EFFECTS OF DRIP APPLICATIONS OF FONTELIS® FUNGICIDE FOR PINK ROOT MANAGEMENT

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Objective

Evaluate in-season applications of Fontelis® fungicide for the management of pink root in onions.

Introduction

Pink root caused by the soil-borne fungus *Setophoma terrestris* (= *Phoma terrestris*) is pervasive disease of onions in the Treasure Valley. Infected roots are less able to supply water and nutrients to the plant, which ultimately limits bulb size. The fungus survives in the soil and on roots and debris of onions and other susceptible crops for a number of years.

Currently, long crop rotations, fall fumigation with chloropicrin or metam sodium, and the use of more resistant onion varieties are the best options to suppress pink root. Crop rotations are limited by the ability of the fungus to survive for long periods of time and the long history of onion production in the Treasure Valley. Host plant resistance also tends to decline with high soil temperatures.

In-season fungicide applications may complement these other management tactics to reduce the impact of pink root on onions. In previous research at the Malheur Experiment Station and elsewhere, penthiopyrad (Fontelis®, DuPont) has performed better than some other soil applied fungicides for management of pink root. Fontelis can be applied through drip irrigation, which moves it through the root zone where the pathogen resides.

In this trial, we evaluated different numbers of Fontelis applications made through the growing season for their effect on pink root on three yellow onion cultivars.

Materials and Methods

This trial was conducted at the Malheur Experiment Station in a field that had not been in onion production for at least 6 years. The field was fumigated with Vapam® at 15 gal/acre and bedded at 22 inches in the fall of 2017.

Three onion varieties were selected for this trial (cv ‘Granero’, ‘Joaquin, and ‘Vaquero’) Onion seed of all varieties was planted at 143,000 seeds/acre on March 28, 2018.

The field was drip irrigated with drip tape laid at 4-inch depth between two onion beds during planting. The drip tape had emitters spaced 12 inches apart and an emitter flow rate of 0.22

gal/min/100 ft (T-Tape, Rivulis USA, San Diego, CA). The distance between the tape and the center of each double row of onions was 11 inches.

Onions were irrigated automatically to maintain the soil water tension (SWT) in the onion root zone below 20 cb. Soil water tension was measured with six granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrometer Co., Riverside, CA) installed at 8-inch depth in the center of the double row. Sensors had been calibrated to SWT. Irrigations were run by a controller programmed to irrigate twice a day applying 0.48 inch of water per irrigation. A Watermark Electronic Module (WEM, Irrometer Co.) was adjusted to override controller irrigations if the SWT was below 20 cb. Four Watermark sensors were connected to the WEM.

Fontelis Applications

Drip applications were made by injecting Fontelis solutions through the drip lines. Each application was made at 24 fl oz/acre. Fontelis was added to a 60-gal tank of water and the solution was injected with an Ozawa pump running at 10 gal/hour for 6 hours. Water alone was run for 1 hour before injection applications began and for 1 hour after injections ended to ensure that the Fontelis was pushed out to the outer rows of each plot.

The trial was laid out as a randomized complete block with four replications of each of four Fontelis treatments for each of the three varieties. The untreated control received no Fontelis treatments. Plots in treatment 1 received one application of Fontelis on May 28 when onions were at 2- to 3-leaf stage. Plots in treatment 2 received two applications of Fontelis, the first on May 28 and the second on June 12. Plots in treatment 3 received three applications of Fontelis, the first on May 28, the second on June 12 at the 5- to 6-leaf stage, and the third on June 27 at the 8- to 9-leaf stage (Table 1).

Table 1. Treatments and application dates to assess the effect of Fontelis® on pink root suppression in onions. Malheur Experiment Station, Ontario, OR, 2018.

Treatment	Fontelis application 1 (24 fl. oz/acre)	Fontelis application 2 (24 fl. oz/acre)	Fontelis application 3 (24 fl. oz/acre)
Untreated	---	---	---
Treatment 1 (Fontelis 1x)	May 28 (2-3 leaf) 61 DAP[a]	---	---
Treatment 2 (Fontelis 2x)	May 28 (2-3 leaf) 61 DAP	June 12 (5-6 leaf) 75 DAP	---
Treatment 3 (Fontelis 3x)	May 28 (2-3 leaf) 61 DAP	June 12 (5-6 leaf) 75 DAP	June 27 (8-9 leaf) 91 DAP

[a] DAP = days after planting

Data Collection

Assessments of plant condition were made on June 4, 7 days after the first application; July 10, 28 days after the second application date, and August 23, 72 days after the third application date. One each sample date, five bulbs were selected from each of the inner and outer double row of onions in each bed, for a total of 10 bulbs per plot on each sample date. Bulbs were taken to the laboratory for data collection.

