FOLIAGE DISEASES OF ALFALFA IN NORTHERN SASKATCHEWAN IN 1970'

Howard Harding [2]

Abstract

The two primary foliage diseases were black stem (Phoma medicaginis Malbr. & Roum.) and yellow leaf blotch (Leptotrochila medicaginis (Fuckl.) Schüepp). Black stem was the more widespread but its incidence decreased between the June and August surveys- while that of yellow leaf blotch increased. Defoliation caused by yellow leaf blotch appeared to be the main source of crop loss. Over 100,000 leaflets and 1600 stems from field samples were examined in the laboratory. There was at least one lesion on 31% of the leaflets and *36%* of the stems. There appeared to be little consistent relationship between disease severity, stem height, and leaflet/stem ratio.

Introduction

Although foliage diseases of alfalfa are very common in Saskatchewan, there has been little work done to estimate accurately the losses caused by such diseases. The present survey records disease incidence in a larger number of fields and over a greater area than was previously attempted (1). In addition, the actual leaf area lost to disease has been estimated in field samples by careful examination of individual leaflets in the laboratory. This kind of estimate should provide a base for assessing the meaninq of subjective disease ratings done in the field.

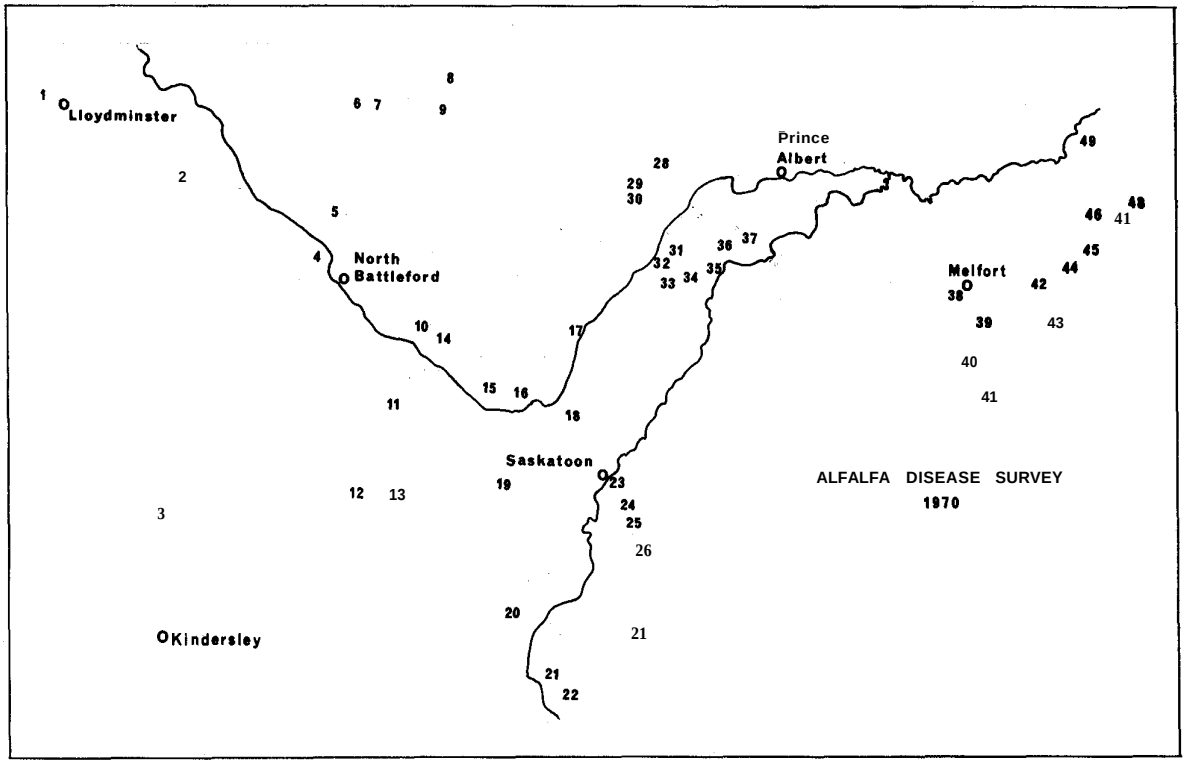

Figure 1. Location of sites visited in 1970 alfalfa disease survey.

[1] Contribution No. 424, Research Station, Canada Department of Agriculture, Saskatoon, Saskatchewan.

[2] Plant Pathologist.

