

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

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### **A Forecasting model (GrammaCast) for fungicide application for control of eastern filbert blight, 2005 - 2006.**

A model called GrammaCast was developed to help decide when to deploy fungicides. Healthy appearing 2-year-old 'Ennis' hazelnut trees were planted on 24 to 25 Jan 05 adjacent to a commercial block of diseased 'Ennis' trees located north of Keiser, OR. Treatments were arranged in a randomized complete block design with 5 trees in each of 4 replications (total of 20 trees per treatment). Treatments were applied on two sides of the tree to run-off using a Solo-Pump-Style backpack sprayer. Approximately 1 gal of a spray suspension was applied per 20 trees. Bravo Weather Stik was applied at 32 fl oz/100 gal water on 3 Mar 05 (bud break), 17 and/or 30 Mar 05 depending on the treatment. Applications of Orbit EC (2.5 fl oz/100 gal water) were based on GrammaCast models where by fungicides were applied if branch wetness lasted more than 20 hours. Applications of Orbit were made on 18 Mar 05, 26 Apr 05 and 11 May 05. Branch wetness due to rain was monitored using an Adcon A730 weather station equipped with standard leaf wetness sensors and customized hazelnut branch wetness sensors. The customized branch wetness sensors consisted of two wires in parallel coils wound around a 0.5 inch diameter hazelnut branch. The amount of current running from one coil to the other is directly related to the amount of moisture on the branch surface. Branch wetness due to dew periods was not considered. Roundup ULTRAMAX (2% solution) was applied to control weeds between trees on 26 Apr 05 and 4 May 05. Trees were fertilized with Urea (46-0-0) at a rate of 1 lb/3 trees on 4 May 05. Supplemental irrigation was provided as needed during the 2005 growing season. The number of diseased trees, cankers per tree and total canker length was determined on 11 Aug 06.

Two PVC trough spore traps were used in plots starting on 23 Feb 05. Each spore trap consisted of a 2.3 meter long 1/2 inch PVC pipe split in half lengthwise, 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 3, 17, and 30 Mar 05, 26 Apr 05 and 11 and 25 May 05 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 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 determined using a light microscope at 400X. Rainfall during the spore trapping periods were as follows: 0.1 in from 23Feb 05 to 3 Mar 05, 0.14 in from 3 Mar 05 to 17 Mar 05, 3.09 in from 17 Mar 05 to 30 Mar 05, 3.04 in from 30 Mar 05 to 26 Apr 05, 1.8 in from 26 Apr 05 to 11 May 05, and 2.03 in from 11 May 05 to 25 May 05.

#### **Fig 1. EFB Fungicide Timing Model, GrammaCast version 2.0.**

**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 Orbit) within 3 days of a rain event that wets branches for longer than 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 14 days 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.

**GrammaCast version 3.0** – Similar but with important changes in fungicide applications. The program starts with a calendar based system of Bravo every 2 weeks starting at bud break. A systemic fungicide, such as Orbit, is applied within 3 days of a rain event that wets branches for longer than 20 hours.

Weather conditions right after bud break were dry with below normal rainfall. The weather turned very wet when a “pineapple express” weather system brought warm wet weather from 25 to 27 Mar. During early shoot growth there were 4 wet periods, initiated by rain, that were 20 hours or longer (Figure 2). These wet periods occurred on 25 Mar 05, 28 Mar 05, 23 Apr 05 and 8 May 05. Spore counts were low during the 2 week period after bud break (Figure 3). Spore counts were considered quite high during the next 2 week period. All fungicide application schedules had been initiated before the “pineapple express” weather system. Trees treated with a single application of Bravo at bud break had a similar number of cankers as those found on nontreated trees. All other fungicide schedules controlled EFB significantly better than with no fungicide at all. No cankers developed on any trees treated with Bravo every 2 weeks (for a total of 3 applications), or on trees treated with either version of the forecasting program. One program, GammaCast version 2.0, had 4 applications of fungicide while GammaCast version 3.0 had 6 applications. Trees treated with only Orbit had slightly more disease but were not significantly different from trees treated with the forecasting programs.

