HAZELNUT (*Corylus avellana 'Jefferson'*)

N. DiManno and J. W. Pscheidt
Dept. of Botany and Plant Pathology
Oregon State University
Corvallis, OR 97331

Quantification of flutriafol in hazelnut shoots after drench or spray application, 2024.

Healthy one-year old 'Jefferson' hazelnut trees that were grown in layering beds and harvested in Nov 2023, were planted in Dec 2023 into 1 gallon pots and grown in a controlled greenhouse environment. Treatments were arranged in a randomized complete block design. Each treatment consisted of 4 single tree replicates. Drench treatments were applied on 13 Feb 2024 (4 weeks prior to bud break) where trees were drenched with a single application of TopGuard (500 ml of either 14 fl oz/100 gal or 28 fl oz/100 gal solutions) or left non-treated. Foliar treatments were applied on 12 Mar 2024 (at bud break) with a single application of TopGuard (14 fl oz/100 gal). Foliar applications were applied to trees from two directions, until runoff, using a Stihl SG20-Pump-Style backpack sprayer equipped with a brass hollow cone nozzle where 0.12 gal of a spray suspension was used per 4 trees. A total of three shoots per tree were collected along the length of the main stem 14 wks after drenching (10 wks after bud break) and then frozen immediately in a -65 °C freezer for later analysis.

'Jefferson' hazelnut trees grown in the same layering beds mentioned previously and harvested in Nov 2023, were field planted in Dec 2023 at the Botany and Plant Pathology Field Laboratory, Corvallis, OR. Trees were planted in 3 rows and 3 feet apart from each other. Treatments were arranged in a randomized complete block design. Each treatment consisted of 3 single tree replicates. All treatments were initiated 19 Mar 2024 (2 weeks prior to bud break) where trees were drenched with a single application of TopGuard (500 ml of either 14 fl oz/100 gal or 28 fl oz/100 gal solutions) or left non-treated. Shoots were collected at seven time points starting two weeks after drench applications which coincided with bud break; 2 wks, 3 wks, 4 wks, 6 wks, 8 wks, 10 wks, and 12 wks post drench. Although 5 shoots per tree were collected along the length of the main stem and then frozen immediately in a -65 °C freezer, only 3 were used for later analysis. Weeds were managed by applying GlyStar Plus (3%) on 23 Feb, Casuron 4G as a general pre-emergent on 8 Mar, Ranger Pro (4 fl oz/gal) on 24 Apr, 18 Jun and 27 Aug, and Reckon 280L (1.7 fl oz/gal) on 31 Jul. Trees were fertilized with 46-0-0 at a rate of 0.5 lb/6 trees on 21 Mar and 19 Apr 2024.

A double density block of Jefferson hazelnuts planted in 2015 on 10 x 20 ft spacing at the Botany and Plant Pathology Field Laboratory, Corvallis, OR was also used for flutriafol investigations. Although entire rows were used for treatments, only temporary trees (trees to be removed as the orchard matures) were used for shoot collection. TopGuard (flutriafol) was sprayed onto orchard soil beneath the first half of a single row of trees at 14 fl oz/100 gal and then at 28 fl oz/100 gal onto the other half of the row. Treatments were applied on both sides of the row on 20 Mar 2024 using a Honda ATV with Wilco 25 Gal tank boomless 10 ft (single left) sprayer (Nozzle TeeJet (B) 1/4XP10L) at 35 psi at a rate of 17.5 gal water/A. Temporary trees from a non-treated row 40 feet from the treatment row were used as controls for shoot collection. Each treatment consisted of 4 single tree replicates. Shoots were collected at seven time points starting two weeks after the TopGuard application which coincided with bud break; 2 wks, 3 wks, 4 wks, 6 wks, 8 wks, 10 wks, and 12 wks post spray. Three shoots per tree were collected from three randomly selected branches distributed evenly around the tree canopy. Shoots were frozen immediately in a -65 °C freezer for later analysis.

For each sample, consisting of three shoots per replicate tree per treatment per collection time point, shoots were weighed and then homogenized via bead beating using methanol as the suspension medium. Homogenized samples were then analyzed for flutriafol content via mass spectrometry/liquid chromatography (LC/MS) at the Oregon State University Mass Spectrometry Center. Methods were developed based on reagent grade standards of the active ingredient. The limit of detection was 0.1 ng/ml, while the limit of quantitation was 0.5 ng/ml flutriafol. Limits were calculated for each collection adjusting for the weight of leaf material analyzed, with an average limit of detection calculated as 1.7 pg/mg and an average limit of quantification calculated as 8.3 pg/mg.