The diameter of each bulb was measured with calipers. The number of total roots and roots displaying pink root symptoms were recorded.

On September 13, onions from the middle two double rows in each plot were lifted. They were topped by hand, bagged on September 18 and placed in storage. The onions from each plot were graded on November 5 and 6. During grading, bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), neck rot (bulbs infected with the fungus *Botrytis allii* in the neck or side), plate rot (bulbs infected with the fungus *Fusarium oxysporum*), and black mold (bulbs infected with the fungus *Aspergillus niger*). The No. 1 bulbs were graded according to diameter: small, medium, jumbo, colossal, and supercolossal. Bulb counts per 50 lb of supercolossal onions were determined for each plot of every variety by weighing and counting all supercolossal bulbs during grading. Marketable yield consisted of No.1 bulbs in the medium or larger size classes (larger than 2¼ inches).

Results and Conclusions

Figure 1 shows the change in total numbers of roots and pink roots per plant in the untreated control for each of the three varieties in the trial. Early in the season on June 4, the three varieties had similar numbers of total roots and pink roots per bulb. All three varieties showed decreasing numbers of roots over the season, with Vaquero having the greatest decline in root mass. The number of pink roots increased over the season; yet again, the increase was greater for Vaquero than for Granero and Joaquin. This change in root system health likely confirms that Vaquero is more susceptible than Granero or Joaquin to pink root. Symptoms of pink root become more pronounced and evident as soil temperatures increase. Heavily infected roots die and then slough off, leading to declines in numbers of roots over the course of the season.

On the first sample date (June 4), 7 days after the first Fontelis application, onions in all of the Fontelis applications had significantly more total roots than did corresponding untreated onions. There were no further Fontelis treatment effects on root mass over the season. However, there were significant differences in root mass among the three varieties. Granero and Joaquin had more total roots than did Vaquero. Granero and Joaquin also had fewer pink roots than did Vaquero at the end of the season (July 10 and August 28 samples). Across all Fontelis treatments, Granero had the lowest decline in root mass than the other two varieties over the growing season (Fig. 2).

As a result of the varietal differences in total roots and pink roots, Vaquero had a significantly greater percentage of pink roots than did either Granero or Joaquin.
Fontelis did not appear to significantly affect total root mass or incidence of pink root. Total numbers of roots and numbers of pink roots were always higher for Vaquero than for Granero and Joaquin regardless of Fontelis treatment.

Fontelis applications tended to reduce the severity of pink root. The best results were with one or two Fontelis applications. Although based on a single year of data, there was evidence that three applications of Fontelis adversely affected onion growth and plant health. These adverse effects were consistent across varieties (Figs. 3-6).

Fontelis applications did not affect bulb size during the growing season. Granero had significantly larger bulbs on the August 22 sample date than either Joaquin or Vaquero across Fontelis treatments (Fig. 4).

Although Fontelis applications did not affect total marketable yield (Fig. 5), Fontelis did shift the size profiles for varieties, especially for Joaquin and Vaquero (Figs. 5 and 6). Approximately 55% of Granero bulbs in the untreated treatment were in the colossal and supercolossal size class. However, treatment with Fontelis increased the proportion of bulbs in these large size classes by 11%. These increases were 34% for Joaquin and 62% for Vaquero (Fig. 6).

Application of Fontelis early in the onion growth stage (i.e., 2- to 3-leaf stage) can complement other management tactics to reduce the severity of pink root. Application of Fontelis shifted the size profile toward larger onion bulbs. This effect may be especially beneficial for varieties that are more susceptible to pink root.

