SURVEY OF PEACH CANKER IN THE NIAGARA PENINSULA DURING 1969 AND 1970[1]

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Abstract

The incidence and severity of peach canker incited by the fungi Leucostoma cincta and L. persoonii were assessed on 2,000 peach trees in 93 orchards in the Niagara Peninsula, Ontario, in July 1969. Ninety-eight percent of the trees were cankered and, on average, approximately 30% infection (percentage circumference affected) was recorded for trunk, crotch, and scaffold branches, with 3 to 4 cankers on a 5-ft length of bearing limb. The orchards were revisited in July 1970 and the same trees showed an increase in infection of 10, 7, and 14% on the trunk, crotch, and scaffold branches, respectively, and an increase of 3 cankers per 5-ft of bearing limb. In addition 10% of the bearing area had been removed by the grower because of canker, and this alone was equivalent to a loss of approximately 1 million dollars in 1970. It is also probable that canker decreases fruit production by decreasing tree longevity, but this cannot be estimated from the results.

Introduction

The peach crop is the third most valuaule fruit crop in Ontario. In 1969 tile 10,000 acres of peach orchards produced 85 million pounds of fruit worth approximately $9 million (3). Peach canker is caused by the fungi Leucostoma cincta (Fr.) Höhn., (Valsa cincta Fr.), imperfect state Cytospora cincta Sacc; and Leucostoma persoonii (Nits.) Höhn. (Valsa leucostoma (Pers.)Fr.), imperfect state Cytospora leucostoma (Pers.) Sacc. (2, 5, 7). The disease is recognized as one of the most serious disorders of peach trees in the Niagara Peninsula, the main peach growing area in Ontario. During tne period 1912-1917 McCubbin reported on the incidence of the disease in commercial orchards (2) and later Willison (6, 8) contributed much to our understanding of the disease by studying its development in experimental orchards. Programs to control the disease have been unsuccessful and the present investigation was undertaken to monitor the level and development of peach canker in a large number of commercial orcnards selected at random in the peach growing area of Ontario.

Materials and methods

The sample used for this survey was based on a sampling scheme designed by the Dominion Bureau of Statistics to estimate prior to harvest the expected yield for the peach (Prunus persica (L.) Batsch) crop of Ontario. A sample of 93 orchards (Figure 1) was selected in proportion to orchard size, and 250 trees were selected in proportion to the number of bearing trees per orchard. The trees chosen were marked with paint so that they could be located easily in successive seasons. For our purposes, a further 1,750 trees approximately (again in proportion to the number of bearing trees uut with a maximum of 50 trees per orchard) were selected in the immediate vicinity of tile original 253 trees chosen (see example, Figure 1), thus making approximately 2,000 trees available for examination in the disease survey in 1969.

The disease assessment method involved estimates of the damage caused by canker. These estimates included the percentage circumference affected on the whole length of the trunk, crotch, and all scaffold branches. In addition estimates were made of the percentage of tile crotch affected and the number of cankers on a 5-ft length of a 2- to 3-inch diameter bearing limb chosen at random. Where there were two or more cankers on the trunk or scaffold branches, the percentage of the circumference diseased was calculated as shown in Figure 2. The trees were classified by age into 5 groups of 5 years within tile range 1 to 25 years, and a sixth group was included for trees from 26 to 50 years of age. A map of each orchard was made to facilitate locating the marked trees on the second visit in 1970, and schematic drawings of each tree were made on a short record form with details of cultivar, age, and disease assessments.