Results

Although flutriafol was detected in all potted trees, including those non-treated, only those treated with TopGuard had enough flutriafol that could be quantified and thus analyzed (Figure 1). Quantities of flutriafol (pg/mg) present

in shoots of the young potted 'Jefferson' collected 10 weeks after budbreak were significantly greater in the TopGuard drenched plants compared with those that received a single foliar application (Figure 1).

Flutriafol found in field planted young trees was variable being close to or below the level of quantification or below the detection level through the fourth week of shoot collection (Figure 2). Trees treated with the high rate of TopGuard had flutriafol consistently above the quantification level starting at 6 wks after drenching while trees treated with the low rate were consistently above this level starting 8 weeks after drenching. Non-treated trees also had quantifiable levels of flutriafol starting 8 weeks after other trees were drenched. There was no significant differences between treatments at 8, 10 or 12 weeks. All field planted tree treatments had levels of flutriafol by 12 weeks after drenching (Figure 2) similar to potted trees foliar sprayed with TopGuard (Figure 1). We suspect that non-treated trees picked up flutriafol from rain splash and/or vapor action of the fungicide.

Flutriafol found in mature trees was variable being close to or below the level of quantification or below the detection level through all 12 weeks of shoot collection (Figure 3). When quantifiable, the levels of flutriafol in mature trees (Figure 3) were lower than those found on young treated trees in the greenhouse (Figure 1) or field (Figure 2). (Note that lack of an experimental design does not allow statistical analysis of data from the mature tree trial.)

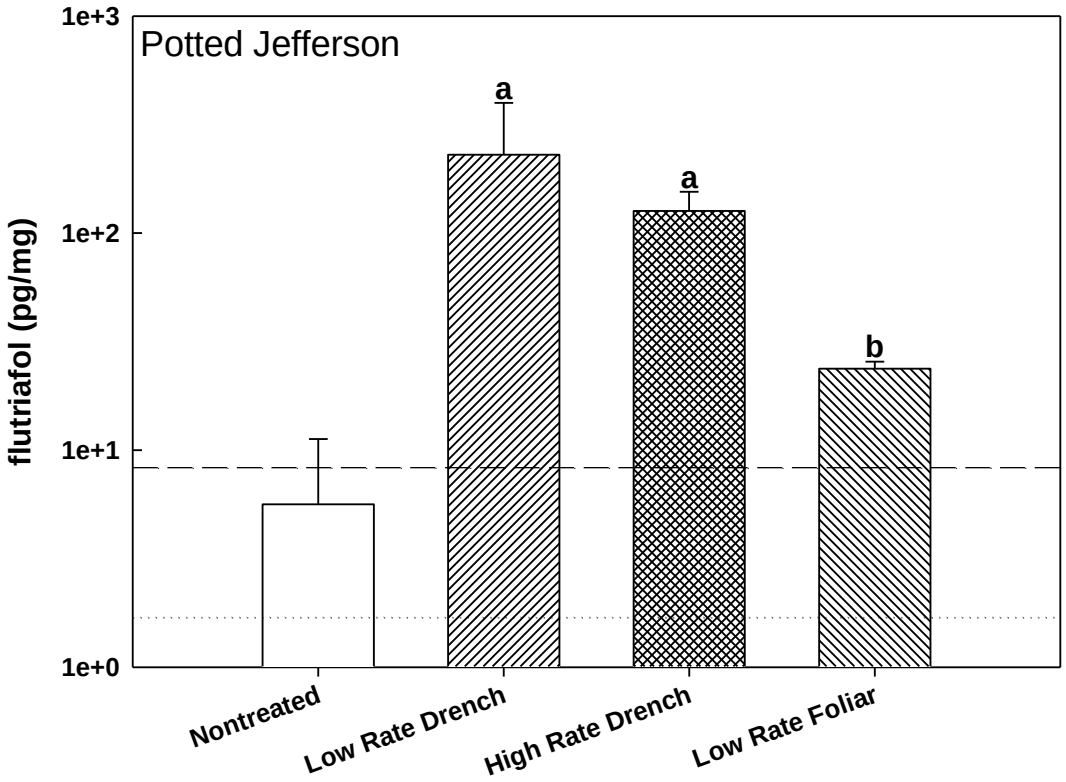

Figure 1. Quantities of flutriafol (pg/mg) present in shoots collected 10 weeks after budbreak of young potted 'Jefferson' trees drenched (four weeks prior to budbreak) or sprayed with TopGuard (at budbreak). Fungicide treatments consisted of a low rate drench (TopGuard @ 14 fl oz/100 gal), high rate drench (TopGuard @ 28 fl oz/100 gal), and single foliar spray (TopGuard @ 14 fl oz/100 gal). The limit of detection (1.7 pg/mg) is indicated with a dotted line, while the limit of quantification (8.3 pg/mg) is indicated with a dashed line. Analysis of variance is based on log (x+1) transformation. Means followed by the same letter do not differ significantly based on Fisher's protected LSD (*P=0.05*).

