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This article is available in Journal of the Department of Agriculture, Western Australia, Series 4: http://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol40/iss1/7
Managing Lupin Anthracnose

A rapid response to an industry issue

Anthracnose in lupins was first reported in commercial crops in Western Australia in September 1996. By October 1996, several thousand lupin breeding lines and wild types of 11 lupin species were sown in New Zealand for resistance screening. In 1997, resistance to anthracnose was confirmed in several breeding lines and commercial cultivars of narrow-leafed lupins (L. angustifolius), landraces of albus lupins (L. albus) and wild types of several other lupin species. Important information on critical seed infection levels and fungicide seed treatment has also been determined.

Greg Shea reports on the research undertaken during the breeding and disease management program, and the results that will enable growers to avoid losses from lupin anthracnose in the future.
Introduction

Anthracnose is a serious disease of lupins, caused by the fungus Colletotrichum gloeosporioides, that has only recently been detected in lupin crops in Australia. It is present in almost every other country where lupins are grown and is considered the most important disease of lupins in Europe, North America and South America.

Major outbreaks of the disease occurred in the Geraldton and Mingenew areas in 1996. Through 1997 and 1998 anthracnose spread to infect many more parts of WA, with some detections in the south and east well removed from the original focus in the north. Significant losses were experienced in several narrow-leaved lupin crops of susceptible varieties in 1998 in the northern and west midlands areas. It is expected that many parts of the wheatbelt now have pockets of low level infection. Infection is particularly widespread in the high rainfall zone between Gingin and Geraldton.

The known extent of Lupin Anthracnose in Western Australia (as at March 1999)

[Map showing the extent of lupin anthracnose in Western Australia as at March 1999]
MANAGING LUPIN ANTHRACNOSE

Resistance screening in New Zealand and breeding activity
(by W.A. Cowling, B.J. Buitchell, D. Luckett, H. Yang and M.W. Sweetingham)

A suitable site for a disease nursery was selected at the Aorangi Research Station near Palmerston North, New Zealand in early October 1996. The nursery was set up outside Australia because of quarantine restrictions on anthracnose in all Australian States and the existence of an eradication program in Western Australia at that time.

In addition, resistance testing had to be carried out as quickly as possible, so that breeding could be undertaken in winter 1997 with the most resistant lines.

More than 6500 one metre rows of varieties, breeding lines, landraces and wild types of 11 lupin species (mostly *L. angustifolius*) were grown and tested at Aorangi Research Station in 1996 and 1997.

The disease was established using parallel 'spreader' rows of susceptible *L. albus* cv. Kiev Mutant, and anthracnose spores were sprayed on to plants during the summer to enhance the disease.

The results from New Zealand in the summer of 1996/97 were very encouraging, with evidence of moderate anthracnose resistance in domesticated *L. angustifolius*, in wild types of *L. angustifolius* from the Mediterranean region and in *L. albus* and some other species. Plants with moderate resistance rated 5 while very susceptible plants rated 9 (see Figure 1).

Under severe disease pressure, when *L. albus* cv. Kiev Mutant was almost dead, many lines were free of symptoms on foliage with only minor pod lesions (see photo below). Breeding lines with ratings between 5 and 6 included *L. angustifolius* cv. Wonga, which had been released in 1996 by New South Wales Agriculture from a breeding line which originated from Agriculture Western Australia.

Line 83A025-24-2-3, which was subsequently released by Agriculture Western Australia in 1998 as cv. Tanjil, also rated between 5 and 6. Also impressive were two landraces of *L. albus* from Ethiopia, and a few wild types in some other species.

Resistance testing also demonstrated that the impact of anthracnose was almost as severe on yellow lupin (*L. luteus*) cv. Teo and older varieties of *L. angustifolius*, such as Unicrop, as on *L. albus* cv. Kiev Mutant. As shown in Figure 2, there were few pods produced on these susceptible varieties, with most pods severely affected by anthracnose.
Illyarrie, bred in the 1970s with some resistance to anthracnose sourced from a breeding program in the United States, appeared only moderately resistant compared with Wonga, which podded successfully despite a high proportion of diseased pods.

Based on the New Zealand results, crossing occurred in Western Australia in early winter 1997 with types of *L. angustifolius* and *L. albus* considered to be most resistant. After accelerated seed multiplication over summer, F3 generation bulks of crosses with resistant *L. angustifolius* parents were screened for resistance in replicated row trials in a disease nursery at Kojareena near Geraldton in 1998.

Most of these F3 rows appeared to be resistant in the foliage, but anthracnose damage on pods was severe in many of these rows. Anthracnose killed flowers on Wonga and caused pod lesions on the main stem. In each row of Wonga, there were on average 8 to 10 plants that appeared to have podded well on the main stem without anthracnose damage. However, in other resistant crosses, there were 15 to 20 healthy plants in each row with no symptoms on pods (see Figure 3). This level of resistance, when carried forward to new varieties, should be sufficient to virtually eliminate anthracnose as a problem in Western Australia.
MANAGING LUPIN ANTHRACNOSE

Clean seed and fungicide seed treatment
(by G. Thomas and M.W. Sweetingham)

The importance of sowing clean seed for the management of anthracnose in lupins has been stressed many times. The use of clean seed remains a major plank of the anthracnose management package. The life cycle of the disease is such that the major contribution to the carryover of the disease is through infected seed rather than spore survival on stubble.