In 1970 the orchards were revisited and

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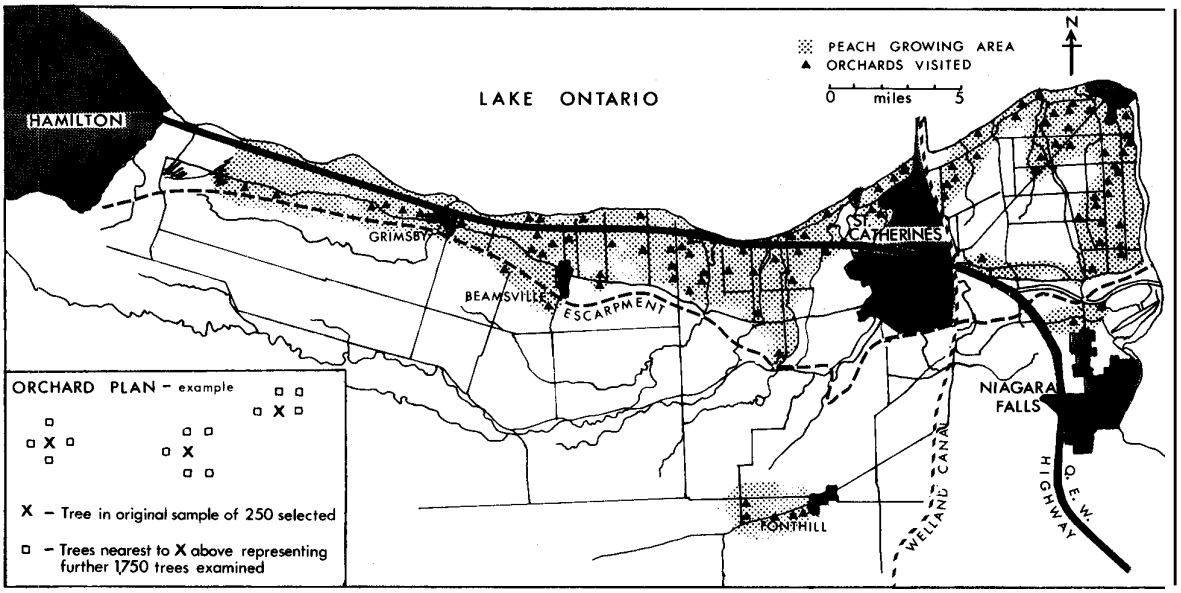

Figure 1. Location of peach growing areas and orchards surveyed for canker, with example of sampling scheme used for selecting trees within orchards.

the same detailed assessments were made on the 227 trees remaining from the original sample of 250 to determine the increase in canker, if any; note was also made of scaffold or bearing branches that had been removed by the grower because of canker. The additional 1,750 trees examined in detail in 1969 were checked only to determine the number and position of trees replaced since 1969. Both surveys were conducted during the latter part of July.

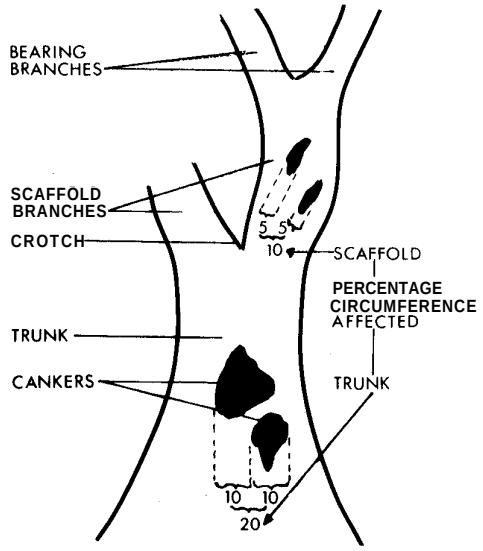

Figure 2. Diagrammatic representation ot the method used for assessing . conker severity.

Results

1969 Survey

A total of 1,969 trees were examined and 98% of them were affected with canker. On average approximately 30% of the circumference of the trunk, crotch, and scaffold branches was affected, and 3 to 4 cankers were found on a 5-ft length of bearing limb (Table 1). After the 1969 season 9% of the trees were removed. The average amount of infection on the trunk, Crotch, and scaffold was higher on the trees that were removed after the 1969 season than in the 91% trees remaining, but the number of cankers per 5-ft of bearing limb was the same (Table 1). The average age of the trees that were removed was 16 years compared with 13 years for the trees that remained, but the age difference was not responsible for the difference in canker uetween the two groups of trees (Table 2). Within both age groups 1 to 20 and 21 to 50 years the trees that were removed generally had higher infection ratings than those that remained; the exception was in the number of cankers on the bearing limb which was approximately the same for the two age groups.

Of the 1,969 trees examined in 1969, the variety Jubilee was the most prevalent and accounted for 38% of all trees checked; the other varieties in decreasing order of importance were Elberta 33%, Veteran 18%, Redhaven 9%, and Loring 1%; other varieties represented the remaining 1%. No differences were noted among the disease assessments recorded for the above varieties.

