

A Forecasting model (GrammaCast) for fungicide application for control of eastern filbert blight, 2004 - 2005.

A model called GrammaCast was developed, based on length of branch wetness due to rain, to help decide when to deploy fungicides. Healthy appearing 2-year-old 'Ennis' hazelnut trees were planted on 9 to 10 Feb 04 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 with a backpack sprayer equipped with a hand wand. 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 11 Mar 04 (bud break) and again on 24 Mar 04 and 7 Apr 04 depending on the treatment. Applications of Orbit EC at 2.5 fl oz/100 gal water were dependent on detecting greater than 20 hours of branch wetness starting 2 weeks after bud break until the first week of May. Applications of Orbit were made on 27 Mar 04 and 15 Apr 04. An additional protocol for using just Orbit after detecting 20 hours wetness anytime after bud break but before the 1st week in May resulted in applications on 27 Mar 04 and 15 Apr 04. 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 at 2 gal/100 gal water was used between trees to control weeds on 1 Apr 04. Trees were fertilized with Triple 16 (16-16-16) at a rate of 1 lb/3 trees on 21 Apr 04. Trees were painted with a 50% solution of white latex paint on 29 Apr 04 on the southwest side of the trunk to prevent summer and winter sunburn. Supplemental irrigation was provided as needed during the 2004 growing season. The number of diseased trees, cankers per tree and total canker length was determined on 12 Jul 05.

Two PVC trough spore traps were placed in the planting on 6 Mar 04. 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 11, 24, and 27 Mar 04, 7 and 15 Apr 04 and 7 May 04 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 M² of trap surface. Rainfall during the spore trapping periods were as follows: 0.1 in from 6 Mar 04 to 11 Mar 04, 0.34 in from 11 Mar 04 to 24 Mar 04, 0.6 in from 24 Mar 04 to 27 Mar 04, 0.21 in from 27 Mar 04 to 7 Apr 04, 0.7 in from 7 Apr 04 to 15 Apr 04, and 1.09 in from 15 Apr 04 to 7 May 04.

Fig 1. EFB Fungicide Timing Model, GrammaCast.

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 or Elite) 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.

Early spring weather was considered dry and rainfall was below normal. During early shoot growth there were 3 wet periods, initiated by rain, that were 20 hours or longer (Figure 2). These wet periods occurred on 14 and 19 Apr 04 and 7 May 04. Another period of wet weather on 25 Mar 04 was interpreted as over 20 hours but upon reanalysis there was a 2 hour dry period between rain events. Nevertheless, Orbit was applied shortly after that Mar wet period and then again after the 14 Apr wet period. Spore counts were low during the entire spring infection period (Figure 3). No cankers developed on any trees. Few if any conclusions can be gleaned from this data set. Lack of disease may have been due to a combination of low spore numbers (similar to 1999 spring conditions), dry weather and/or overspray from the neighboring commercial orchard. Substantial disease did develop on test trees at NWREC.

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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	0	0	0
Bravo Weather Stik 32 fl oz	11 Mar (BB) only	1	0	0	0
Bravo Weather Stik 32 fl oz then Orbit EC 2.5 fl oz after a wetness period of >20 hours	11 Mar..... 27 Mar and 15 Apr.....	1 2	0	0	0
Orbit EC 2.5 fl oz after a wetness period of >20 hours	27 Mar and 15 Apr.....	2	0	0	0
Bravo Weather Stik 32 fl oz every 2 weeks	11 and 24 Mar, and 7 Apr.....	3	0	0	0
Bravo Weather Stik 32 fl oz every 2 weeks AND Orbit EC 2.5 fl oz after a wetness period of >20 hours	11 and 24 Mar, and 7 Apr..... 27 Mar and 15 Apr.....	3 2	0	0	0
Orbit EC 2.5 fl oz after a wetness period of >20 hours any time after bud break.....	27 Mar and 15 Apr.....	2	0	0	0

¹ Means without any letters did not differ significantly.

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.