DEVELOPMENT OF A SEED HEALTH STANDARD FOR CORIANDER BACTERIAL BLIGHT

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Background

- Coriander is one of the major field grown herbs in the UK with production mainly for the fresh leaf market
- Leaf blight caused by the bacterium *Pseudomonas syringae* pv. *coriandricola* (*Psc*) is considered as the most important disease by growers.
- The disease is primarily seed-borne, but there are no generally accepted seed-health standards in the UK for fresh leaf production.
- This grower-funded project used data from transmission studies and field trials to model the risks of significant disease in relation to different seed testing plans.

Transmission

Seed with different doses sown in glasshouse experiments.

Model:

$$P = 1 - \exp(-w.d^x)$$

where:

- P - probability of transmission
- w - 'one-hit' probability (1.6×10^{-4})
- d - dose (number of *Psc* per seed)
- x - dose coefficient (0.28)

Spread model

Field trials with a single primary infector.

Model:

$$\ln[p/(1-p)] = \ln(a) + b\ln[c+s] + r.t$$

where:

- p - proportion of plants diseased
- a - intercept
- b - gradient
- c - truncation parameter
- s - distance from primary infector
- r - relative infection rate
- t - time

Example risk scenarios

- For 1 million coriander seeds sown(~0.36 ha, ~10 kg)
- Seed infestation from 0.003 to 0.1%
- 10^2 to 10^5 CFU per infested seed
- Seed test: dilution plating on selective media
- Probability of positive test result is a function of the infestation level, sub-sample size and test sensitivity

Seed inf.			Prob.	Spread[3]		Pr +ve test[4]		Overall risk[5]	
1 in	%	CFU[1]	Trans.[2]	Max %	Avg %	1 x 3k	3 x 3k	1 x 3k	3 x 3k
30,000	0.003	10^2	0.019	19	0.4	0.03	0.08	0.02	0.02
		10^3	0.037	19	0.7	0.09	0.25	0.03	0.03
		10^4	0.069	19	1.3	0.10	0.26	0.06	0.05
		10^5	**0.128**	19	2.4	0.10	0.26	0.12	0.09
15,000	0.007	10^2	0.038	33	1.3	0.06	0.16	0.04	0.03
		10^3	0.072	33	2.4	0.18	0.44	0.06	0.04
		10^4	**0.133**	33	4.4	0.18	0.45	0.11	0.07
		10^5	**0.240**	33	7.9	0.18	0.45	0.20	0.13
10,000	0.010	10^2	0.057	45	2.6	0.08	0.23	0.05	0.04
		10^3	**0.106**	45	4.8	0.25	0.58	0.08	0.04
		10^4	**0.193**	45	8.7	0.26	0.59	0.14	0.08
		10^5	**0.337**	45	15.2	0.26	0.59	0.25	0.14
5,000	0.020	10^2	**0.111**	70	7.8	0.16	0.40	0.09	0.07
		10^3	**0.201**	70	14.1	0.44	0.82	0.11	0.04
		10^4	**0.349**	70	24.5	0.45	0.83	0.19	0.06
		10^5	**0.561**	70	39.3	0.45	0.83	0.31	0.09
1,000	0.100	10^2	**0.444**	95	42.1	0.57	0.92	0.19	0.03
		10^3	**0.674**	95	64.1	0.94	1.00	0.04	0.00
		10^4	**0.883**	95	83.9	0.95	1.00	0.04	0.00
		10^5	**0.984**	95	93.5	0.95	1.00	0.05	0.00

Notes:
[1] No. of bacteria per infested seed. [2] Probability of transmission. [3] Predicted disease incidence by 8 weeks after sowing. [4] Prob. of positive test result for a test on one or three sub-samples of 3,000 seeds. [5] Probability of transmission x probability of a negative test result; values in red are considered to represent an unacceptable level of risk (i.e. > 10%).

Conclusion

Recommended seed health standard:

Test protocols should be designed to achieve a tolerance standard of 0.03% with an analytical sensitivity of 900 CFU with 95% probability.

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