HAZELNUT (*Corylus avellana* 'Royal')
Eastern Filbert Blight; *Anisogramma anomala*

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A FORECASTING MODEL FOR FUNGICIDE RE-APPLICATION FOR CONTROL OF EASTERN FILBERT BLIGHT, 1999 - 2000. A model was developed, based on length of branch wetness due to rain, to help decide weather or not systemic fungicides with after infection activity (such as a DMI) are needed after an initial budbreak application of a protectant fungicide (such as Bravo). Healthy 2-year-old 'Royal' hazelnut trees were planted on 3 Feb 99 within a commercial block of heavily diseased 'Ennis' trees planted in 1985 on a 10 x 20 ft spacing near Canby, OR. Prior to planting the ground was rototilled and after planting the trees were mulched with sawdust. Treatments were arranged in a randomized complete block design with 5 trees per treatment in each of 4 replications. Treatments were applied to run-off with a backpack sprayer equipped with a hand wand. Approximately 2 gal of a spray suspension were applied per 20 trees. Bravo Weather Stik was applied at 32 fl oz/100 gal water on 19 Mar 99 at budbreak. Applications of Orbit at 2.74 fl oz/100 gal water were dependent on detecting greater than 5, 12 or 20 hours of branch wetness starting 2 weeks after the initial budbreak application until the first week of May. Another application of Orbit was made if the same conditions existed starting 2 weeks after the first Orbit application until the first week of May. According to the model, no further fungicide applications are needed after the first week of May (Fig 1). Trees treated with only the budbreak application of Bravo or with only Orbit served as controls. Branch wetness due to rain was monitored using a Belfort Leaf Wetness Recorder (hemp string wetness sensor) placed in the canopy of a mature hazelnut tree. Dew periods were not considered. The heavily diseased trees surrounding the trial were removed during the summer of 1999. The number of diseased trees, cankers per tree and total canker length was determined on 28 Sep 00.

A PVC trough spore trap was placed in each replication on 5 Mar 99. (Each spore trap consisted of a 2.3 meter long 1/2 inch PVC pipe split in half, supported by 2 metal posts, and angled at 20 degrees to drain into a covered 16 liter collection bucket. Each bucket contained 200 ml of 50% copper sulfate v/v as a spore preservative and germination inhibitor.) Rainwater from the traps was collected on 19 Mar 99, 5 and 23 Apr 99 by swirling the contents and pouring into a volumetric cylinder to measure the total volume of rainwater collected. Approximately 500 ml of the rainwater was collected for laboratory analysis and the copper sulfate solution was replenished after each collection. The rainwater was filtered first through a 20 um sieve then through a cellulose nitrate filter with 0.8 um pore size. This filter paper was placed on a microscope slide, stained with 0.05% (v/v) trypan blue in lactoglycerine. The number of ascospores on filters was then determined using a light microscope at 400X and used to calculate the number of ascospores collected per M^2 of trap surface. Rainfall from 15 Sep 98 to 19 Mar 99 (budbreak) was approximately 44.25 in (1123 mm) which corresponds to a 99% spore release (Pinkerton et al, 1998). Rainfall during the spore trapping periods are as follows: the North Willamette Research and Extension Center (nearest Canby orchard) recorded 1.21 in from 5 Mar 99 to 19 Mar 99, 2.01 in from 19 Mar 99 to 4 Apr 99, and 1.08 in from 4 Apr 99 to 23 Apr 99.

The spring was characterized as dry which may have resulted in lower disease pressure. Wetness periods were uncharacteristically short from bud break through early shoot growth (Figure 3). No wet periods due to rain were longer than 21 hours. Spore counts, however, were similar to past years in this same location. Figure 2 shows that spore counts significantly increased during the two-week period following bud break when compared to the two-week period before bud break. Spore counts declined after that period. Cankers did not seem to form on trees as they had in past years. Cankers appeared arrested in development and slow to appear if at all. Removal of surrounding mature trees resulted in unusually high amount of drought stress and may have impacted fungal colonization and canker development. There was no significant difference in cankers on trees treated with fungicides when compared to nontreated trees. Few conclusions can be drawn from this data set due to low canker development on nontreated trees. If we assume that these results are due to poor fungal establishment then the reapplication trigger can be raised from 20 to 21 hours branch wetness (the longest wet period during the early growing season). No conclusions can be gleaned if fungal establishment was normal but canker or symptom development was abnormal.

Acknowledgements: We would like to thank Richard Birkemeier for use of his orchards and for helping prepare the land and tend trees.

Treatment and Rate /100 gal water	Application Timing	Number of Applications	Disease Incidence[1,2] (%)	Ave Number of Cankers/Tree[1,3]	Total Canker Length[1,3] (cm)
Nontreated.....……..	None……	0	10.0	0.2	2.4
Bravo Weather Stik 32 fl oz	19 Mar (BB) only…	1	15.0	0.2	3.1
Bravo Weather Stik 32 fl oz then Orbit 2.74 fl oz after a wetness period of >5 hours	19 Mar……. 5 Apr and 23 Apr…	1 2	5.0	0.1	1.1
Bravo Weather Stik 32 fl oz then Orbit 2.74 fl oz after a wetness period of >12 hours	19 Mar……. 5 Apr and 23 Apr…	1 2	5.0	0.1	0.8
Orbit 2.74 fl oz after a wetness period of >12 hours	5 Apr and 23 Apr…	2	10.0	0.1	1.4
Bravo Weather Stik 32 fl oz then Orbit 2.74 fl oz after a wetness period of >20 hours	19 Mar…… None……	1 0	10.0	0.1	1.6
Orbit 2.74 fl oz after a wetness period of >20 hours	None……	0	10.0	0.1	2.8

[1] Means not differ significantly based on Fisher's protected LSD (P=0.05).

[2] Analysis of variance is based on arcsin (square root (x)) transformation. Values presented are detransformed means.

[3] Analysis of variance is based on log10 (x+1) transformation. Values presented are detransformed means.

Fig 1. EFB Fungicide Timing Model.

Step 1) Apply protectant fungicide (such as Bravo) at Budbreak.
Step 2) Wait two weeks.
Step 3) Apply systemic fungicide with after infection activity (such as Rubigan, Orbit or Elite) within 3 days of a rain event that wets branches for longer than XX (20) hours. If a long wet period is not detected until after the first week in May then no more fungicide is needed.
Step 4) Wait 10 days to two weeks then repeat step 3.
Stop after the first week of May.

Note: Model is based on research, high costs of fungicide and grower reluctance to make more than three applications per season. If more applications of fungicide are possible then continue forecasting through mid-May.