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AN EXPERIMENT ON THE CONTROL OF CURRANT
CANE NECROSIS BY SUMMER PRUNING

F. C. STEWART



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AN EXPERIMENT ON THE CONTROL OF
CURRANT CANE NECROSIS BY
SUMMER PRUNING.

F. C. STEWART.

SUMMARY.

Necrosis, also known as wilt, blight and cane blight, is a destructive disease of currants in the Hudson Valley. In its most conspicuous form it is characterized by the sudden wilting and dying of canes here and there through the plantation. It is caused by the fungus *Botryosphæria ribis* which attacks the canes, killing and discoloring short sections of the bark and wood and thereby causing the death of all parts above the point of attack.

The behavior of the disease led to the belief that it could be controlled by the systematic removal of all diseased canes at intervals of three or four weeks during the spring and summer of each year. This bulletin contains, chiefly, an account of an experiment in which this method of treatment (called summer pruning) was tested. The experiment comprised six four-row plats each containing about one-fourth acre. Commencing when the plants had been set one year, three plats were carefully summer pruned from two to six times each year during six consecutive years. The alternate three plats were used as checks. The result was disappointing. At no time during the experiment was there any indication that the disease had been materially checked by the treatment. The infections seemed as numerous and as injurious on the treated as on the untreated plats and the yield of fruit was even smaller on the treated plats. Accordingly, summer pruning can no longer be recommended for the control of necrosis. In fact, no method of treatment can be confidently recommended at present.

THE DISEASE.

The disease under consideration is one which is better known as wilt, blight or cane blight. It is the disease first brought to notice by Fairchild¹ in 1891 and described, in 1899, by Stewart and Blodgett² in Bulletin No. 167 of this Station under the name cane blight. In Technical Bulletin No. 18 of this Station Grossenbacher and Duggar³ have given an account of the life history, biology and parasitism of the causal fungus, *Botryosphaeria ribis* Gross. & Dug. Presumably, the currant disease studied by Durand⁴ was the same; if so, he was in error in ascribing it to *Nectria cinnabarina*.

Briefly, the symptoms of necrosis are as follows: On certain canes or portions of canes the leaves wilt, turn brown and die. This may occur at any time while the plants are in foliage. An examination of an affected cane will reveal, somewhere, a section of dead wood one to four inches long. Here is the seat of the trouble. The bark has been killed and the wood and pith invaded by the mycelium of the causal fungus. This hinders the ascent of sap and thereby causes all parts of the plant beyond the point of injury to wither and die. To the casual observer the symptoms of necrosis resemble those shown by canes attacked by cane borers; but the difference is seen at once when an affected cane is split open. The cane borer forms a conspicuous burrow in the pith and, frequently, the larva itself is present; while in canes suffering from necrosis neither burrow nor larva is to be seen. By close observation one may detect a fine, whitish, cobwebby mycelium in the discolored pith at the point of attack. Its presence can generally be determined with the unaided eye and nearly always with the aid of a good hand lens.

¹ Fairchild, D. G. Notes on a new and destructive disease of currant canes. *Bot. Gaz.* 16: 262. 1891.

² Stewart, F. C., and Blodgett, F. H. A fruit-disease survey of the Hudson Valley in 1899. N. Y. (State) Sta. Bul. 167: 292-4. 1899.

³ Grossenbacher, J. G., and Duggar, B. M. A contribution to the life history, parasitism and biology of *Botryosphaeria ribis*. N. Y. (State) Sta. Tech. Bul. 18. 1911.

⁴ Durand, E. J. A disease of currant canes. N. Y. (Cornell) Sta. Bul. 125. 1897.

In the Hudson Valley, particularly in the vicinity of Highland, Milton and Marlboro where currants are grown extensively, necrosis is an important disease. In this region, it occurs to a greater or less extent in almost every currant plantation and is regarded as one of the chief hindrances to currant culture. Since the disease does not attack the roots new shoots continue to appear so that the plants are rarely killed outright; but as the plants grow older more and more of the canes succumb until, finally, there are so few fruit-bearing canes left that the plantation ceases to be profitable. While the virulence of the disease varies somewhat from year to year it is never wholly absent from a plantation in which it has once become established.

