DISEASES OF THREE SPECIALTY LEGUME CROPS IN SASKATCHEWAN IN 1972: FIELD PEA, LENTIL, AND FABABEAN

D.L. McKenzie and R.A.A. Morrall[1]

Abstract

A total of 20 fields of field pea (Pisum sativum var. arvense), lentil (Lens culinaris), and fababean (Vicia faba) were assessed quantitatively in late summer for leaf, stem, and root diseases. The most prevalent disease was ascochyta blight (Ascochyta pinodes) of field peas. Powdery mildew, sclerotinia stem rot, and root and foot rots incited by Fusarium spp. and Rhizoctonia sp. were also commonly found.

Introduction

A survey of the diseases of three legume crops, field pea (Pisum sativum var. arvense (L.) Poir.), lentil (Lens culinaris Medik.) and fababean (Vicia faba L.) was undertaken in 1972 as part of a continuing project in this laboratory on diseases of specialty crops in Sasktachewan. Previous surveys (2) had provided preliminary qualitative data on field pea and lentil and had suggested that an effort to gather quantitative data was warranted. In addition, fababean, grown for the first time in 1972 as a field crop in Saskatchewan, was included in the survey. Field pea has been grown in Saskatchewan for many years, while lentil is a relatively new crop (2). Actual acreages of field pea and lentil grown in previous years in the Province have been published elsewhere (2); in 1972 the acreages of the three crops were: lentil (13,000 acres), field pea (5,000 acres), fababean (500 acres). All of these figures represent increases over 1971.

The three crops were grown mainly in localized parts of the Province. Field pea was concentrated in the Bellevue area (60 miles N.E. of Saskatoon) and in the Nipawin area (150 miles N.E. of Saskatoon). Lentil was mainly in the Eston–Coleville area (150 miles S.W. of Saskatoon). Most of the fababean fields were in the Outlook irrigation district (60 miles S. of Saskatoon), but at least two fields were on dryland, one near Bellevue and the other near Perdue (40 miles W. of Saskatoon). These areas dictated the locations of the fields surveyed.

Methods

General

The survey was conducted in the period August 16 - September 3, 1972, and involved a total of 20 fields. The methods of sampling the crops and assessing diseases involved considerable improvisation, mainly due to a lack of pertinent information in the literature, such as appropriate field keys. Each field was sampled in four locations, usually near the corners, but about 50-100 ft into the crop. Sampling was done in a manner which ensured that for root and stem diseases it was possible to derive values for either the number of diseased plants per square meter or the percentage of diseased plants. At the same time it ensured that for foliar diseases the percentage of leaf area diseased could be determined. Thus, for root and stem disease assessment, either known areas of the crops were delimited with quadrats and the numbers of diseased plants in the quadrats counted, or a fixed number of plants in a row or cluster were pulled and rated for disease, or a combination of the two methods was used. Foliage, or whole plants, were collected from each sample area and taken to the laboratory for leaf disease assessment. Isolations from diseased tissue were always made when the identity of the casual agent was unknown. Tissue pieces were surface sterilized in 10% Javex (5.0% NaOCl) for 1 min and plated on potato dextrose agar (PDA). The disease assessments of each sample area or quadrat were averaged to give field means and then these were used to calculate the means for all the fields of the crop that were sampled.

Field pea

Root and, stem diseases were assessed by placing 1 m quadrats on the ground and counting the number of diseased plants in the quadrat. Foliage and pods were collected from the upper green portions of plants in the quadrats and taken to the laboratory. Leaves from the lower parts of the stems were invariably dead at the time of sampling and consequently were not included in the sampled foliage. The percentages of leaf area affected by ascochyta blight and by powdery mildew were determined with a disease assessment key for stomphylium leaf spot of red clover (1). Field pea leaflets were removed from the leaves and arranged in

[1] Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0

triplets, so that they could be compared rouuhly with the diagrams in the key. Twenty-five triplets of leaflets were rated from each quadrat sample. In addition, 25 pods were rated for the same two diseases by approximation using an assessment key for bacterial blight of bean pods (1).

