Impact of Diseases on Canola Production

Lorne J. Duczek
Agriculture and Agri-Food Canada Research Centre, 107 Science Place, Saskatoon, Saskatchewan S7N OX2

The Problem of Low Yields

The focus of this paper is on how plant diseases affect the yield of canola. One question, that was asked to be addressed, is the possible relationship between diseases and the unexplained low yields of canola that have occurred in various parts of the province. The description of this problem is that crops look good even at swathing time, and it is only after combining that producers realize that the crop yield was 50% or less than what was expected. A second problem is the possible increasing difference in yield between Polish and Argentine canola. In this case, can diseases explain the poor yields in Polish canola. A third problem is that of reduced or suppressed yields. The latter problem might be best described as the best yield in a field occurs with the first canola crop.

Could diseases be involved in low yields in good looking crops? Diseases with obvious symptoms of premature ripening in plants, lodging, and various discolouration such as that caused by blackleg, sclerotinia stem rot, altemaria black spot, and white rust are likely not involved in reducing yields in good looking crops. The simple reason is that to get a reduction of 50% in yield there would have to be some very obvious symptoms of damage. The observation made by those who experienced this problem is that these fields look great. However, there may be other possibilities for involvement of pathogens. If the loss is due to a reduction in the number of pods, than diseases could be involved, because some diseases are capable of doing this damage without showing other symptoms of discolouration. For instance, an unknown bacteria was isolated from crops in 1996 which can kill individual florets at flowering time. Later, the damaged parts dry up and the only symptom at swathing would be missed pods. Also it is possible that some pathogens which affect the roots could be involved. There are various organisms that could be causing some damage without causing a lot of symptoms. This would not be like brown girdling root rot which occurs in the Peace River of Alberta because this disease has obvious recognizable symptoms. Tests we did on barley and wheat with soil fumigation showed yield increases of 19-29% over that of untreated areas. Plants in treated areas looked better but without the side to side comparison one would consider that the untreated crop looked okay. In this case, there were some organisms in soil which lowered the yield. This could also be occurring in canola. Nevertheless, there would likely be some symptoms of poor

growth if this type of damage resulted in a 50% loss in yield. The pattern for this problem of low yields in good looking crops appears to be related to high moisture areas in some of the east and east central parts of Saskatchewan in 1994, 1995 and 1996. It maybe possible that root 'nibblers' are involved or if pods are missing something like a bacteria could be involved.

The apparent increasing difference between yields of Polish and Argentine canola might have a disease component. Polish canola might be yielding less because it sustains more damage from altemaria black spot and blackleg than Argentine canola. Altemaria black spot does more damage on Polish canola where losses of over 30% have been recorded in fields in recent years. However, in this case there are symptoms of black spots on the leaves, peduncles, pedicels, and pods of plants. In severe cases altemaria black spot would be hard to overlook in the field because patches of the field or the whole field should turn an unusual dark shade and ripen prematurely. In addition, blackleg could be involved because all varieties of Polish canola are susceptible while there are now varieties of Argentine canola which have some resistance.

The third problem of the generally suppressed yield of canola could have a disease component. Diseases of canola are widespread and can be damaging crops to an extent that yields are okay but not as great as would be expected. In this case, there would be symptoms of disease but if losses are low, these symptoms would not be very obvious.

So lets examine some of the diseases of canola and describe what they look like, what losses may be expected, and what can be done about them.

Assessment of Individual Diseases

Blackleg is caused by the fungus, *Leptosphaeria maculans* (Desm.) Ces. et de Not. The virulent form is widespread in Saskatchewan and causes significant annual yield losses in canola crops (Gugel and Petrie 1992). The Canola Council of Canada has estimated annual losses of $50 million in Saskatchewan since 1984. Diseased plants have greyish to dirty white coloured lesions on cotyledons and leaves. Numerous pinhead-sized, black sporulating bodies are often present in the lesions. Stem lesions, also called cankers, are similar in appearance to leaf lesions, but usually are sunken into the plant tissue and have a black or purple border. Cankers are generally found at the stem base or at the point where a leaf was attached. Lesions that girdle the basal stem may sever plants completely from their root systems, causing the plants to lodge. Plants not as severely infected can ripen prematurely. Observing lodged and prematurely ripened plants in a field usually indicates a disease problem. If a closer inspection of affected plants shows basal cankers than the cause is blackleg. Some recently registered varieties of Argentine canola are resistance to

the disease but currently all Polish canola is susceptible. Consult the annually produced publication 'Varieties of Grain Crops' for information on the disease reaction of varieites to blackleg. Oriental, brown, and yellow mustard are highly resistant to blackleg. The fungus produces spores on infected crop residue for many years, so a rotation of at least four years between canola crops is recommended to provide time for the infected residues to decompose. This recommendation also applies when growing resistant varieties. The disease is also seedborne, but this is of little consequence relative to the widespread occurrence of blackleg on crop residues. Tilt (propiconazole) is registered for control of blackleg and it is applied during the rosette stage of plant growth.

