



Seed Sanitation Results and Opportunities

David Trotter
BC Forest Service
Ministry of Agriculture



ACKNOWLEDGMENTS

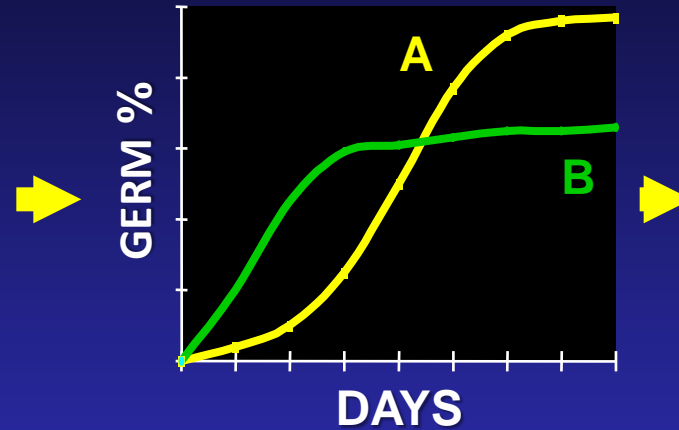
- APPLIED FOREST SCIENCE
- BC RESEARCH
- CANADIAN FOREST SERVICE
- COMMERCIAL NURSERIES
- ECOS BIOLOGICAL CONSULTANTS
- TREE SEED CENTER

Seed Handling Strategies

Assays



Vigour / Upgrade



Running Water



Culture / Logistics



Germination/Sanitation



Post-strat Treatment





Root Rots

Cylindrocarpon spp.,
Fusarium spp.,
Pythium spp.

CONTROL PROGRAM

- CULLING/FUNGICIDES
- CULTURAL CONTROL
- SANITATION



Sirococcus Shoot Blight

SEED PATHOLOGY

- INTRODUCTION
- MAJOR PATHOGENS
 - *Caloscypha fulgens*
 - *Sirococcus conigenus*
 - *Fusarium* spp.
- SEED SANITATION STRATEGIES



Seed-borne fungi	Fungus source and effects on seeds or seedlings
<i>Fusarium</i> spp. ^a	soil-, air-, and water-borne damping-off fungus
<i>Coloscypha fulgens</i> ^a	soil-borne pathogen kills and mummifies seeds
<i>Sirococcus conigenus</i> ^a	water-splash, air-borne from seedlings of infected seeds
<i>Cylindrocarpon destructans</i>	soil-borne saprophyte and weak parasite
<i>Alternaria</i> spp.	air-borne saprophyte and weak parasite
<i>Phoma glomerata</i>	soil-borne blight fungus
<i>Phomopsis</i> spp.	water-borne blight fungus
<i>Botrytis cinerea</i>	air-borne saprophyte and weak parasite
<i>Trichoderma viride</i>	soil-borne fungal antagonist
<i>Penicillium</i> spp.	air-borne saprophyte
<i>Mucor</i> spp.	water-borne saprophyte

^a Seed-borne fungi of greatest concern, whose presence is routinely tested for in BC.



	<i>Fusarium</i> spp.	<i>Caloscypha</i> <i>fulgens</i>	<i>Sirococcus</i> <i>conigenus</i>
Affected tree species	Interior Douglas-fir	Sitka x interior spruce hybrid	Sitka x interior spruce hybrid
	Western larch	Grand fir	Western larch
	Western white pine	Subalpine fir	Sitka spruce
	Western redcedar	Interior spruce	Interior spruce
	Ponderosa pine	Sitka spruce	Western hemlock
	Coastal Douglas-fir	Western white pine	
	Sitka x interior spruce hybrid	Noble fir	
	Grand fir	Amabilis fir	
	Western hemlock	Interior Douglas-fir	
	Subalpine fir	Western hemlock	
	Sitka spruce	Coastal Douglas-fir	
	Yellow-cedar		
	Noble fir		
	Amabilis fir		
	Interior spruce		
	Mountain hemlock		
	Interior lodgepole pine		

