

Fungal Assays Reduce the Impact of Seed-borne Pathogens

The identification and quantification of potential seed pathogens is a critical and cost-effective step to direct integrated pest management (IPM) practices, limit seedling losses and improve seed-use efficiency.

Program Priorities

1994 – Applied Forest Science Ltd. determines appropriate sample sizes for 95% confidence in each fungal assay. Numbers in brackets indicate the standard deviation.

- **Caloscypha fulgens** 250 seeds required to detect a 5% infection ($\pm 2.5\%$) level
- **Fusarium spp.** 500 seeds required to detect a 5% contamination ($\pm 2\%$) level
- **Sirococcus conigenus** 1500 seeds required to detect a 1% infection ($\pm 0.5\%$) level

1996 – A seed pathology group (P. Axelrood, J. Dennis, D. Kolotelo, M. Neumann, M. Peterson and D. Trotter) determines species priorities and develops standards for fungal assay testing.

Testing is performed on dry seed allowing for greater test repeatability by reducing variability in seed condition that could occur with imbibed or stratified seed. This decision retained the value of approximately 2000 historical tests.

Species priorities for fungal assays (Table 1) established specifying **High** and **Medium** tree species X fungal species priorities. Actual tests performed influenced by the seedlot size, germination capacity, genetic class, use, feedback from clients and budget resources.

Interpretation of the Results

The results are based on all tests performed, although some seedlots have expired since testing. The variables are defined below Table 1, but an example is probably helpful, so let's look at the results for coastal Douglas-fir (Fdc) for *Fusarium* testing. There is a 56% probability of a seedlot being contaminated and the average contamination level is 2.8%. The worst case scenario was 84% providing an indication of how bad the situation can be.

A common question is at what level does a pathogen become significant? This is not an easy question to answer as other factors such as the germination environment, seed treatment and moisture content can have a significant impact on actual disease occurrence. For *Fusarium* spp. and *Caloscypha fulgens* a level of 5% or more is considered significant, but for *Sirococcus conigenus* a level of 1% is considered significant as this pathogen can spread to adjacent seedlings quite rapidly.

Pathologists were uncomfortable assigning a significance level to *Fusarium* as disease incidence could be significantly influenced by actual *Fusarium* species (assays to species level are currently cost prohibitive), variability in degree of bulking-up rates for stratified seed and differences between tree species. A more conservative approach is therefore warranted in predicting potential disease incidence from *Fusarium* fungal assay results.