Necrosis occurs frequently, also, in central and western New York, but is rarely destructive, even in large plantations. The reason for this is not clear.

SUMMER PRUNING A THEORETICAL METHOD OF CONTROL.

Because of the damage done by necrosis there has been a steady demand for information concerning means of controlling it. The writer has advised making two or three systematic inspections of the plants during the spring and summer and promptly cutting out and burning all diseased canes found.¹ We call this the summer-pruning method. It depends for its success on the assumption that the diseased canes can be readily detected before the causal fungus has produced spores, thus making it possible to remove the affected canes before the disease has had a chance to spread.

Prior to the investigations of Grossenbacher and Duggar, the spore forms of the fungus were unknown, but it had been observed by Fairchild and the writer that canes killed by the fungus usually bear no spores of any kind until they have been dead a long time. Moreover, all attempts to make the fungus produce spores in artificial cultures have failed. Hence, the fungus came

¹ Stewart, F. C. Currant cane blight kept in control. *Amer. Agr.* 69: 820. 28 Je. 1902.

to be known as a "sterile" fungus. Grossenbacher and Duggar¹ found, however, that instead of being sterile the fungus possesses three conspicuous spore forms belonging to the genera *Macrophoma*, *Dothiorella* and *Botryosphaeria* respectively. They found, also, that in spite of this wealth of spore forms infection apparently does not occur until after the middle of June. Therefore, it would seem as if the removal of affected canes in the spring should be decidedly helpful in keeping the disease under control. Winter pruning, on the contrary, is obviously ineffectual owing to the difficulty of detecting diseased canes while the bushes are bare of foliage.

TREATMENT EXPERIMENTS BEGUN.

Finally, in the spring of 1907 some treatment experiments were started at Milton, N. Y. It was realized, at the outset, that to rejuvenate an old, badly diseased plantation would be more difficult than simply to keep the disease from becoming established in a young plantation. So two experiments were commenced, one in a badly diseased twelve-year-old plantation and the other in a moderately affected one-year-old plantation. The former experiment was so planned as to show the effect of spraying and summer pruning separately and in combination. Bordeaux mixture was the fungicide used. It is unnecessary to give the details of the experiment. Before the close of the second season we became convinced that, under the prevailing conditions, the disease could not be controlled. In most of the plants the fungus had become firmly entrenched in the crown where it could not be entirely removed by pruning. Accordingly, the experiment in the old plantation was abandoned.

THE PRINCIPAL EXPERIMENT.

The experiment in the young plantation appeared more promising. The object of this experiment was to determine if necrosis

¹ Grossenbacher and Duggar. *Loc. cit.*

can be controlled by summer pruning commenced while the plants are young and continued regularly each season. The experiment was conducted on the farm of J. R. Clarke & Son, Milton, N. Y. It comprised 24 rows of currants, 512 feet long, planted in a pear orchard. The pear trees were planted 16 x 16 feet. The currants (variety, Cherry) were set in the rows of pear trees and also between them in such manner that two rows of pear trees included four rows of currants. At the beginning of the experiment there were blank spaces between every other pair of pear trees so that the currants stood in plats of four rows each with blank spaces 16 feet wide between plats. (See the accompanying diagram).¹

	0xxxxx0xxxxx0	The experiment included six of these four-
I.	xxxxxxxxxxxxx xxxxxxxxxxxxx 0xxxxx0xxxxx0 0xxxxx0xxxxx0	row plats containing approximately one-fourth acre each. Three plats (II, IV and VI) were given the summer-pruning treatment while the alternating three plats (I, III and V) were left untreated for checks. In 1908 two rows of currants were planted in each of the blank spaces, but these
II.	xxxxxxxxxxxxx xxxxxxxxxxxxx 0xxxxx0xxxxx0	were not included in the experiment.

