves had fallen from unsprayed trees in Wilkes County. At harvest time on September 11, defoliation amounted to nearly 75 per cent.

4. Where does the fungus overwinter?

The black rot fungus grows profusely in the bark of dead, woody branches of many kinds. Apple twigs killed by the fire blight disease seem particularly suitable for the growth of the fungus. Dead orchard prunings are also usually affected. In the bark of such dead branches the fungus forms tremendous numbers of small pimple-like fruiting bodies called perithecia in which the fungus produces abundantly the spores by which it is reproduced. During periods of rainy weather, these spores are pushed out into the air and carried by rain, wind, or insects to leaves, fruits, and dead wood. On such plant parts, the spores germinate and produce fine threads that grow throughout the particular plant part affected. After some time, fruiting bodies of another type, known as pycnidia, are produced in great abundance on recently affected dead twigs or rotted fruit. Altho spores are found in the fruiting bodies of the fungus the year around, records in 1947 indicate that spores are discharged in large numbers during several periods and soon after the first leaves are unfolding.

5. What conditions favor the development of epidemics of leaf spot and black rot?

Two important factors are (1) abundant inoculum of the black rot fungus and (2) humid, rainy weather. There is evidence in many orchard. that twigs killed by an epidemic of fire blight in the preceding year provide an ideal place for the development of abundant spores of the black rot fungus. Other factors which influence the variation in the severity of black rot and leaf spot in different orchards are: 1) prevalence of fruit injuries due to insects, hail, spray injury, and careless handling, 2) poor air drainage of the orchard which creates humid conditions favoring infection, and 3) probable variation in virulence of different races or strains of the fungus in some orchards.

6. Why is loss from black rot often not fully recognized?

Usually the apples are affected as they approach maturity. Soon after they are affected with black rot they drop prematurely. These fruits on the ground quickly rot and may pass unnoticed. For that reason and because there is rarely more than 2 or 3 per cent of the fruit upon a tree affected with black rot at any one time, the disease is less apparent than would be the case if all affected fruits remained on the tree until harvest.

7. Since black rot and bitter rot of apple are often confused, how can they be distinguished?

Black rot	Bitter rot
a. Usually 1 spot or lesion per fruit	a. Often several to many spots
b. Lesion increases in size rapidly	b. Lesions increase in size less rapidly
c. Lesion usually not sunken	c. Lesions usually somewhat sunken or flattened
d. No fruiting bodies of fungus on fruit on tree	d. Pustules of spores abundant on lesions of fruit on tree
e. Rotted tissue has sweetish taste	e. Rotted tissue often tastes bitter
f. Disease rarely spreads on the tree from one apple to another	f. Spreads rapidly from apple to apple
g. Affected apples drop in a few days	g. Affected apples remain on tree for long time
h. Fruits affected most as they approach maturity	h. Fruit infection appears about first of June and continues to harvest
i. Leaf spots on apple leaves	i. Leaves not affected

j. Widespread over state	j. Tends to be more serious at lower elevations and in orchards with poor air drainage
k. Infects apples only thru injuries or natural openings	k. Infects apples directly thru skin
l. Sprays not very effective in control	l. Sprays are effective in preventing infection
m. Overwinters primarily on dead branches and old mummied apples	m. Overwinters primarily on mummied apples and cankers on trees

8. Can the black rot fungus be satisfactorily controlled with fungicides?

On the fruit - no. Fungicides applied to apples do not protect them satisfactorily against black rot because the fungus enters the fruit thru unprotected injuries or natural openings.

On leaves - yes. The results with several fungicides in spray programs upon the control of frogeye leaf-spot and defoliation in Wilkes County are shown in the following table. All the fungicides used were quite effective in control of leaf-spot and reduced defoliation from that disease to a fairly low level.

Spray Program	Leaves infected with frog-eye leaf spot		Average defoliation	
	June 28 1946	July 26 1947	June 28 1946	Sept. 11 1946
	%	%	%	%
No Spray	82	57	42	72
Lime-sulfur, 3 sprays; Bordeaux, 4 sprays	13	5	4	29
Phygon, 7 sprays	1	11	0	5
Flotation sulfur plus Fermate 3 sprays; Fermate, 4 sprays	5	1	6	6
Lime-sulfur, 3 sprays; Fermate, 4 sprays	4	-	1	5

Prepared by: C. N. Clayton and Robert Aycock, Plant Pathology Section, Department of Botany, N. C. Agricultural Experiment Station.

FIRE BLIGHT OF APPLE

Caused by a bacterium.

Blights blooms, spurs, and twigs of apple and pear.

Results in cankers on branches and trunks of trees.

Reduces set of fruit and kills spurs, branches, and even trees.

Black rot fungus overwinters in blighted twigs and branches.

Much is known about fire blight and its control. However, more practical and more effective control measures are needed.