FUNGAL ASSAYS & SEED HANDLING

- STRATEGIES

- **SANITATION:** RW, POST-STRATIFICATION TREATMENT

- TRIAL - EFFECT OF RW ON *FUSARIUM* INOCULUM & SEED GERMINATION

- TRIAL - DRY VS STRAT SEED, SEED VOLUME, INOCULUM SOURCES

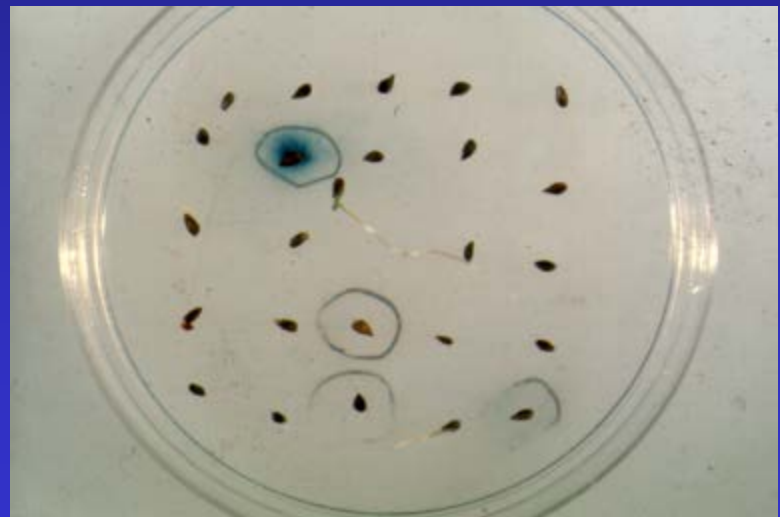
- TRIAL - *SIROCOCCUS* SOURCES

- TRIAL - RW / PEROXIDE TREATMENTS - SEED & EQUIPMENT

- **GROWING REGIME (MICRO):** TEMP, WATER MGMT, LIGHT, FERTILIZER, BLOCK

- **SEED PROCESSING & UPGRADING**

- **SEEDLOT VIGOUR & SOWING REVIEWS**



AFS & CFS

Caloscypha fulgens

THE SEED OR COLD FUNGUS

- **STRATEGIES**

- Seed upgrading & sowing factors
- Seedlot screening - fungal assays
- Optimal germination environment
- Running water / chemical treatments?



Canada

AFS & CFS

Sirococcus conigenus

SIROCOCCUS SHOOT BLIGHT

- **STRATEGIES**

- Seedlot screening - fungal assays
- Site contamination - inside / outside nursery
- Physical / chemical treatments - roguing & fungicides
- Cultural regimes - N levels



AFS & CFS

Fusarium spp.

- **STRATEGIES**

- Seedlot screening - seed vigour & fungal assays
- RW treatment
- Cross-contamination
- Request size / soak time
- Sanitation
- Chemical treatments - H₂O₂

