Impact of Preceding Crops on Incidence and Severity of Disease in Canola

Progress Report

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I. Research Objectives

1. Document the influence of crop rotation on the incidence and severity of sclerotinia, blackleg, and alternaria black spot in canola.
2. Determine the impact of the previous crop on disease levels in canola.
3. Determine if fungicide applications can be eliminated or rates reduced by altering the sequence of crops in the rotation.

II. Research Procedures

Crop Rotations

Six crop rotations were established at Minot, ND in 2000 (Table 1). Every crop of the rotation must be grown in every year to help explain the effect of individual years. Each treatment was replicated four times. Each crop was planted into a 30 foot by 180 foot plot, with a 30-foot border around all sides of each plot. One-half of each plot was treated with a fungicide to protect the canola from sclerotinia stem rot (SSR) while the other half was left untreated.

Table 1. Crop rotations by year and sequence.

Rotation	2000	2001	2002	2003	2004	2005	2006	2007	
1	C	C	B	W	C	C	B	W	B = barley
2	C	W	C	W	C	W	C	W	C = canola
3	F	C	B	W	F	C	B	W	F = flax
4	F	W	C	W	F	W	C	W	W = wheat
5	C	B	W	C	B	W	C	B	
6	C	C	C	C	C	C	C	C	

Disease Sampling

Each half (fungicide treated, and untreated) of every canola plot was sampled for Sclerotinia spores and disease, and for blackleg and alternaria black spot incidence and severity .

Sclerotinia

Sclerotinia ascospore counts. Ascospore sampling was done within the canopy of each canola plot. Sampling for spores was at 20% bloom and again 1 week later, on June 24 and July 1, respectively. Petri plates with Steadman's (Steadman *et al*) semi-selective medium was placed on the soil surface at four locations in the center of canola subplots to sample spores in the plot. The plates were exposed with the covers removed for 2 ½ hours. After exposure, the plates were covered and incubated for 3 days at 70-75° F in the dark.

Canola petals were also tested for the presence of ascospores. Petals were collected from four areas within each canola subplot on the same ascospore sampling dates previously mentioned. Four petals from each sampling area were placed on a petri dish with the same semi-selective media previously mentioned. The petri plates were incubated the same way. Sclerotinia disease risk will be reported on the scale of 0 to 45% incidence being low risk, 45-90% incidence being high risk, and 90 to 100% incidence being high risk (Morrall and Thomson 1991).

Sclerotinia Incidence and Severity. Canola stems were evaluated for incidence and severotu of SSR. The 10 sampling locations were paced off, and 10 consecutive stems at each

location, beginning where the pace ends, were removed and inspected for blackleg. This will assure a sample size of 100 plants per subplot. Sclerotinia was identified by bleached white stems that were spongy or shredded. Sclerotinia incidence (percent of infected plants), and severity on a scale of 0 to 5 (0 being healthy, 5 being dead) was recorded.

Flax will also be evaluated for sclerotinia incidence and severity. A total of 100 plants per plot were evaluated in a similar fashion as canola.

Blackleg
The sampling was done twice during the growing season. The first evaluation was on blackleg lesions on canola leaves. Canola leaves on 10 plants at 10 random locations per subplot was evaluated for blackleg lesions. Incidence of the lesions was recorded, not severity.

The second evaluation was conducted when the crop was in the swath. The blackleg evaluation was conducted at the same time and fashion as SSR incidence and severity evaluations. Blackleg was identified by plant crowns that are black, or gray or streaked with gray (determined by cutting the stem off at the crown). Blackleg incidence (percent infected plants), and severity on a scale of 0 to 5 (0 being healthy, 5 being dead) was calculated for each plot.

Alternaria Black Spot
Sampling was done at 10 locations in each canola plot. The locations and timing of sampling corresponded to those for blackleg and Sclerotinia. A sample of 5 pods was collected at random from several different stems at each of 10 locations.

III. Results and Discussion

Sclerotinia ascospore levels detected by petal and Steadman tests indicated very low disease risk in 2000. Low ascospore levels in 2000 were likely due to lack of inoculum in the area as the field history was cereal grains for twenty years prior to the initiation of the study.

In 2001, increased inoculum and favorable environment resulted in moderate disease risk, 65, and 100% incidence, detected by the early Petal and Steadman tests, respectively. However, little precipitation between the first and second evaluation caused a dramatic drop in disease risk. Risk is considered low at 0 to 45%, moderate at 45 to 95%, and high at 90 to 100% incidence on the petal test (Morrall and Thompson 1991).

