THE EXTENT AND ROLE OF CANOLA AND LUPIN SOILBORNE DISEASES ON YIELD DEPRESSION: A PREREQUISITE FOR DEVELOPING AN EFFECTIVE AND SUSTAINABLE CONTROL STRATEGY

Final report

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by

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CHAPTER 1

EXECUTIVE SUMMARY

Soilborne diseases are major constraints to both sustainability and expansion of canola and lupin production in the winter rainfall region of South Africa. These diseases cause serious economical losses worldwide and annual yield losses of more than 20% have been reported. However, little or no information about these diseases is available in South Africa. During 1999 the incidence and extent of soilborne diseases of canola and lupin were determined in the major production areas in the winter rainfall region. The three farming areas in the Southern Cape (Bredasdorp/Napier, Heidelberg and Swellendam) and the Swartland (Moorreesburg, Piketberg/Eendekuil and Porterville) included in this survey represented different soil types and rainfall regimes. Plants were sampled 4-6 wk (seedling stage), 8-10 wk (vegetative stage) and 14-16 wk (flower/pod stage) after planting. Results of this survey revealed, and confirmed surveys done in other countries, that blackleg (caused by *Leptosphaeria maculans*) is the most important disease of canola. *Leptosphaeria maculans* attacks plants at various stages with cotyledon and crown infection having the most serious effect. Incidences of up to 100% were observed in the Swartland, but this disease was less severe in the Southern Cape. Damping-off of canola can be considered the second most important seedling disease of this crop. Several fungi, highly pathogenic on other crops, were associated with damping-off viz. *Fusarium avenaceum, Pythium irregulare, Pythium tracheiphilum* and *Rhizoctonia* spp. On lupin, damping-off appears to be the most important disease during the seedling stage with incidences of up to 43% being recorded. In these cases, large bare patches could be observed in the affected fields. Fungi associated with diseased seedlings were *F. avenaceum*, *F. solani*, *F. oxysporum*, *Phytophthora megasperma*, *Pythium* F-group, *Pythium* G-group, *Pythium* HS-group, *P. irregulare*, *P. tracheiphilum* and *Rhizoctonia* spp. Black spot (caused by *Alternaria* spp.) and *Sclerotinia* stem rot were equally important at the vegetative stage of canola, although only low incidences were recorded (0.1 and 0.3%, respectively). This situation changed at the flower/pod stage. Black spot (1.5 and 14% disease for Southern Cape and Swartland, respectively) may then be considered the second most important disease, followed by *Sclerotinia* stem rot (0 and 4% for the Southern Cape and Swartland, respectively). While *Sclerotinia* stem rot was not prevalent in lupin fields in this survey,

leaf blotch (caused by *Alternaria* spp.) was observed at both the vegetative and flower/pod stages of lupins with incidences of 2 and 16% recorded for the Southern Cape, and 2 and 0% for the Swartland, respectively. Crown rot of lupin was observed only in the Swartland and incidences increased from the vegetative (1%) to the flower/pod stage (3%), leaving bare patches in lupin fields. *Rhizoctonia solani* was frequently isolated form diseased crown tissue. According to this survey, root rot is the fourth most important disease of canola, but the most important soilborne disease of lupin in South Africa. High incidences were observed at the vegetative stage (8%) of lupin, with a slight increase towards the flower/pod stage (10%) in the Southern Cape. Although incidences of lupin root rot were lower in the Swartland, the same trend occurred. Similar to damping-off, several fungi pathogenic on other crops were isolated from root rot including *F. avenaceum. F. solani, F. oxysporum,* and *P. irregulare.* In 2000, pathogenicity tests were conducted with representative isolates of fungi from seedlings with damping-off symptoms. A sand-bran inoculum of each isolate was prepared, and a pasteurised topsoil, sand and perlite mixture (1:1:1) inoculated at 0.5% m/m. Controls consisted of a pasteurised soil mixture inoculated with an uninoculated sand-bran mixture. Two canola (Dunkeld and Monty) and lupin (Esta and Wonga) cultivars (three replicates of each) were planted in the inoculated soil mixture and incubated in a controlled environment. Percentage survival was determined two weeks after planting. Of the *Pythium* spp. tested, *Pythium* F-group, *P. colloratum* and *P. dissotocum* were highly aggressive to canola. *Pythium* HS-group, *P. irregulare*, *P. mamillatum*, and *P. tracheiphilum* caused damping-off of canola and lupin seedlings, while *P. nunn* caused damping-off of only canola seedlings. *Pythium ultimum* var. *sporangiiferum* and *P. ultimum* var. *ultimum* caused damping-off of cultivars Dunkeld, Monty and Esta, but little or none of cv. Wonga. *Pythium* T-group, *P. aristosporum*, *P. acanthicum*, *P. connatum*, *P. erinaceus* and *P. vanterpoolii* were not pathogenic to canola and lupin seedlings. *Fusarium avenaceum* was pathogenic to canola cv. Dunkeld and both lupin cultivars, causing symptoms varying from damping-off to hypocotyl rot. Of the 24 *Rhizoctonia* isolates tested, only six caused damping-off of both crops. These results indicate that a complex of fungi causes damping-off of canola and lupin seedlings. Due to the fact that no management strategy is available for damping-off of canola and lupin seedlings, application of a seed treatment was investigated in 2001. Three fungicides viz. iprodione, metalaxyl and thiram and were evaluated singly and in combination, under controlled conditions, in soils artificially infested with fungi previously determined to cause damping-off and in five naturally infested soils. The treatment with the combination of fungicides significantly increased

percentage survival in both canola (cultivars Dunkeld and Monty) and lupin (cultivars Esta and Wonga) planted in soil artificially infested. With the exception of one naturally infested soil, the combination treatment significantly increased percentage survival of canola and lupin seedlings. This survey provided the opportunity to determine which diseases occur and to what extent, as well as the causal organisms of these diseases. Although the combination fungicide seed treatment was effective in a controlled environment, it should be tested under field conditions to include effect of climatic conditions, which represent the major production areas. Evaluation under field conditions is also essential for registration of these fungicides for control of canola and lupin damping-off.