CONTROL



RW



**PEROXIDE
3%; 4 hr; RW**



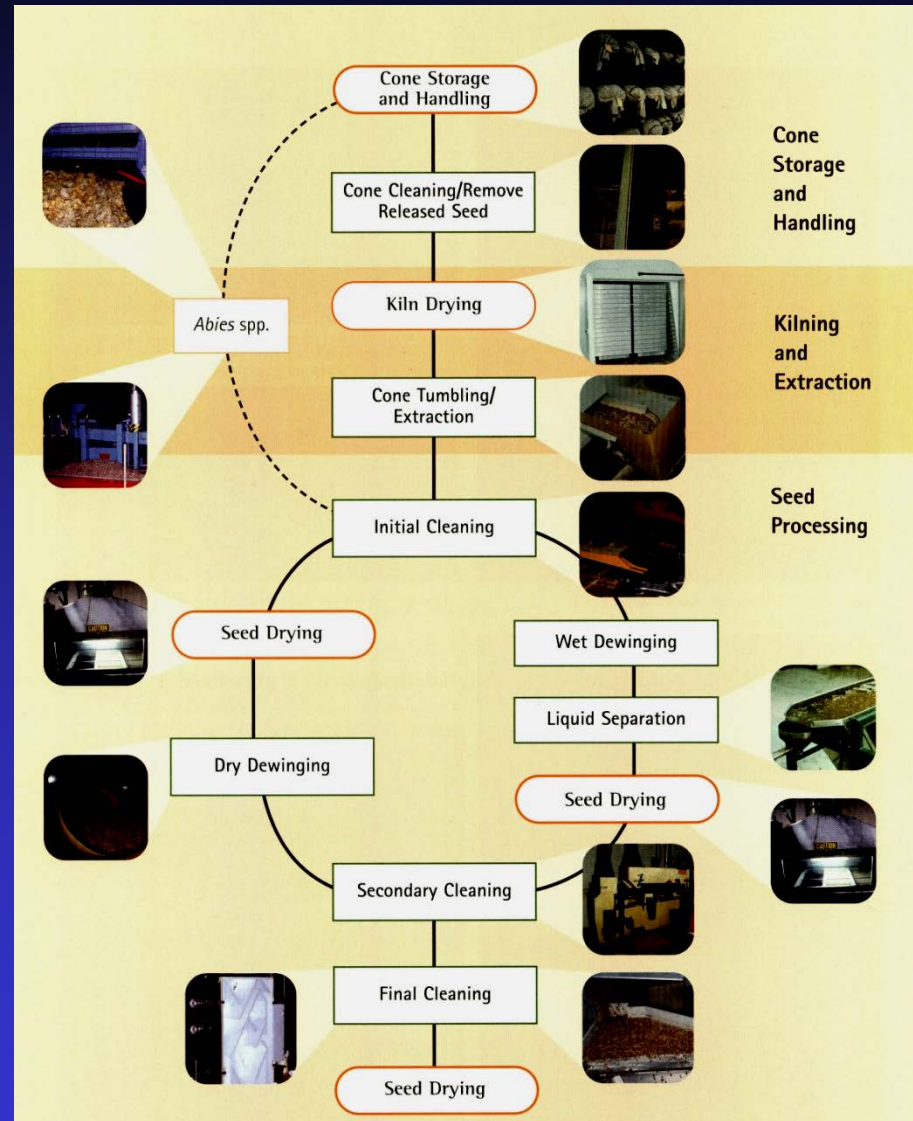


- RW – 24-48 hours
- Complete exchange: 4-8 hours
- Possible additional aeration
- Water/seed volume: 3:1
- Single tank: low risk species
- Multi-tanks: Fd & Lw; % fungus
- Tank sanitation



IPM REVIEWS: NEUMANN & MEYER

- VACCUM SYSTEM
- SANITATION - LAB EQUIPMENT, TANKS, SCREENS, PROCESSING EQUIPMENT
- MONITORING STATIONS
- TRAINING
- OUTDOORS - CLEAN-UP



FUNGAL ASSAYS & SEED HANDLING

QUESTIONS

- **FUNGAL ASSAYS**

- Potential: IPM strategy / Risk Mgmt, Seed species / Source:
 - *Caloscypha* - 5%, *Sirococcus* - 1%, *Fusarium* - 2- 5%
 - AFS; Noshad research; AGRI PCR/Lab assays

- **LIMITATIONS**

- Sample Size, Dry Vs Strat Seed, Pathogen species ID, Disease potential



FUNGAL ASSAYS & SEED HANDLING

QUESTIONS (cont'd)