Critical seed infection levels

In 1997 and to a lesser extent in 1998 anthracnose-free seed was relatively easy to obtain from locations remote from the 1996 outbreak areas. From 1999 on, anthracnose-free seed will become an increasingly rare commodity. So the question for most growers will be – what level of anthracnose infection can be tolerated in my seed?

Trials were designed to determine the yield loss in resistant and susceptible lupin varieties grown from a range of initial seed infection levels. It was not possible to include all the currently grown varieties because of the large areas required for such a trial, so a selection spanning the range from the most susceptible to the most resistant was chosen (Kiev Mutant, Wodjil, Myallie, and Wonga).

Trials were established at Kojareena near Geraldton, Mingenew, and Mount Barker on farms where anthracnose had been previously found and in isolation from any other lupin crops or blue lupins. Sites were monitored with a weather station.

Different seed infection levels were simulated by transplanting an appropriate number of infected seedlings into each plot at emergence. Large lupin plots (10 x 40 metres) were laid out with a 10 metre buffer plot of canola on each side in an attempt to contain disease spread within each plot.

At the Kojareena site (475mm average annual rainfall) anthracnose spread very rapidly with the early winter rains, particularly in the Kiev and Wodjil. Considerable infection crept into the plots sown with no infected seed by the combination of rain-splash and wind gust from adjacent infected plots. By the end of the season all the Kiev Mutant plots were wiped out. Spore loads coming off the Myallie and Wonga plots were much lower and so inter-plot spread was much lower in these varieties.

There was a penalty of approximately 1.0t/ha from sowing 0.5 per cent infected Myallie seed. By comparison, the penalty in
Wonga was only 0.2t/ha (see Figure 5). Seed infection levels were measured in harvested seed samples. Seed infection levels in the highly infected Wonga were low (0.6 per cent) compared to the highly infected Myallie (5.5 per cent).

**Seed testing**

French researchers concluded that as little as one infected seed in 10,000 (0.01 per cent) could result in severe disease in Albus lupins in a conducive season.

A commercial PCR test, based on research carried out at the Centre for Legumes in Mediterranean Agriculture and the State Agricultural Biotechnology Centre, is available to growers. This test is capable of detecting one infected seed in 10,000. It is clear that exceeding the 0.01% level is a problem for Kiev Mutant in the medium and high rainfall zones where a yield loss of at least 20 per cent could be expected. At the other extreme, with Tanjil and Wonga, significantly higher levels of seed infection can be tolerated.

Given these developments, quantitative seed tests are being developed by AGWEST Plant Laboratories and by BioWest Australia. The test would need to measure above a level of one in 1000.

**Field inspection**

The value of a grower inspecting their own crop seems to depend largely on individual experience. It appears to be a good guide when the grower knows exactly what to look for.

**Fungicides**

The anthracnose fungus is highly seed-borne and infected seed not only carries the fungus to new locations but initiates anthracnose epidemics each season in crops sown with a proportion of infected seed. Fungicide seed treatment reduces transmission of the disease from infected seed to the emerged seedling. Some fungicides can also reduce secondary infection from spores splashed from an infected seedling to neighbouring seedlings.

With the recent publicity surrounding anthracnose it is easy to forget that brown spot will cause far greater losses in Western Australia than anthracnose in 1999. Growers must treat seed with a fungicide containing the active ingredients iprodione (Rovral® or Civet®) or procymidine (Sumisclex®) for brown spot control in seedling crops.

The best fungicides for anthracnose control and brown spot control are different. This means that growers need to treat with a mixture of products.

Trials were conducted in 1998 at Mingenew and Geraldton with highly infected Albus seed. At both sites a Rovral + Thiram mixture gave a large reduction in anthracnose transmission (see Figure 6).
MANAGEMENT PACKAGE IN SUMMARY (by G.G. Shea)

**Plant low risk seed**
Select a seed source with the lowest anthracnose infection level available. Seed should be graded to remove the smaller infected seeds. A commercial seed test is available – follow the sampling guidelines carefully.

**Fungicide seed treatment**
Thiram is effective and is usually mixed with a dicarboximide for brown spot control. Fungicide is strongly recommended in all parts of the State.

**Crop rotation**
Do not sow lupins back onto the previous season’s lupin stubble. A single-year break is sufficient for stubble-borne spores to break down.

**Reduce reservoirs of infection**
Control infected blue lupins on fencelines and roadways. To be effective, these need to be sprayed out early in the seedling stage before the disease has a chance to multiply and spread. Control volunteer lupins in cereal and canola crops in paddocks that will be sown to lupins the following season.

**Machinery hygiene**
Avoid contaminating clean seed with infected material during harvest and grading. Be aware of the potential for spraying rigs to spread disease within and between paddocks.

**Varities**
Note the relative resistance of the current lupin varieties. Tanjil and Wonga are the most resistant followed by Kalya. In higher risk situations do not grow Kiev Mutant, Wodjil, Myallie or Tallerack.