Impact of Topography and Management On Diseases of Canola and Wheat

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Introduction

Crop productivity on hilly terrain may vary greatly from upper to lower slopes due to differences in fertility, moisture and microenvironment. Plant diseases are affected by these conditions, resulting in differences in yield and quality among slopes. Precision farming technology allows the characterization of a field into specific landscape positions such as slope position and may increase the production efficiency by applying the optimum amount of inputs to each position. In order to apply precision farming technology to plant pathology it is necessary to understand the relationship among microenvironments within a field created by slope and the occurrence and severity of plant diseases.

Objectives:

To determine:

1) the variation in diseases of canola and wheat over the landscape,

2) the interaction of slope position with fungicide application for alternaria black spot control in canola, and

3) the interaction of soil nutrients and seeding rate with diseases of wheat.

Methodology

* Canola (Hysyn 110, Brassica rapa) was established on hummocky terrain at Prince Albert and wheat (AC Barrie) at Prince Albert and Watrous. Plots consisted of long narrow strips approximately 2 m wide by 100 m long at each location.
* Canola was replicated five times with two treatments: iprodione (Rovral Flo, Rhone-Poulenc, 1 .O L/ha., 240 g ai/L in 100 L of water) sprayed or unsprayed at the 60% bloom stage of canola.
* Wheat was replicated four times with treatment combinations of nitrogen and phosphorus fertility (0, 1 and 2 times the recommended rate) and seeding rate (67, 100 and 134 kg/ha).
* Data were determined not to violate the assumptions of the analysis of variance. Therefore data were analyzed using a split-plot experimental design with management treatments as main plots and slope positions as sub-plots.
* Diseases of each crop were identified visually from samples collected from each slope position within each plot. Altemaria black spot *[Alternaria brassicae* and *A. raphani]* of canola was rated based on the percentage of pod and upper stem area covered by lesions on 100 plants per sample. Foliar diseases, septoria *[Septoria tritici* and S. *no&rum] I* tan spot *[Pyrenophora tritici-repentis]* of wheat were assessed on the percentage leaf area diseased on 25 plants using a 0 (disease free) to 9 (plant dead) scale. Common root rot *[Cochliobolus sativus]* was rated based on the

percentage of plants out of 25 with subcrown internodes that had 50% or greater of the surface area discolored or covered by lesions.

* Yield was recorded Corn each sampled area.

Results

* Altemaria black spot was the most prevalent disease. observed on canola, while septoria / tan spot and common root rot were visually identified as the main diseases of wheat.
* Altemaria black spot increased in severity from upper to lower slope positions (Table 1). Application of iprodione reduced disease severity on all slope positions. However, a yield increase (205 kg/ha) on sprayed over unsprayed plots was detected only on the lower slope positions.
* There was no relationship between nitrogen and phosphorus fertility or seeding rate and disease severity of wheat due to septoria / tan spot or common root rot (Table 2).
* Septoria / tan spot were observed to be more severe on wheat on upper rather than lower slope positions at Prince Albert (Table 3). Lower slope positions outyielded upper slopes by 483 kg/ha. Part of this yield increase on lower slopes may have been due to reduced disease severity. However the magnitude of the disease severity difference was not great and it is more likely that other factors such as moisture and fertility differences between the slope positions were responsible for the majority of the yield difference.
* At Watrous common root rot was determined to be less severe on upper slope positions than on mid or lower slopes. However upper slopes had a lower seed yield than mid or lower slopes reflecting the importance of conditions other than common root rot on yield.

Table 1. Disease severity of altemaria black spot based on the surface area of pods and upper stems covered by lesions (%) and yield (kg/ha) for Hysyn 110 canola at Prince Albert, 1997.

Slope	Sprayed	Unsprayed	$Lsd_{(0.05)}$
Disease rating			
upper	*0.95*	*2.70*	1.15 *
mid	1.65	4.59	1.48 *
lower	2.85	7.90	2.27 *
Yield			
upper	558	352	278
mid	895	803	221
lower	915	710	205 *

Table 2. Analysis of variance for foliar disease severity and yield of wheat at Prince Albert and for common root rot and yield of wheat at Watrous, 1997.

Source	df	Mean Sq	F value	Pr > F
Foliar disease severity at Prince Albert				
Treatment	7	*0.786*	1.71	0.16
Slope	1	*10.563*	8.38	0.01
Treatment x Slope	7	*0.741*	0.59	0.76
Yield at Prince Albert				
Treatment	7	*428549*	*2.46*	*0.05*
Slope	1	*373 1484*	*37.11*	co.01
Treatment x Slope	7	*163404*	*1.63*	*0.28*
Common root rot at Watrous				
Treatment	7	*25.881*	*0.45*	*0.86*
Slope	2	*782.167*	*11.84*	co.01
Treatment x Slope	14	*81.595*	1.24	*0.28*
Yield at Watrous				
Treatment	7	*2383 140*	18.97	co.01
Slope	2	*4980239*	19.32	co.01
Treatment x Slope	14	*104712*	0.41	*0.97*

Table 3. Wheat foliar disease rating (O-9 scale) and yield (kg/ha) at Prince Albert and common root rot rating (% of plants with severe symptoms) and yield (kg/ha) at Watrous, 1997.

Slope	Prince Albert		Watrous	
	Disease Severity	Yield	Disease Severity	Yield
lower	4.7	2508	16.5	2523
mid			14.1	1861
upper	5.5	2025	7.0	1821
$lsd_{(0.05)}$	0.58	164	4.1	255

Conclusions:

1) disease severity in canola and wheat varied with slope position,

2) application of iprodione reduced alternaria symptoms of canola at all slope positions but increased yield only at the lower slope position, and

3) nitrogen and phosphorus fertility or seeding rate affected yield, but did not affect disease severity of wheat.