The currants had been set out in the spring of 1906. Our experiment was begun in the spring of 1907 and continued through six seasons. Each winter all six plats were winter pruned in the usual manner under the direction of the owners. The spraying, also, was done by the owners. Each spring before the appearance of the leaves all six plats were sprayed with lime-sulphur for San José scale. Currant worms were well controlled on all plats by a single spraying made each season about June 1. For this purpose bordeaux and arsenate of lead were used in the first two seasons and lime-sulphur and arsenate of lead in the last four seasons. The summer pruning was all done by the writer

¹ O = pear tree; X = currant bush. Currants set 2½ to 3 feet apart in the row; rows 5¼ feet apart. Dotted lines indicate the two rows of currants set between plats in 1908.

and his associates, J. G. Grossenbacher and W. O. Gloyer. To Mr. Grossenbacher, in particular, the writer is under obligation for much valuable assistance. The number of summer prunings varied from two to six in different seasons. At each pruning every plant on plats II, IV and VI was carefully examined and all dead or dying canes cut out, carried away and burned. In the removal of diseased canes an attempt was made to cut low enough to remove all of the fungus. It will be shown later that this was sometimes found difficult to accomplish.

A brief account of each year's work on the experiment will now be given.

FIRST SEASON.

During the first season of the experiment (1907) the three treated plats (II, IV and VI) were summer pruned six times on the following dates: May 20, June 10 and 26, July 17, August 16 and September 20. The small size of the plants at this time made it practicable for a man to cover two rows at each passage through the field. The prunings were placed in small piles between the rows and afterward carried out to the ends of the rows and burned. In the first pruning there were found large numbers of canes of the previous season's growth with 4 to 10 inches of their upper portion dead and without leaves. Some of these may have died from other causes than necrosis, but all were carefully cut out. Frequently, the pith was discolored for a distance of several inches below the lowest point of wood discoloration. In some cases this necessitated the removal of living branches.

SECOND SEASON.

In 1908 four prunings were made as follows: June 2 and 26, July 31 and August 21. The first pruning of this season should have been made earlier as the new shoots were so long (12 to 14 inches) that they hid the dead branches. Fifty dead canes were removed in the first pruning and 46 in the second. In the third pruning Mr. Grossenbacher noted 198 new cane infections and 49 old ones besides numerous leaf infections. In the fourth prun-

ing he found a total of 193 infections, 151 of which were leaf infections which had not yet entered the stem.

THIRD SEASON.

In 1909, also, there were four prunings made on the following dates: May 19, June 16, July 14 and August 18. The first pruning, on May 19, might better have been made on May 15. Considering the care with which the pruning had been done we were surprised to find that a good many canes were killed clear to the ground and the fungus had gained access to the crown of the plant. Four plants with single stems were entirely dead. Fifty-two diseased canes were removed in the second pruning and 69 in the third. The first pruning required two hours and forty-five minutes; the second, one hour and five minutes, and the third, one hour and fifteen minutes.

FOURTH SEASON.

This year pruning was done on May 2, June 6 and July 6. The spring was an unusually early one. At Milton, currants were in half bloom by April 18. Beginning with the first pruning of this year a single row was pruned at each passage through the field. Owing to the increased size of the plants it was found difficult to manage two rows at a time without overlooking some of the diseased canes. The time required for the first pruning (including removal of the prunings) was two hours and twenty minutes. Plats IV and VI each yielded one large armload of prunings while on Plat II there were more than could be carried at a single load. It was thought that time might be saved by putting the prunings into a large muslin bag slung over the shoulder, but a brief trial showed this method to be quite impracticable. Some of the affected canes were so large that they could not be put into the bag readily. This year, for the first time, the yield of fruit was measured. The three pruned plats yielded 2,402 quarts (3,193 qts. per acre) while the total yield of the three check plats was 2,481 quarts (3,296 qts. per acre).

FIFTH SEASON.