Pathogen Incidence by Tree Species

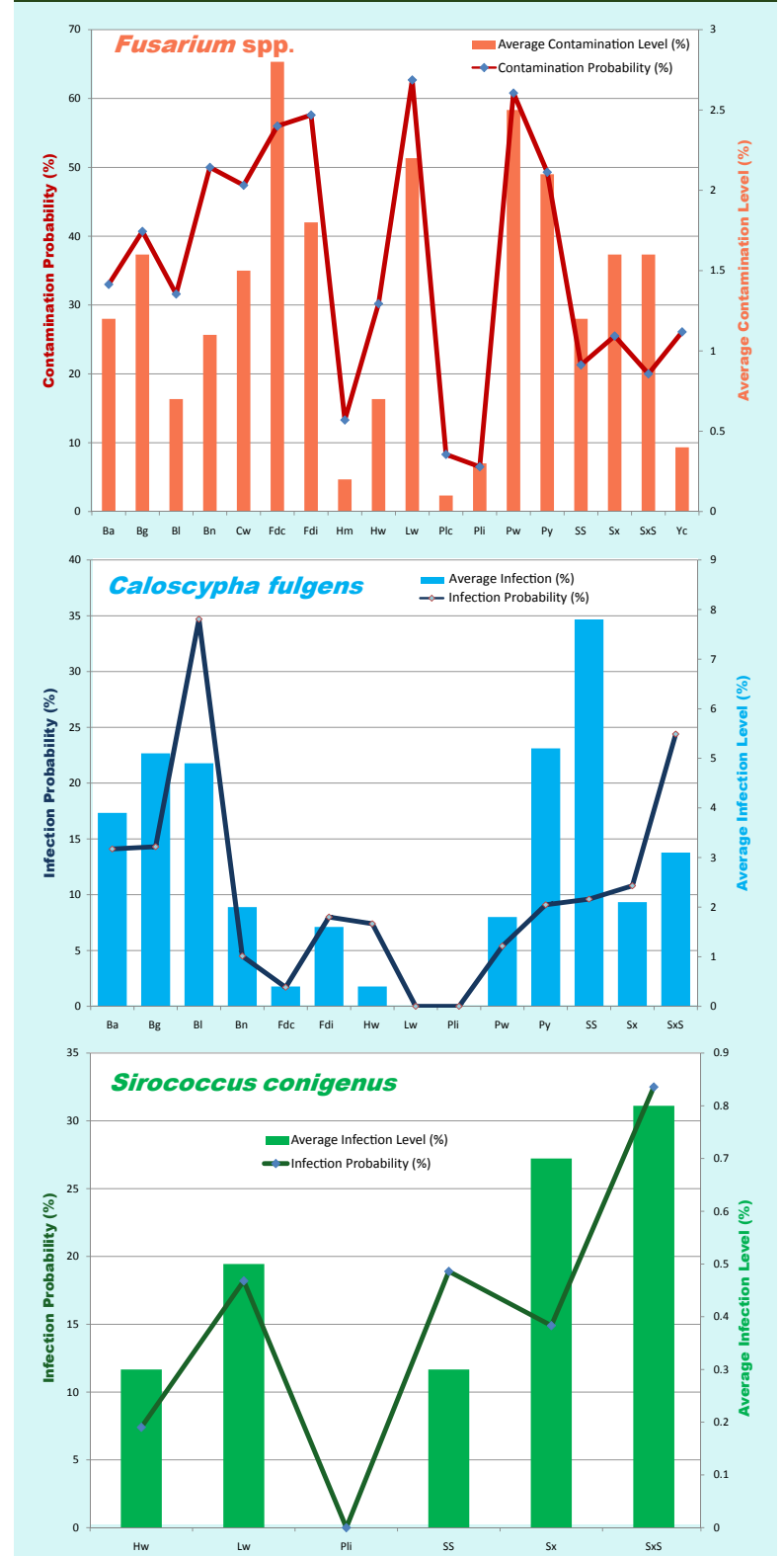


Table 1. The results of the fungal assay testing program.

Species ¹	<i>Caloscypha fulgens</i> (INFECTION %)			<i>Fusarium</i> spp. (CONTAMINATION %)			<i>Sirococcus conigenus</i> (INFECTION %)		
	Infection Probability	Average Infection	Maximum Infection	Contamination Probability	Average Contamination	Maximum Contamination	Infection Probability	Average Infection	Maximum Infection
Ba	14.1	3.9	22.0	33.0	1.2	14.0			
Bg	14.3	5.1	12.4	40.7	1.6	7.0	0.0	0.0	0.0
Bl	34.7	4.9	32.8	31.6	0.7	2.8			
Bn	4.5	2.0	2.0	50.0	1.0	2.0			
Cw	0.0	0.0	0.0	47.4	1.5	20.4			
Fdc	1.7	0.4	0.4	56.0	2.8	84.0	0.0	0.0	0.0
Fdi	8.0	1.6	4.4	57.6	1.8	42.0	0.0	0.0	0.0
Hm	0.0	0.0	0.0	13.3	0.2	0.2			
Hw	7.4	0.4	0.4	30.2	0.7	4.8	7.4	0.3	0.5
Lw	0.0	0.0	0.0	62.7	2.2	43.2	18.2	0.5	1.4
Plc	0.0	0.0	0.0	8.3	0.1	0.1	0.0	0.0	0.0
Pli	0.0	0.0	0.0	6.5	0.3	1.2	0.0	0.0	0.0
Pw	5.4	1.8	4.8	60.8	2.5	29.0	33.3	0.3	0.9
Py	9.1	5.2	10.0	49.3	2.1	35.8			
Sb				0.0	0.0	0.0	0.0	0.0	0.0
Ss	9.6	7.8	37.6	21.3	1.2	6.4	18.9	0.3	1.5
Sx	10.8	2.2	16.0	25.5	1.6	39.8	14.9	0.7	7.8
Sxs	24.4	3.1	16.0	20.0	1.6	4.6	32.5	0.8	2.4
Yc	0.0	0.0	0.0	26.1	0.4	0.8			
Total		1424			4035			961	

6420 fungal assay seedlot tests on above species performed to date (August 2010)

Red indicates a high testing priority
Pink indicates a medium testing priority

Probability = the % of seedlots showing an infection or contamination level > 0.0% for this tree seed/pathogen combination
Average = the average infection level of seedlots showing an infection > 0.0% for this tree seed/pathogen combination
Maximum = the maximum infection found for this tree seed/pathogen combination

INFECTION is the penetration of fungi within a seed. **CONTAMINATION** is the occurrence of fungi on the surface of seeds.

¹ The BC Tree Code List can be found at this link http://www.for.gov.bc.ca/hre/becweb/Downloads/Downloads_SpeciesList/treecode_45.doc

More Information

More details on the potentially pathogenic fungi and sanitation practices can be viewed online in the Seed Handling Guidebook: http://www.for.gov.bc.ca/hti/publications/misc/seed_handling_guidebook_hi.pdf

More details regarding *Fusarium* can be found online in "Fusarium species-a British Columbia perspective in forest seedling production": http://www.fs.fed.us/rm/pubs/rmrs_p057/rmrs_p057_109_125.pdf



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