How the disease overwinters. In living tissues near the margins of overwintered cankers ("hold-over" cankers) on the larger branches.

How the disease develops:

Bacteria in ooze from over-wintered cankers are splattered by rain to blossoms and twigs where infection occurs.	From blighted blossoms rain & insects spread the bacteria to other blossoms, young twigs and leaves.	Disease works from blossoms down thru spurs into branches resulting in blight and cankers.

Factors affecting the development of epidemics.

There are several interrelated factors affecting the development of fire blight. Therefore, its occurrence and severity varies considerably from season to season and from orchard to orchard. Nearness to hold-over cankers is necessary to get the disease started. Rain is needed to spread the bacteria to the blooms, to raise the moisture level in the blooms, twigs, and leaves so that the bacteria can infect and develop in them. Wind during the rain aids in spreading the bacteria. Temperatures around 70° and 80° F. are most favorable for the development of the fire blight bacteria. Young succulent tissues full of water are most susceptible. Moist conditions favor the development of the bacteria.

Little or no blossom blight will occur if "hold-over" cankers have not exuded bacteria by bloom or if they have exuded and no rain has occurred during bloom. If bacteria exude from cankers only after bloom, only twig blight occurs.

Spread by pollinating insects from infected blooms to healthy ones most frequently occurs during warm sunny weather following rainy periods. Pollinating insecting frequently carry the bacteria to blooms near the tops of trees, resulting in blighted blooms and cankers from which the bacteria can be washed down by rain to all parts of the tree. Pollinating insects also carry the blight bacteria from orchard to orchard and from tree to tree.

How does blight get into an orchard? Introduced in nursery stock or by pollinating insects.

What practices will aid in preventing epidemics of fire blight?

a. Elimination of "hold-over" cankers: Cutting off branches with cankers during the winter has been recommended. Another way to reduce the number of cankers on large branches and trunks of trees is to rub off all water-sprouts during the spring and summer. Keep such shoots and spurs from developing on main branches. The source of blight for commercial orchards is often maintained in neglected pear and apple trees in yards, gardens, and home orchards. In the near vicinity of commercial orchards such uncared-for trees should receive the axe.

b. Bloom sprays. Blossom blight infection has been reported to be reduced considerably by an annual practice of spraying during bloom with a weak Bordeaux mixture, 2-4-100 (made with 2 lbs. copper sulfate and 4 lbs. hydrated lime in 100 gals. of water). Perfect control of blight should not be expected from bloom spraying. Too, severe russeting of fruit has at times resulted from use of Bordeaux in bloom.

c. Use best orchard practices to keep trees from being over-stimulated to too rapid and vigorous growth, particularly during and just after the bloom period. Blight is usually less serious in sod orchards than in clean cultivated ones.

d. Avoid planting varieties of pears and apples that are extremely susceptible to fire blight.

e. Scattered bloom clusters on young trees should be removed before they open.

Prepared by: C. N. Clayton, Plant Pathology Section, N. C. Agricultural Experiment Station, and
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Basic Fungicides Sold in 1939

68,000,000 lbs. copper sulfate	$2,750,000.00
9,500,000 lbs. lime-sulfur	925,000.00
33,660,000 lbs. sulfur	1,000,000.00

Ceresan = Ethyl mercuric chloroide
ethyl alcohol plus corrosive sublimate

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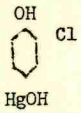
Semesan = Hydroxy mercuric chlorophenol
carbolic acid plus mercury and chlorine



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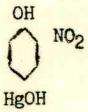
Semesan Bel = Semesan plus
Hydroxy mercuric nitrophenol
Carbolic acid plus mercury and nitrogen



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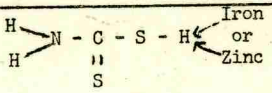
Puratized N 5 = Phenyl mercuric triethanol
ammonium lactate

1 pt. Carbolic acid
1 pt. Corrosive sublimate
1 pt. Ammonium hydroxide
1 pt. Lactic Acid
3 pts. Ethyl alcohol

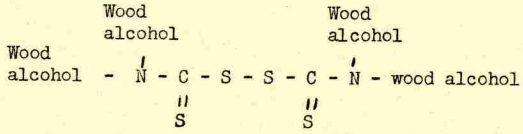
Wood
alcohol
also ethyl
and other
alcohols



Iron = fermate
Zinc = zerlate

. . . . . .

Combine two molecules through sulfur.



Arasan

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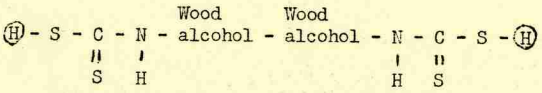
Combine from other end.



Replace H's with sodium = Dithane D 14.

Replace H's with zinc = Dithane Z-78 or Parzate

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