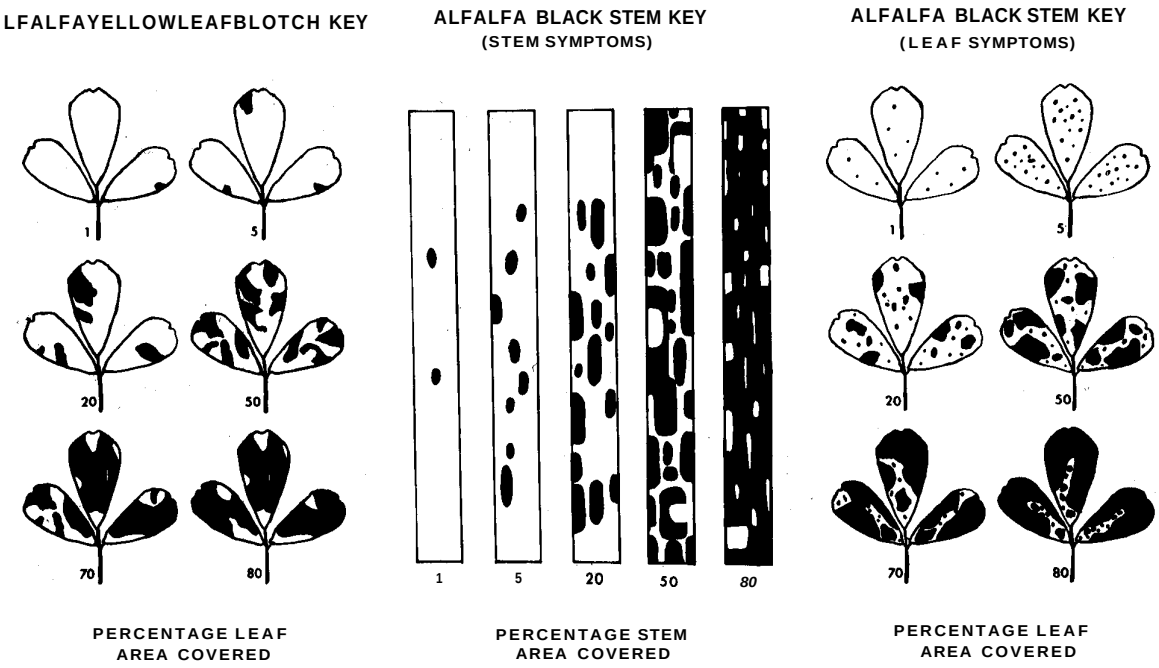

Figure 2. Alfalfa disease rating keys. Shaded areas represent "diseased" tissue whether chlorotic or necrotic.

Materials and methods

Surveys were conducted from June 9 to 18 and August 19 to 24. A total of 64 fields in northern Saskatchewan (Fig. 1) were scored for frequency of plants affected and disease severity. Rating was done as previously described (1) on a scale of 1–10. For laboratory examination, 167 10-stem samples were taken from 4–10 sites in each of 20 fields during the June survey. Each stem and leaflet was examined individually and the area occupied by diseased tissue was estimated using previously prepared disease assessment keys (Fig. 2). Stem ratings were done on the length of stem between the uppermost lesion and the stem base. Also, the < 1% category was included in the 1% category and consequently the amount of stem tissue affected by disease was probably exaggerated. Stem lengths and leaflet/stem ratios were also recorded.

Results

Black stem, caused by Phoma medicaginis Malbr. & Roum. and yellow leaf blotch, caused by Leptotrochila medicaginis (Fuckl.) Schuepp, appeared to be the two primary foliage diseases. Common leaf spot, caused by Pseudopeziza trifolii f. sp. medicaginis-sativae Schmiedeknecht, was found in most fields but in these, with one excention, only a few plants were affected.

Table 1. Alfalfa disease survey June 9–18, 1970

Location no.	Black stem		Yellow leaf blotch	
	% plants affected	Disease rating*	% plants affected	Disease rating*
1	80	1	10	1
2	100	1	20	1
3	40	1	20	1
12	100	2	5	1
14	20	1	0	
16a	30	1	80	3
17	5	1	50	1
21a	100	2	0	
21b	100	2	10	1
21c	100	1	5	1
23	100	1	20	1
24	100	1	20	1
28	20	1	100	1
30	70	1	40	1
34a	70	1	50	2
35	50	1	50	1
37	50	1	50	1
39	100	2	10	1
42	80	1	0	
42	20	3		
46	80	1	20	1
46	20	2		
47	50	1	0	
48a	75	1	0	
48b	100	2	5	1
49	80	2	5	1
49	20	4		

* Where 0 = no disease and 10 = severe disease.

In the June survey (Table 1) black stem wqs widespread though usually in slight amounts. Yellow leaf blotch was present in most fields but appeared to be causing damage only at location 16a. At location 30, 70% of the plants were slightly affected by downy mildew, caused by Peronospora trifoliorum de Bary.