In 2002 and 2003, the petal test indicated very low disease risk at both evaluation dates. However, the Steadman test in 2002 detected a higher level of ascospores than the petal test, possibly due to the microclimate within the crop canopy being more favorable for sporulation. In 2004, petal tests indicated moderate SSR disease risk, 56 % incidence, at the early evaluation, but ascospore incidence decreased by the second evaluation. SSR ascospore incidence in 2005 averaged slightly higher over evaluation timings than in previous years, but disease risk would still be considered low to moderate.

To date, general observations on disease risk indicate it is more dependent on environment than rotation.

SSR disease incidence on standing canola plants adjacent to canola swaths was too low to detect any significant differences throughout the study. SSR disease incidence peaked at 5% in canola on canola rotations in 2001, where risk test indicated the highest level of ascospores, but canola yield was not adversely affected. In 2000 through 2005, there was little risk or incidence of SSR, regardless of rotation or fungicide treatment, in this study. SSR disease incidence in 2005 averaged slightly higher than in previous years, 4%; however, this is still too low to detect any significant differences due to rotation or fungicide treatment.

Blackleg incidence has gradually increased each year, except 2004 (Figure 1). There was very little blackleg detected in 2000, the first year of the study. In 2001, blackleg incidence was up to 8% in canola on canola rotations. In 2002, the third year of the study, blackleg incidence was 37% in canola preceded by two years of canola, 24% in canola on canola, and less than 10% in first year canola or canola preceded by wheat preceded by canola (canola every other year). Although blackleg incidence in canola every other year was slightly higher than in first year canola, it was not significantly different. In 2003, canola once in four years and canola once in three years had similar blackleg incidence, 22%. Blackleg incidence was higher in canola preceded by three consecutive years of canola, 45%, which was similar to canola preceded by canola, and canola preceded by wheat preceded by canola (canola every other year). Blackleg severity did not increase with the occurrence of canola in the rotation and yield was not affected by blackleg incidence in 2002 or 2003 (Figure 2). The lack of yield response to higher blackleg incidence is likely due to the blackleg resistance of the canola variety planted, as well as below-normal precipitation and high temperatures during flowering in 2002 and 2003. In fact, overall canola yields were down in 2002 and 2003 compared to 2000 and 2001. However, in 2004 and 2005, blackleg incidence not significantly different between rotations. In 2004, this is likely due to heavy rain and hail in early June which damaged young canola plants that had shown symptoms of blackleg. The canola recovered, but the blackleg lesions did not reoccur. In June 2005, we received over 7 in above-normal rainfall. Prolonged wet weather increases disease spread and may be the reason no differences were observed between rotations.

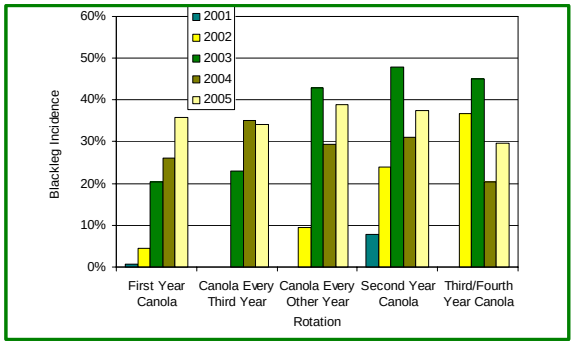

Figure 1. Blackleg disease incidence, 2001-2005.

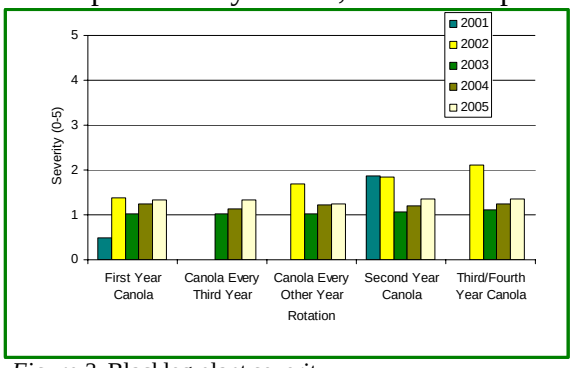

Figure 2. Blackleg plant severity.

Alternaria blackspot has not been observed throughout the duration of the study.

Literature Cited

Morrall, R. A. A. and J. R. Thomson. 1991. Petal test manual for Sclerotinia in canola. University of Saskatchewan, Saskatoon, SK 25pp.

Steadman, J. R., J. Marcinkowska and S. Rutledge. 1994. A semi-selective medium for isolation of *Sclerotinia sclerotiorum*. Can. J. Plant Pathology 16:68-70.