Table 1. Average amount of canker on peach trees examined in 1969

Trees examined in 1969	No. of trees	Percentage circumference affected and corresponding standard error			No. of cankers per 5-ft length of bearing limb
		Trunk	Crotch	Scaffold	
All trees examined	1969	29 ± 0.6	26 ± 0.8	29 ± 0.5	3.7 ± 0.06
Trees remaining after 1969 season	1796	27 ± 0.6	24 ± 0.8	27 ± 0.5	3.6 ± 0.06
Trees removed after 1969 season	173	43 ± 2.1	37 ± 3.0	35 ± 1.8	3.7 ± 0.26

Table 2. Canker severity expressed as the percentage of the total number of trees in each disease category within two age groups; data for trees remaining and trees removed after assessment in 1969; all data recorded in 1969

Disease assessment method and disease category	Trees remaining after 1969		Trees removed after 1969	
	Age group (yr) 1–20	21–50	Age group (yr) 1–20	21–50
Percentage circumference of trunk affected				
0 to 50%	85	83	65	63
over 50%	15	17	35	37
Percentage crotch affected				
0 to 66%	83	85	75	72
over 66%	17	15	25	28
Percentage circumference scaffold affected				
0 to 50%	89	75	82	65
over 50%	11	25	18	35
No. of cankers per 5-ft length of bearing limb				
less than 5 cankers	69	47	73	60
5 cankers or more	31	53	27	40
Number of trees in each age group	1453	238	130	43

Approximately 50% and 20% of all trees examined were free from canker on the crotch and trunk, respectively, whereas only 10% of the trees were free from canker on the scaffold and bearing branches (Table 3). In approximately one out of eight trees the entire crotch areas was affected, but disease assessments of 100% were not noted for any trunk or scaffold branch. The data did not lend itself to a correlation analysis of age and amount of canker but the figures in Tables 2 and 3 show that in general the older trees had more disease than the younger ones.

The increase of disease with age is most apparent for canker recorded on bearing limbs (Table 3); 45% and 3% of the 1- to 5-yr old trees and 0 and 5–6 cankers respectively, compared with 2% and 35% of 26- to 50-yr old trees. The same trend to more disease on older trees can be detected for disease assessments on the trunk, crotch, and scaffold. The indication that canker seems to increase rapidly with age up to approximately 15 years and then stabilizes is generally true for all the disease assessments recorded.

Table 3. Canker severity expressed as the percentage of trees in each disease category within various age groups; data for all trees examined in 1969

Disease assessment method and severity category		Age group of trees (yr) 1-5	6-10	11-15	16-20	21-25	26-50	All groups
Percentage circumference of trunk affected	0	51	20	12	8	10	12	20
	1- 10	11	21	18	19	19	14	18
	11- 25	9	15	16	13	14	14	13
	26- 50	21	30	35	37	36	41	33
	51- 75	4	10	12	15	14	13	11
	76- 99	4	4	7	8	7	6	5
	100	0	0	0	0	0	0	0
Percentage circumference of crotch affected	0	64	48	47	47	46	54	50
	1- 33	11	19	25	28	25	14	21
	34- 66	9	13	11	11	11	17	12
	67- 99	5	4	4	2	5	5	4
	100	12	6	13	12	13	10	13
Percentage circumference of scaffold branches affected	0	37	10	4	3	3	1	10
	1- 10	19	22	15	9	6	10	15
	11- 20	16	17	18	13	10	15	15
	21- 30	12	20	21	15	19	17	18
	31- 50	11	25	29	38	30	35	28
	51- 70	4	6	10	17	24	17	12
	71-100	1	0	2	4	7	4	2
NO. of cankers on 5-ft length of bearing limb	0	45	12	3	2	1	2	10
	1- 2	38	27	21	13	11	12	22
	3- 4	13	38	37	34	33	38	33
	5- 6	3	16	28	31	35	35	24
	7- 8	1	6	8	16	17	8	9
	9- 10	0	1	3	2	3	4	2
	11- 12	0	0	0	1	0	1	0
	13- 14	0	0	0	1	0	0	0
NO. of trees in each age group		289	539	357	407	218	163	

1970 Survey

The survey was repeated in 1970 to estimate the increase in canker since 1969. The variability in the disease assessments recorded in 1969 suggested that a sample of approximately 250 trees was adequate to detect an increase of 10% canker on the trunk or scaffold branches or an increase of one canker on a 5-ft length of bearing limb. Of the total sample of 1,969 trees examined in 1969 only 1,796 (91%) remained in 1970, and similarly of the original sample of 250 trees selected in 1969, only 227 (91%) remained in 1970. The increase in canker between 1969 and 1970 is shown in Table 4 and is based on the 227 trees examined in both years. The average percentage of trunk, crotch, and scaffold affected by canker increased from 33 to 44, 28 to 35, 31 to 45, respectively, and the number of cankers on 5-ft of bearing limb increased from 3.9 to 6.6. Records for the same 227 trees showed that the bearing area had been reduced by 10.1% due to the removal of scaffold or bearing limbs.