Table 2. Alfalfa disease survey August 19-24, 1970

Location no.	Black stem		Yellow leaf blotch	
	% plants affected	Disease rating*	% plants affected	Disease rating*
5	10	1	0	
6	70	1	70	2
7	5	1	5	1
8	80	1	100	4
9	50	1	50	1
10	40	1	70	1
10			30	4
11	50	1	70	2
13	20	1	0	
15	10	1	5	1
16a	30	1	60	2
16a			40	6
16b	30	1	0	
18	5	1	40	1
19	70	1	5	1
20	80	1	80	2
20			20	6
21b	100	1	70	2
21b			10	4
22	0		0	
24	80	1	0	
25	80	1	5	1
26	5	1	70	2
27	5	1	90	3
28	70	1	60	4
28			40	4
29	5	1	50	1
29			40	3
30	10	1	60	1
30			40	5
31	5	1	0	
32	70	1	80	2
32			5	5
33	70	1	70	1
34b	5	1	5	1
34c	5	1	0	
36	80	1	40	1
37	80	2	80	4
38a	100	8	80	3
38b	70	1	100	2
40	5	1	5	1
41	5	1	30	2
43	70	1	100	4
44	75	1	80	2
44			5	5
45	0		0	
46	70	1	100	4
47	100	2	70	2
48	50	2	5	1

* Where 0 = no disease and 10 = severe disease.

At the time of the August survey (Table 2) the incidence of black stem had decreased and only in a seed field at location 38 did it appear to be' causinq real losses. The incidence of yellow leaf blotch was greater and at several locations the disease was causing obvious defoliation. In a newly-established field adjacent to the seed crop at location 38 about 20% of the plants were moderately affected by common leaf spot.

A total of 103,581 leaflets were examined individually in the laboratory and the averages for the 20 fields are shown in Table 3. On an overall average 68.7% of the leaflets were clean, 15.2% had less than 1% of the leaf area occupied by diseased tissue, 11.8% had 1%, 3.4% had 5%, and 0.6% had 20%. Of the 1670 stems 64.5% were clean, 25.7% had an estimated 1% diseased tissue, 7.3% had 5%, and 3.2% had 20%. There appeared to be little consistent relationship between disease severity, stem height, and leaflet/stem ratio (Table 3).

Discussion

Of the two primary diseases, black stem appeared the more widespread: losses caused by it, however, were less than anticipated on the basis of past observations. In particular, the crops grown under contract for alfalfa dehydration plants were remarkably free from black stem. Certainly, traces of the disease were found but probably good crop management reduced black stem losses to a minimum. On the other hand, yellow leaf blotch appeared to be causing some defoliation even in these well-managed fields. In obviously less well-managed stands, the incidence of both diseases was higher.

The high incidence of black stem in seed crops is reflected in the amount of seed-borne inoculum of P. medicaginis. In a survey of seed produced in Saskatchewan in 1969, 85% of the samples carried the organism with levels ranging from less than 1% to 34.4% of the seeds infested (2). It seems reasonable to suggest that with the use of cleaner seed and good crop management the incidence of black stem could be reduced considerably.

On the other hand, most of the diseased tissue on the leaflets examined in the laboratory represented black stem lesions and the fact should not be overlooked that almost a third of the leaflets carried at least one lesion. This estimate is also somewhat low in that a large proportion of the "clean" leaflets were the youngest and, therefore, smallest. Certainly, any more sophisticated estimate of loss should be based on actual leaf area rather than leaflet number.

Although the actual area covered by diseased tissue is relatively small, the presence of just one lesion may decrease the photosynthetic efficiency of a leaflet to a

Table 3. Distribution of individual leaflets into classes based on percentage leaf area occupied by diseased tissue

Location no.	% leaflets in each class							Leaf-stem ratio	Average stem length (cm)
	0	<1%	1%	5%	20%	50%	70%		
3	73	8	10	7	0.8			65	26
12	78	11	11	1				55	24
17	78	6	8	7	0.5			64	24
21a	57	22	16	4	0.6			70	37
21b	46	22	25	6	1.2			58	30
21c	63	18	13	5	1.0			65	39
23	74	18	7	1				62	38
24	58	21	16	5	0.3			62	30
28	76	12	10	2	0.1			90	29
30	79	5	6	3	2.3	2.4	1.7	85	31
34a	62	11	19	8	0.6			68	26
35	80	10	8	1	0.3			76	26
37	65	15	16	3	0.6			62	25
39	67	14	13	4	1.6			37	
42	74	19	5	2				37	
46	79	16	5	1	0.3			47	
47	64	21	13	2				34	
48a	68	22	9	1	0.1			43	
48b	61	20	16	3	0.5			35	
49	71	15	11	2	0.6	0.4		58	

disproportionately large degree. Also, even low levels of infection may substantially affect the nutritional value of the forage. It has recently been shown (4) that the control of P. medicaginis and other leaf-infecting fungi by fairly heavy fungicide applications resulted in an increased carotene content as well as an increase in dry matter. In a different vein, work at North Carolina (3) has shown that coumestrol levels increase in alfalfa leaves following infection by P. medicaginis. It seems, therefore, that further work should be directed towards determining at what level of infection individual leaflets cease to function at maximum efficiency and at what stage the nutritional value of the forage is affected.

Acknowledgment

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