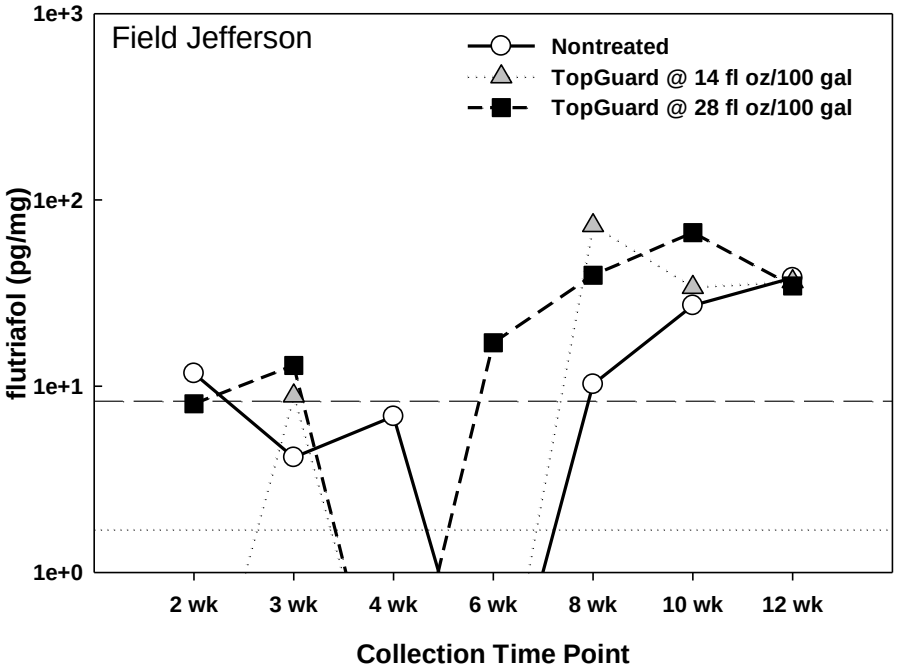

Figure 2. Quantities of flutriafol (pg/mg) present in shoots collected at multiple time points after bud break of young field planted 'Jefferson' trees drenched with TopGuard. The limit of detection (1.7 pg/mg) is indicated with a dotted line, while the limit of quantification (8.3 pg/mg) is indicated with a dashed line. Analysis of variance is based on log (x+1) transformation. Means without letters are not significantly different based on Fisher's protected LSD (*P=0.05*).

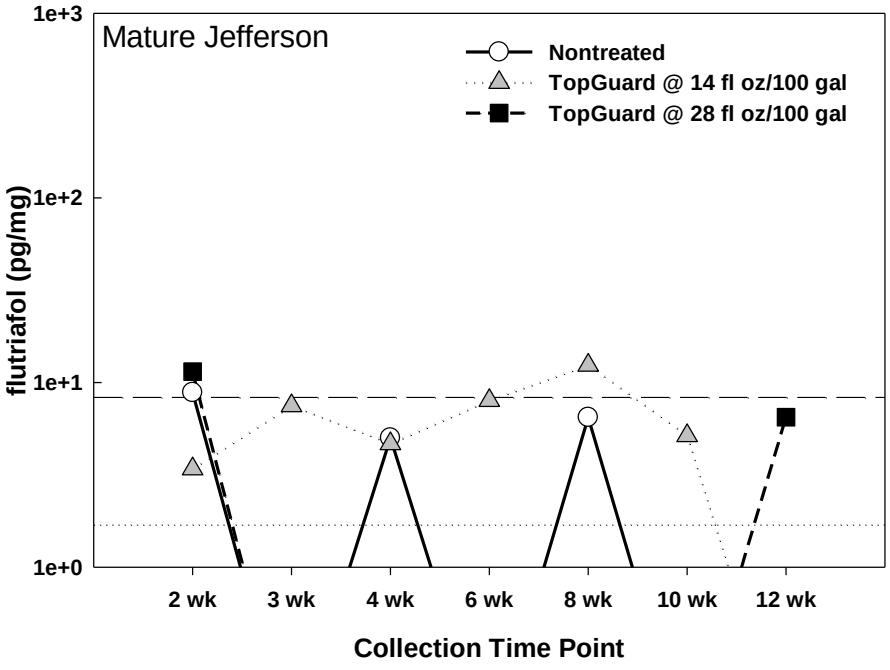

Figure 3. Quantities of flutriafol (pg/mg) present in shoots collected at multiple time points after bud break of mature 'Jefferson' trees ground sprayed with TopGuard. The limit of detection (1.7 pg/mg) is indicated with a dotted line, while the limit of quantification (8.3 pg/mg) is indicated with a dashed line.