Sclerotinia stem rot caused by *Sclerotinia sclerotiorum* (Lib.) de Bary, affects many dicot plant species including canola and mustard. Diseased plants have greyish to white lesions with faint concentric markings on their stems. Plants wilt as their stems become girdled, and become straw coloured as they ripen prematurely. Infected stems tend to shred and break, releasing hard, black resting bodies called sclerotia that overwinter in crop debris or in soil. Observing lodged and prematurely ripened plants in a field usually indicates a disease problem. If a closer inspection of affected plants shows greyish to whitish lesions which are shredding, than the cause is sclerotinia stem rot. Losses in seed yield and quality can be significant with yield losses in the 5-10% range being common (Platford 1996) and losses as high as 50% have been recorded (Dueck et al. 1983). The fungus is long-lived, and no resistant varieties are available. A rotation of more than four years without crops like canola, peas, lentil and sunflower is recommended. The risk of stem rot epidemics in canola fields can be predicted using petal test kits to determine whether fungicide spray applications are economic. Two types of petal test kits are distributed through various sources. Contact either Reed Agricultural Services in Elrose or Dupont Canada for information on individual kits. In addition there is a Sclerotinia Stem Rot Checklist which enables an assessment to be made on the potential for damage to occur in a field. This checklist is available from various sources including the Canola Growers Guide. An additional piece of information is the Sclerotinia Risk Map for Western Canada which is updated twice a week starting in the middle of June through July. It is made available through the cooperation of Dupont Canada, Canola Council of Canada, and the three prairie provincial Departments of Agriculture, and Environment Canada. It is published in various farm magazines, is available on the DTN network, and is also provided by phoning Dupont's toll-free hotline. There are two fungicides registered for use in controlling sclerotinia stem rot and they are: Benlate (benomyl) and Rovral (iprodione). For control of this disease, the application timing is at the 20-30% bloom

stage.

Altemaria black snot is caused by *Alternaria brassicae* (Berk.)Sacc. and *A. ruphuni* Groves & Skolko. Infected plants develop grey to black spots that vary in size and shape on leaves, stems, and pods. Severely infected fields will ripen early and display an abnormal brown colour which on closer inspection will show it to be due to the numerous black spots. The disease is widespread in the canola growing area of Saskatchewan and causes severe losses if moist conditions occur during seed ripening. For instance, losses of up to 36% occurred in 1995 in Polish canola (Jones-Flory and Duczek 1995). In addition to lowering yield, the disease reduces seed weight, increases green seed count, and decreases seed germination. Polish canola is more susceptible than Argentine canola. Oriental and brown mustard are also susceptible to black spot; yellow mustard is relatively resistant Timely swathing which speeds up ripening can reduce the damage caused by this disease. Some fungicides are effective in controlling altemaria black spot but none are currently registered.

White rust and staghead are caused by the fungus *Albugo candida* (Pers.) Kuntze. Cream-coloured pustules appear on the underside of infected leaves from the seedling stage onwards. Infection of the flower buds causes swollen, twisted, and distorted inflorescences called stagheads, which become brown, hard, and dry as they mature. The fungus has several "host-specific" races; one of these attacks Polish canola and another attacks oriental and brown mustard. Yellow mustard is susceptible to both the Polish canola and the mustard races of white rust. Argentine canola is resistant to white rust. Significant yield losses occurred in Polish canola until resistant varieties became available in the early 1980's. It is not unusual to see some stagheads in a field of Polish canola but the incidence is usually quite low. This disease is quite striking even if a low percentage of plants are affected. Recently, a new form of the Polish canola race of white rust has appeared and all varieties of Polish canola are susceptible to it. Some varieties of oriental mustard are resistant to the disease, but all brown mustard cultivars are susceptible. A new race of white rust that occurs on mustard has also appeared recently. All mustard cultivars are susceptible to this new race.

Root and foot rots are caused by several soilbome fungi including *Rhizoctoniu solani* Kuhn, *Fusarium* spp., and *Pythium* spp. These fungi often act together in a disease complex that causes poor stand establishment or a root rot complex on older plants. Seeds may rot before germination or soon afterwards. Seedlings may fail to emerge, and

emerged seedlings have constricted roots just below the soil surface. Infected seedlings eventually topple and die. Light brown or greyish lesions develop on the tap roots of older plants. These may become girdled or the lesion may extend up one side of the stem. Seriously affected plants wilt and then ripen prematurely. It is not unusual to see some infected plants in a field. A severe form of root rot called brown girdling root rot causes the tap root to rot away completely, leaving a stump. Hard, brown lesions that develop at the stem base are called foot rot. Yield losses may be significant if crops are excessively thin or patchy due to poor stand establishment. In some cases reseeding may be required. Losses in established stands are generally minor except where brown girdling root rot is established which until now has only been in the Peace River area of northern Alberta and British Columbia.

Other diseases. do occur on canola which are of minor importance. Downy mildew usually occurs in association with staghead but on occasion it is associated with forming small stagheads in Argentine canola. Bacteria are capable of infecting infloresences which results in missing pods. Gray stem is widespread and appears as grey to purple patches on stems as the plants mature. The stubble of entire fields can appear grey but the disease rarely damages plants because it only develops after the plants have matured.

References

Dueck, J., R.A.A. Morrall, and D.L. McKenzie. 1983. Control of *Sclerotinia sclerotiorum* in rapeseed with fungicides. Can. J. Plant Pathol. 5:289-293.

Gugel, R.K. and G.A. Petrie. 1992. History, occurrence, impact, and control of blackleg of rapeseed. Can. J. Plant Pathol. 14:36-45.

Jones-Flory, L.L., and L.J. Duczek. 1995. Effect of fungicide application on alternaria black spot in AC Parkland canola, 1995. Pest Management Res. Rep., Insects and Diseases (on diskette from the Expert Committee on Pest Management Research Report)

Platford, R.G. 1996. Distribution, prevalence and incidence of canola diseases in Manitoba in 1995. Can. Plant Dis. Surv. 76:103-105.