Table 4. Increase in canker severity from 1969 to 1970 in the 227 trees examined in both years

Canker assessment method	Increase in % circumference affected*
Trunk	10.6 ± 0.9
Crotch	7.0 ± 1.0
Scaffold	14.3 ± 0.8
Bearing limb	2.7 ± 0.16†

* Percentage and standard error.

† Average number of cankers per 5-ft length of bearing limb.

Discussion

One of the main purposes for conducting disease surveys using standardized disease assessment methods is to try to obtain records which are quantitative rather than qualitative, so that the importance of the disease under study can be established. However, only rarely is it possible to estimate how much real damage has ueen caused by disease, and perennial crops present a more difficult problem than annual crops because the effect of disease on the crop may not be manifest in the year the disease is recorded (1). Also, in the peach crop commercial practices such as thinning of fruit make the task of relating disease level to the yield of fruit per tree problematic. Disease surveys are important because they monitor the level and development of disease as it occurs in commercial crops where crop management and conditions are often different to those found in experiments.

The effect of canker on yield cannot be estimated in one simple measurement because some of the effects of the disease are direct and others indirect. For example, the 10% decrease in bearing area due to the removal of cankered scaffold and large bearing branches is a direct effect which is easily measured and is equivalent to a loss of approximately $1 million. On the other hand the decrease in tree longevity which undoubtedly is to some extent due to canker is indirect and difficult to measure. Although the data in Table 2 cannot be cited as evidence that all the trees removed were replaced because of canker (a large proportion were removed because of age), it is more than coincidence that the levels of canker on the trunk, crotch, and scaffold branches are much higher for the trees that were removed. than for the remaining trees. However, it is interesting to note that the data for the number of cankers on bearing branches are the same for trees remaining and for those removed (Tables 1 and 2). The removal of badly cankered limbs in conjunction with a program to allow new and healthier uearing limbs to develop results in tne number of cankers per 5-ft of bearing limb remaining constant. This suggests that cankers on trunk, crotch, and scaffold are the criteria that growers use for deciding whether a tree should be removed or not and that the number of cankers on a uearing branch has little significance in this decision. Canker can accelerate the tree replacement rate through decreasing the longevity of trees but it is not possible to estimate what proportion of the 9% replacement rate reported for this survey was due to canker.

The higher level of disease on the older trees may be due to their greater susceptibility or it may merely reflect the longer exposure period to disease, compared with the younger trees. Disease seemed to increase rapidly with age up to approximately 15 years and then stabilize; this may be the result of grower practice which allows disease to develop for a period of time until the canker level is unacceptable, resulting in a continuous program of removing cankered branches over a few years and finally replacing the tree. It should be noted that the results of the present survey reflect grower practice to a great extent and this may explain why no differences in disease assessments were recorded for the different varieties examined. However, it cannot be concluded that the varieties did not differ in their susceptibility to canker because the practice of replacing trees and removing cankered wood will tend to eliminate any varietal differences. The present results therefore do not conflict with the findings of Weaver (4) who reported a negative correlation between canker and rate of defoliation and on this basis classed the varieties Clberta and Redhaven resistant and moderately susceptible, respectively.

The survey reported here has shown that 98% of the trees in the commercial peach orchards of the Niagara Peninsula are affected by canker and that the data on average infection (Table 1) represents a high level of canker on the trunk, crotch, scaffold, and uearing branches. By making consecutive assessments in 1969 and 1970 on the same trees it was shown that there was a substantial increase of disease after one year (Table 4). The increase in disease between 1969 and 1970 cannot be used to project the levels of disease for a period of years because climatic and other factors affect its development, and consequently the increase will vary from year to year (8). However, the level of canker in the orchards in 1969 combined with the increase in 1970 provides evidence that canker is a very serious problem and should command a high priority in research.

Acknowledgments

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