MONITORING FIELD BEANS IN ONTARIO FOR BACTERIAL BLIGHT AND ROOT ROT BY AERIAL PHOTOGRAPHY - 1972'

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Abstract

In 1972, 65 field bean (Phaseolus vulgaris) fields (1,519 acres) in the vicinity of Hensall, Ontario, were aerially photographed, using infrared film, to determine the incidence of bacterial blight and root rot. Fifty-one fields were affected by blight, with the percentage of plants infected ranging from less than 1% in most fields to 6.5%. The overall infection level, 0.668%, is the lowest recorded since the initiation of this work in 1968. Root rot was detected in 61 of the 65 fields, with 27% of the plants affected, representing over 413 acres of the crop in the area. Root rot is now more important in Ontario than bacterial blight and appears to be more severe in fields where herbicides have been used extensively.

Resume

En 1972, on a effectué des photographies aériennes dans l'infra-rouge pour determiner l'incidence de la brûlure bactérienne et du pourridie dans 65 champs (1,519 acres) de haricots (Phaseolus vulgaris) de la region de Hensall (Ont.). Cinquante-et-un champs étaient atteints de brûlure bactérienne, le pourcentage de plants infestés variant de moins de 1%, dans la plupart des champs, jusqu'à 6.5%. Le taux moyen d'infestation, 0.668%, est le plus faible enregistré depuis la mise en marche de ces relevés en 1968. La pourridie était present dans 61 des 65 champs et 27% des plantes étaient atteintes, ce qui représentait plus de 413 acres cultivés de cette region. Le pourridié est aujourd'hui plus dangereux que la brûlure bacterienne en Ontario; il semble être plus virulent dans les champs où on a fait un vaste usage d'herbicides.

Aerial photographic surveys in 1968 and 1970 revealed that under a selected flight path at Hensall, Ontario, 5.22% and 6.561, respectively, of the field bean (Phaseolus vulgaris) crops were affected by bacterial blight (1,2). This particular flight path was chosen because it contains a number of select seed plots as well as foundation and commercial bean fields. The select seed plots are disease-free or are discarded if they contain bacterial blight. Seed from these plots is used to produce, initially, pedigreed seed and, thrcugh year to year multiplication, commercial bean crops. The Hensall flight path, therefore, is important in showing the effects of the select seed program as a blight control measure, and in measuring the overall incidence of blight in the bean crop.

In 1972, in addition to the determination of blight, an attempt was made to ascertain the incidence of root rot in the crop, as it was apparent that this problem was more prevalent than in previous years.

Methods

Sixty-five bean fields representing 1,519 acres were aerially photographed in the vicinity of Hensall, Ontario. This represents a total of 30.4 line miles of aircraft flying. The flying altitude was 6,900 feet above sea level to produce a photographic scale of 1:6,000 (datum plane: 900 feet). For maximum photographic interpretation, a Zeiss camera with a 12 inch focal length and Aerochrome infrared 2443 film, 9 x 9 inch format, developed as a positive, were used throughout the study. Although flights were scheduled for August 10 and 20, flights were delayed until August 20 and September 9 due to adverse weather conditions. However, interpretations were made only from the August 20 photographs because the crop had matured by the time of the second flight and the photographs could not be interpreted.

During the period August 1 to August 23 extensive ground truth studies were carried out. Each of the 65 fields was examined twice during this period. Within each field an area of from 1 to 3 acres, depending on field size, was examined thoroughly for symptoms of blight. Infected leaf samples were collected and forwarded to the Ottawa laboratory for determination of the causal organisms, Xanthomonas uhaseoli (E. F. Sm.)

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Table 1. Severity of bacterial blight and root rot in field beans in the Hensall, Ontario, area 1972