Three prunings were made: on May 22, June 12 and July 5. No record was made of the quantity of prunings or the time required to do the work in the first pruning. The second pruning required three hours and $8\frac{1}{2}$ large arm-loads of prunings were obtained. The third pruning required $11\frac{1}{2}$ hours. The quantity of prunings was small. On many plants the fungus had become firmly entrenched in the crown beyond the reach of the pruning knife. Also, it frequently happened that the point of attack was so close to a cluster of branches that, in order to get below the disease, it was necessary to remove the whole cluster of branches. In such cases there was some loss of fruit. Picking was begun on July 5. The total yield of the treated plats was $1,612\frac{1}{2}$ quarts ($2,143\frac{1}{2}$ quarts per acre) and of the check plats $1,628\frac{1}{2}$ quarts ($2,165$ quarts per acre).

SIXTH SEASON.

Only two prunings were made in 1912 (May 15 and June 11). The time required for the first pruning was five hours and ten minutes. The quantity of prunings amounted to about five large arm-loads and consisted entirely of dead canes. This pruning should have been made a few days earlier. In the second pruning there were found 174 plants more or less diseased and the fact that many of the affected canes were leafless showed that they had been overlooked in the first pruning. The time required for the second pruning was one hour and thirty-five minutes. It was planned to make a third pruning on July 18, but owing to the condition of the foliage it had to be abandoned. Hot weather and a light attack of anthracnose had brought about much tip-burn and partial defoliation which made it very difficult to detect diseased canes. Much of the fruit being sun-burned and shriveled it was considered not worth while to measure the yield. Throughout the entire period of the experiment canes attacked by cane-borers were found only rarely.

As some changes contemplated by the owners necessitate the destruction of a portion of the experiment plantation, the experiment was brought to a close in the autumn of 1912.

COMMENTS ON RESULTS.

Our observation of this experiment forces us to the conclusion that currant cane necrosis can not be controlled by summer pruning. Theoretically, it should be effective, but when put to experimental test it has failed. At no time was there any indication that the treatment had materially checked the disease. Each spring treated and untreated plats showed an equal number of diseased canes so far as could be determined. Also, the yield of fruit on treated plats was even less than that on the checks.

Although the disease was not as destructive in the experiment plantation as in some others, it is believed that it was sufficiently abundant to make the test a fair one. Why the treatment failed is not entirely clear. Much difficulty was experienced in completely removing affected canes. In numerous instances it was observed that the disease had continued to work downward from cuts made in a previous pruning. Often it was found difficult to make the cut low enough to remove all of the fungus without sacrificing considerable living wood. Moreover, in spite of the most careful pruning the fungus often succeeded in reaching the crown of the plant where it could pass from one cane into another with impunity. Although no method of disinfecting the pruning knife was used it seems improbable that the fungus was spread by means of the pruning knife. It was deemed sufficient to occasionally wipe the knife-blade on the coat sleeve or trousers to remove adhering particles of diseased wood.

Another thing which may have been a factor in the failure of the treatment was the difficulty in finding all of the diseased canes. In the first pruning of the season diseased branches are to be detected chiefly by their being leafless. Accordingly, this pruning should be made just as soon as the leaves have started sufficiently to show readily which branches are dead. Probably

this is about the time the first berries are setting. The exact date will vary in different localities and in different seasons. If the first pruning is delayed until the new shoots have become several inches long it is inevitable that some of the diseased canes will be overlooked. This difficulty was encountered in the experiment. Besides, some late infections of the previous season are hard to detect under the most favorable conditions.

Perhaps a third factor in the failure of the treatment was the close proximity of the treated plats to untreated plats in which the disease was prevalent. Our present knowledge of the mode of dissemination of the fungus is so imperfect that we are unable to accurately estimate the importance of this factor.

The results of the experiment being as they are, we can no longer recommend summer pruning for the control of necrosis. It should be said, however, that it will probably assist greatly in keeping cane-borers under control and will improve the appearance of the plantation. The expense of four treatments will vary from \$2 to \$4 per acre according to the age of the plants and the virulence of the disease. With the rows six feet apart the affected canes may be removed at any time without material injury to either fruit or foliage. It is understood, of course, that most of the dead wood should be removed during the winter when other work is least pressing.

It is regrettable that summer pruning has proven a failure, because, at present, no other line of treatment can be confidently recommended. The planting of vigorous-growing varieties such as Wilder may give some relief. An experiment on the control of necrosis by spraying is in progress.