Lentil

Groups of 50 plants were collected at random at each sample area and taken to the laboratory, where all disease assessments were made. Root infections were classified on the basis of the area covered by lesions on the main root: a rating of slight was given if less than 50% was affected, and a rating of severe if 50% or more was affected. All diseased root material was retained and isolations made on PCA to determine the causal organisms. Leaf diseases were not assessed because very few leaves had lesions: however, isolations were made from a few infected leaves.

Fababean

In most fields, a 1 m^2 quadrat was used to delimit a group of plants in each sample area, and the total number and the number with foot rot were recorded. In one field where the crop was planted in very wide rows, 50 plants from part of a row were scored in each sample area. In addition, foliage was collected from some of the assessed plants, normally from all the leaves still living from 5 plants in each sample area. The bean pods from the same plants were also collected and taken to the laboratory. Diseases of the leaf and pod samples respectively were assessed using the same keys as for field pea.

Table 1. Diseases of field pea

Disease	Fields of occurrence NO.	%	% area lesioned Range	Mean	No. of plants affected per m^2 Range	Mean
Ascochyta blight						*
leaf	9	100	0.4- 6.7	4.65	n.a.	
pod	9	100	0.1- 6.6	1.57		
Powdery mildew						
leaf	1	11.1	0 -13.2	1.46	n.a.	
pod	1	11.1	0 - 2.7	0.30		
Fusarium root rot	3	33.3	n.a.		0-0.8	0.2
Sclerotinia stem rot	2	22.2	n.a.		0-0.3	0.07

* n.a. = not applicable.

Results

Field pea

Table 1 shows that only 4 diseases were found in the nine fields surveyed. Ascochyta blight (Ascochyta pinodes L. K. Jones) was the predominant disease, with lesions covering means of 4.65% and 1.57% of the leaves and pods respectively. Most plants, and in fact, most of the leaves and pods were infected in all fields. Powdery mildew (Erysiphe polygoni D. C. ex Mérat) was noticeably absent in all but one of the fields examined. In that field infection was quite heavy in two of the sample areas but absent in the other two. Root and stem diseases (Fusarium spp. and Sclerotinia sclerotiorum (Lib.) de Bary) occurred in almost insiqnificant amounts.

Lentil

?he amount of root infection by Fusarium spp. was extremely high (Table 2). However, with all types of root rot, the effect of even the severe lesions on the above-ground parts of the plants did not appear to be very great. This, of course, is a subjective impression, but it is likely that the root lesions were initiated at a late stage of plant development. Table 2 also indicates that Sclerotinia and Botrytis infections on stems were at quite a low level: they appeared to be less frequent than in a previous survey (2), although it must be recognized that the earlier survey was mainly qualitative and was done in fields in different locations from those in the 1972 survey. Representative isolates from the Botrytis infections were identified as B. cinerea Pers. Some stem lesions, which resembled those incited by Sclerotinia, yielded Alternaria spp. and Fusarium Spp. on isolation. However, pathogenicity tests were not conducted on the isolates. Similarly, a few punctiform leaf lesions yielaed Alternaria spp. on isolation, but proof of pathogenicity was not established.

Table 2. Diseases of lentil

Disease	Fields of occurrence NO.	%	% of plants infected Range	Mean
Fusarium root rot				
slight	6	100	15.5-69.0	49.08
severe	6	100	1.0-35.0	21.33
Rhizoctonia root rot				
slight	2	33.3	0 - 4.5	0.83
severe	2	33.3	0 - 2.5	0.50
Rhizoctonia - Fusarium root rot				
slight	2	33.3	0 - 0.5	0.17
severe	2	33.3	0 - 0.5	0.17
"*Alternaria* stem rot"	6	100	2.5-12.0	6.50
Sclerotinia stem rot	1	16.7	0 - 3.0	0.50
Botrytis stem rot	1	16.7	0 -10.0	1.67
"*Fusarium* stem rot"	2	33.3	0 - 2.5	0.75