- **Seed Orchards**

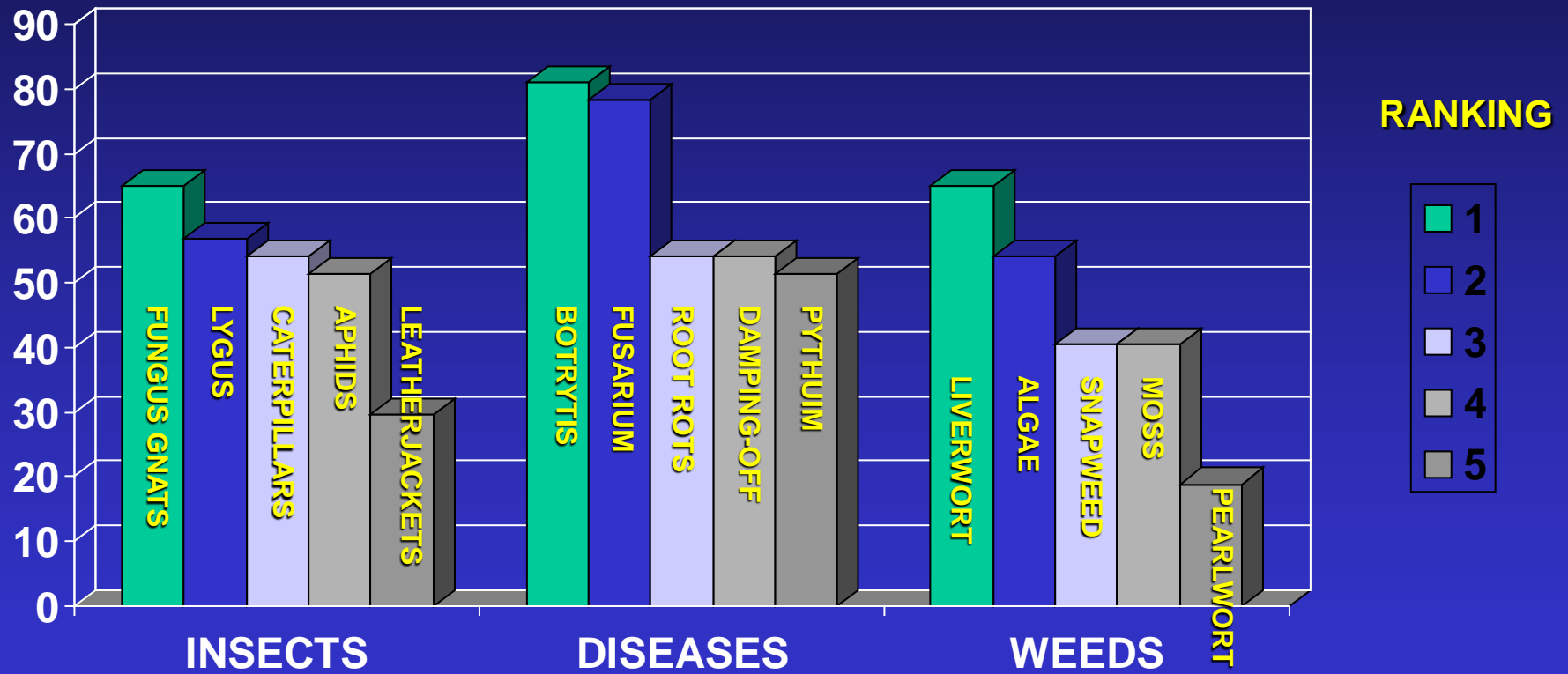
- Potential: orchard location; adaptation strategies & mgmt: supply chain.

- **Fungicides**

- Efficacy, Health Canada/PMRA reviews, Nursery, Disease potential



FOREST NURSERY PEST SURVEY - 2004



Relative importance of diseases in Canadian forest seedling nurseries
Rating from 0 (lowest priority) to 3 (highest priority)

DISEASES	British Columbia	Canada outside of BC
Botrytis (grey mould)	1.7	2.7
Fusarium	1.5	0.2
Sirococcus	0.6	0.6
Damping off	0.3	0.5
Scleroderris canker	0.0	0.5

Fungicides used in the past 5 years at Canadian forest seedling nurseries

FUNGICIDES	BC (21 answers)	Outside BC (15 answers)
iprodione	86 %	60 %
thiophanate-methyl	86 %	80 %
chlorothalonil	71 %	93 %
captan	48 %	27 %
metalaxyl-m	52 %	20 %

Thank you

Sanitation

- Container – dip tank
- Bleach, sodium meta-bisulphite
- Steam box