Field number	Total acreage	Bacterial blight		Root rot	
		Acreage infected	Percent infection	Acreage infected	Percent infection
1	47.433	0.1349	0.2844	0.6207	1.3085
2	15.7028	0.1706	1.0865	3.5359	22.5176
2A	19.4571	0.0232	0.1194	7.3135	37.5878
3	15.9411	0.0410	0.2575	1.4146	8.8739
4	39.8965	0.1651	0.4138	16.4805	41.3081
5	15.6778	0.0643	0.4100	6.4156	40.9216
6	35.6807	0.0164	0.0461	21.5409	60.3713
7	7.4992	0.1825	2.4331	1.4048	18.7327
8	66.8204	0.0312	0.0467	32.4909	48.6242
9	12.8704	0.0668	0.5194	2.6335	20.4617
10	18.1008	0.5539	3.0601	2.7823	15.3711
11	11.1184	0.716	6.4396	0.5986	5.3839
12	9.882	0.6469	6.5465	2.5599	25.9047
13	17.1956	0.4636	2.6962	3.2482	18.8897
14	10.0459	0.1519	1.5119	2.4871	24.7574
15	75.7727	0.0169	0.0223	17.9899	23.7419
16	20.7248	0.0153	0.074	13.2116	63.7478
17	68.9842	0.0512	0.743	11.7878	17.0877
18	5.6543	0.0091	0.1608		
19	19.4262	0.0613	0.3158	2.9871	15.3766
20	9.0092	0.0780	0.8664	5.201	57.7299
21	39.5451	0.0977	0.2471	18.2076	46.0426
22	25.3387			10.9407	43.1778
23	54.1598	0.5689	1.0504	27.1611	50.1499
24	13.0135	0.0192	0.1475	1.0403	7.9940
25	36.7393	0.0274	0.0747	13.1623	35.8262
26	13.2205	0.2821	2.1338	2.9949	22.6535
27	48.9666	0.0168	0.0343	25.2076	51.4792
27A	40.689	0.9120	2.2316	15.4549	37.9830
28	21.4758	0.0323	0.1505	7.2479	33.7492
28A	7.1388	0.0767	1.0741	2.8094	39.3540
29	33.4232	0.1379	0.4127	3.7190	11.3424
30	67.5289	1.6338	2.4194	0.1714	0.2538
31	22.9904	0.1064	0.4629	2.8582	12.4322
32	38.8088	0.0755	0.1945	0.1759	0.4533
33	13.8518	0.0627	0.4528	0.3463	3.2689
34	1.3658				
35	9.3242			0.0033	0.0354
36	24.1668	0.0148	0.0612	0.1237	0.5119
37	3.0563	0.1122	3.6715	0.1888	6.1774
38	2.5566			0.1218	4.7614
39	2.8988	0.0467	1.6124	0.1446	4.9883
40	2.7750			0.3777	13.6108
41	11.6208	0.1158	0.9964	1.3513	11.6283
42	8.4342	0.0125	0.1481	2.6172	31.0308
43	15.0423	0.4668	3.1036		
43A	4.4658	0.0814	1.8218		
44	18.6231	0.0174	0.0577	1.8693	10.0375
45	40.0171			2.5676	6.4163
46	10.6074			0.7727	7.2845
47	57.1723	0.0091	0.0159	2.0446	3.5762
48	10.1839			2.231	21.9071
49	46.665	0.0400	0.0858	30.6345	65.6477
50	50.1094	0.0086	0.0215	19.537	48.7093
51	48.6915	1.447	3.0182	31.2646	64.2096
52	39.4608			13.3208	33.7570
53	21.6339	0.0119	0.0552	1.7040	7.8765
54	9.5163	0.0268	0.2383	4.0381	42.4335
55	1.8515			0.0583	3.1488
56	1.9066			0.2412	12.6508
57	17.217	0.0159	0.0928	1.989	11.5525
58	9.9191			4.1443	41.7810
58A	7.3185			1.6755	22.8440
59	9.8883	0.0093	0.0938	3.0598	30.9436
60	14.0836			0.7933	6.6328
Total acreage	1519.8715	10.1457		413.4004	
Overall percent infection			0.668		27.1997

Dows. and Xanthomonas phaseoli var. fuscans Burkh. (Starr. & Burkh.). Patterns of root rot were noted in affected fields but root samples were not taken.

Disease interpretations were made from 9 x 9 inch color prints and ground truth notes. The field infection levels were determined using the drum scanner method (3).

Results and discussion

Fifty-one of the sixty-five fields were infected with blight to some extent (Table 1). Although most fields had less than 1% of the crop area affected, infection levels ranged up to 6%. The overall infection was low, 0.668% involving 10 acres of a total of 1,519 acres photographed and interpreted. This level of infection is the lowest since aerial photography of the crop was initiated in 1968. Future surveys will determine if the low level of blight in 1972 was the result of the select bean program, initiated in 1967. August conditions for an epiphytotic of blight in 1972 were similar to those in 1968, when 5.22% of the crop was infected, as mean daily temperatures in both years were the same and the relative humidities varied between 78% and 80%. The fact that 48 of the 65 fields contained less than 1% infection, indicates a low level of seed infection.

By ground truth survey, 41 fields were found to be infected with blight, 10 less than by photographic interpretation. Of the 10 affected fields missed in the ground survey, nine showed less than 0.5% infection. The difference between the ground and aerial survey results can be accounted for in part because it was not possible to cover more than 20% of the larger fields by ground survey whereas the entire area of each field was photographed and interpreted. Pathogenic cultures of X. phaseoli (common blight) or of X. phaseoli var. fuscans (fuscous blight) were isolated from leaves from 32 of 41 fields sampled. Isolates of X. phaseoli were isolated more frequently than X. phaseoli var. fuscans (Table 2). This trend has persisted since 1970, although the initial epiphytotics of bacterial blight in 1961 and 1962 were caused primarily by X. phaseoli var. fuscans (4).

Table 2. Frequency of occurrence of X. phaseoli and X. phaseoli var. fuscans in bean fields, 1970-72

Year	Number of fields affected by		
	X. phaseoli	X. phaseoli var. fuscans	Both pathogens
1970	30	21	4
1971*	36	6	
1972**	29	12	9

* Data from fields in Chatham and Hensall areas; a total of 84 and 69 fields were examined in 1970 and 1971, respectively.

** Data from Hensall area; a total of 65 fields were examined.

Root rot was present in 61 of the 65 fields under the flight path and more than 27% of the plants were infected, representing over 413 acres of the crop in the area. No information is available on the incidence of root rot in previous years or on the effect of root rot on yield. Root rot appears more severe in fields where herbicides have been used extensively over a number of years and there is apparently some confusion in distinguishing between herbicide injury and root rot.

Literature cited

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