Table 3. Diseases of fababean

Disease	Fields of occurrence NO.	%	% area lesioned Range	Mean	% of plants infected Range	Mean
Leaf spot	5	100	2.2-11.8	4.58	n.a.*	
Pod spot	5	100	0.4-22.2	6.46	n.a.	
Powdery mildew of leaf	1	20	0 - 0.3	0.06	n.a.	
Rhizoctonia sp. foot rot	3	60	n.a.		0-4.1	1.16
Fusarium spp. foot rot	1	20	n.a.		0-0.5	0.10

* n.a. = not applicable.

Fababean

Table 3 indicates that the principal pathological conditions recorded on fababean were leaf and pod spotting. Spotting of both organs was of two types: large irregular necrotic areas with indefinite edges and smaller oval lesions with light brown centers and dark brown definite margins. Alternaria spp. were frequently, but not consistently, isolated from both types of lesions, but pathogenicity tests were not made on the isolates. While the cause of these two leaf spots is obscure, it seems likely that at least some of the former type was tissue necrosis associated with senescence. Powdery mildew[2] was recorded in only one field, and then in only one of the four sample areas. However, in another field it was observed outside of the sample areas, in moderate amounts in a strip of plants which had not been inoculated with Rhizobium at seeding. Elsewhere in the field the disease was practically nonexistent, suggesting a marked effect of nitrogen nutrition on disease severity.

[2] The pathogen was initially identified as Erysiphe polygoni. Subsequent work suggested that it may have been another species, but no specimens were retained

Discussion

While the acreages of field pea, lentil, and fababean in Saskatchewan were small in 1972, there are indications that all three crops may become more important in future. Systematic breeding programs on all three crops are in progress at the Crop Development Centre, University of Saskatchewan, and possible new uses are also being studied. Thus, pathological studies, including disease surveys, are important and should be continued and expanded. The results reported here, as well as those of previous work on two of the crops (2), have demonstrated only one disease, ascochyta blight of field pea, to be occurring at serious levels. This disease is already receiving attention in the breeding program at the Crop Development Centre. However, the surveys have pointed to a number of other pathological problems which could become more serious and which require further study.

Field pea has been grown in Saskatchewan for many years (2), during which time the varieties have changed and the relative frequencies of the three species of Ascochyta known to cause blight of peas have probably also changed (3). However, levels of inoculum of all pea pathogens have probably stabilized in the traditional pea growing areas. Thus, the major factor affecting disease severity is probably weather conditions during the growing season. On the other hand, inoculum of pathogens of lentil and fababean will almost certainly increase over the next few years if the crops continue to be grown and the acreages expanded. Diseases so far not recognized in Saskatchewan will probably appear and it remains to be seen whether serious losses will occur. Even now, further work is necessary to identify the cause of some of the pathological conditions found in 1972, such as leaf spot of fababean and stem rot of lentil. Also, the exact role of Fusarium spp. and Rhizoctonia sp. in root necrosis of lentil, and the effects of necrosis, if any, on yield need to be clarified. The relationship of weather to the severity of certain diseases under Saskatchewan conditions may require study; 1972 was considered to be a relatively dry year in most parts of the Province, and this probably affected all foliage diseases, and diseases such as botrytis and sclerotinia stem rots. Another problem which may require study is the host range of some of the pathogens of these legumes, since rotation is often important in disease control.

A major shortcoming in the surveys of specialty crops so far conducted from this laboratory is that they have been done only at the end of the growing season. Thus, not only have seedling, and perhaps some other kinds of diseases, been completely overlooked, but also no picture has been developed of the progression of diseases with time. It is intended to remedy these deficiencies in future surveys.

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