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Treatment and Rate /100 gal water	Application Timing	Number of Applications	Disease Incidence <sup>1,2</sup> (%)	Ave Number of Cankers/Tree <sup>1,3</sup>	Total Canker Length <sup>1,3</sup> (cm)
Nontreated.....	None.....	0	40 a	0.5 a	10.7 a
Bravo Weather Stik 32 fl oz	3 Mar (BB) only	1	30 ab	0.4 ab	9.7 ab
Bravo Weather Stik 32 fl oz then Orbit EC 2.5 fl oz after a wetness period of >20 hours	3 Mar..... 18 Mar, 26 Apr & 11 May.....	1 3	 0 c	 0.0 c	 0.0 c
Orbit EC 2.5 fl oz after a wetness period of >20 hours	18 Mar, 26 Apr & 11 May.....	3	10 bc	0.1 bc	1.3 bc
Bravo Weather Stik 32 fl oz every 2 weeks .....	3, 17 and 30 Mar.....	3	0 c	0.0 c	0.0 c
Bravo Weather Stik 32 fl oz every 2 weeks AND Orbit EC 2.5 fl oz after a wetness period of >20 hours	3, 17 and 30 Mar..... 18 Mar, 26 Apr & 11 May.....	3 3	 0 c	 0.0 c	 0.0 c
Orbit EC 2.5 fl oz after a wetness period of >20 hours any time after bud break.....	18 Mar, 26 Apr & 11 May.....	3	5 bc	0.1 bc	0.8 bc

<sup>1</sup> Means followed by the same letter do not differ significantly based on Fisher’s protected LSD (P=0.05).

<sup>2</sup> Analysis of variance is based on arcsin (square root (x)) transformation. Values presented are detransformed means.

<sup>3</sup> Analysis of variance is based on log10 (x+1) transformation. Values presented are detransformed means.

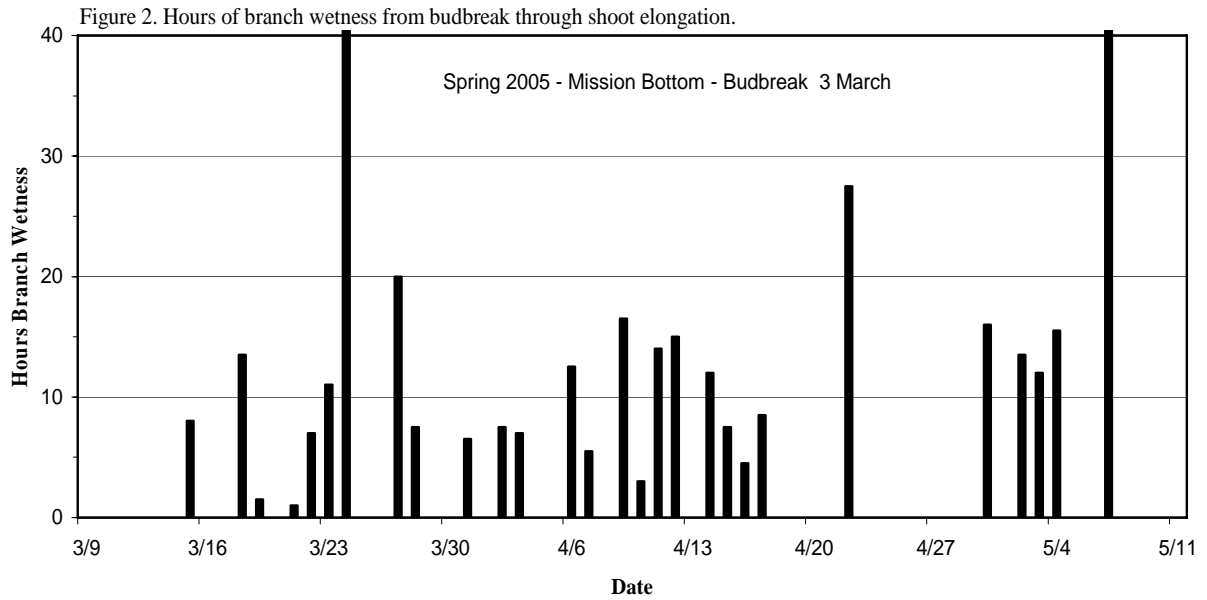


Figure 3. Mission Bottom ascospore counts from Ennis bud-swell through shoot elongation, 2005 season.