Acknowledgments

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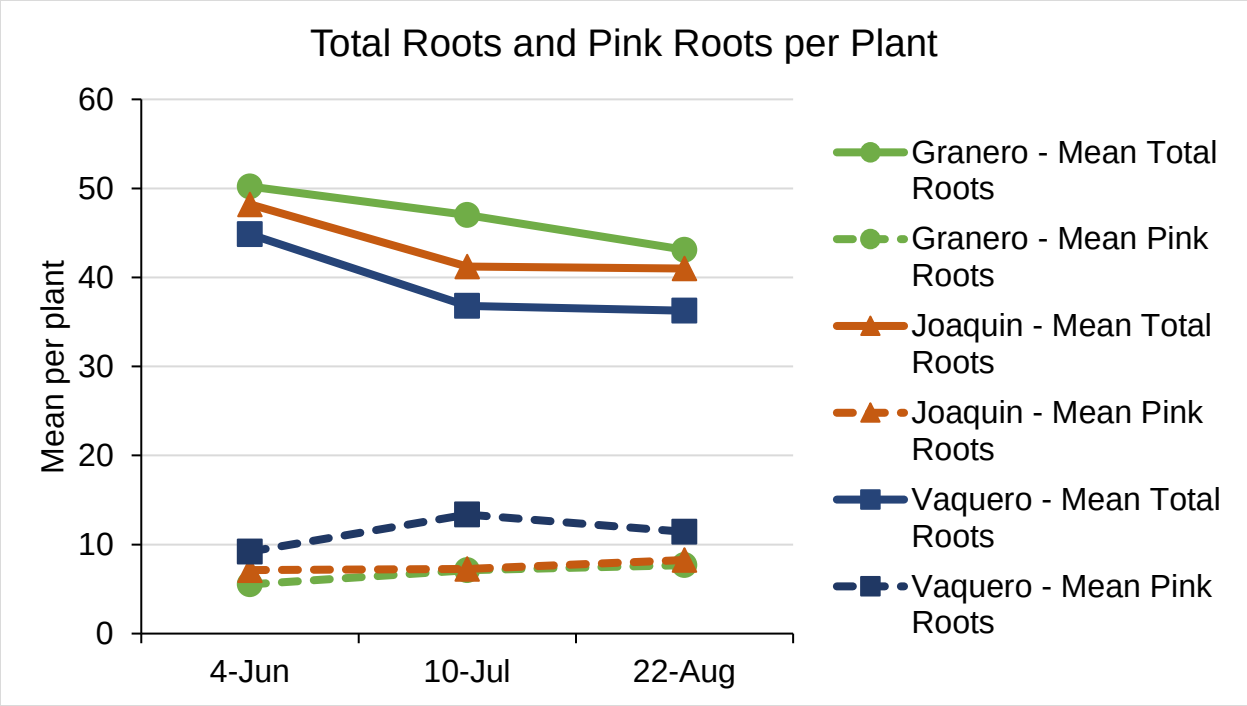

Figure 1. Changes in total roots and pink roots per plant over the season for onions not treated with Fontelis®. Over the course of the growing season, Vaquero had fewer total roots but more pink roots than Granero and Joaquin.

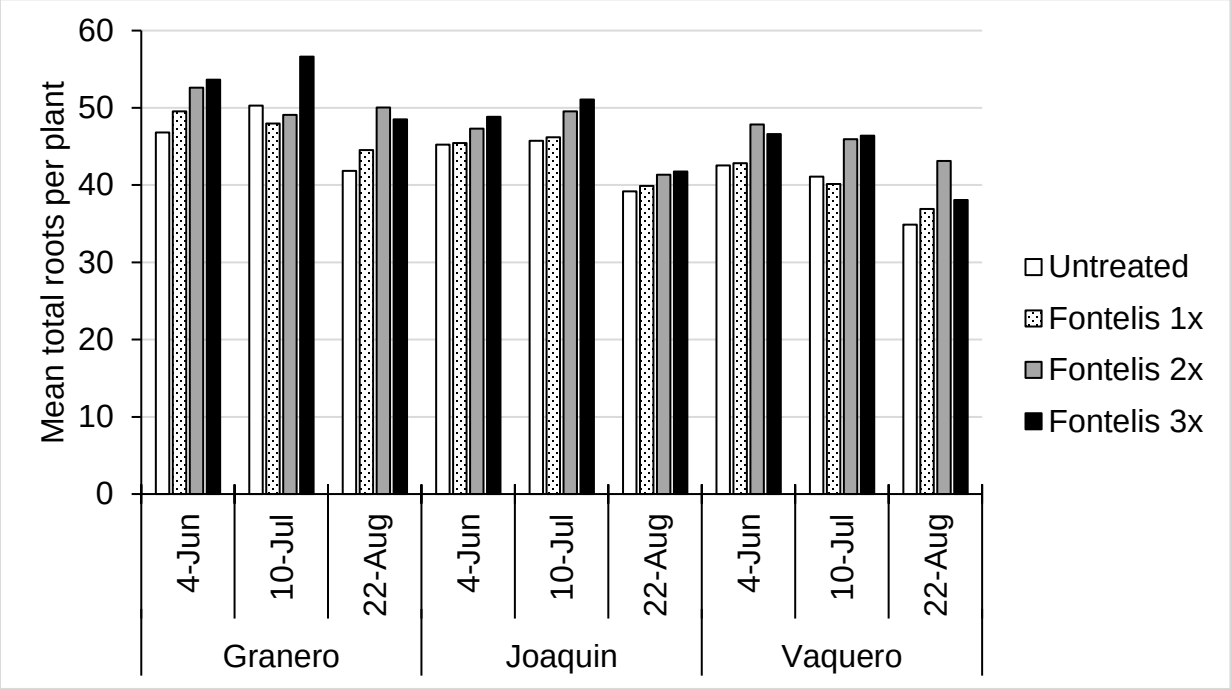

Figure 2. Total roots on three onion varieties treated with different numbers of Fontelis applications. Malheur Experiment Station, Ontario, OR, 2018.

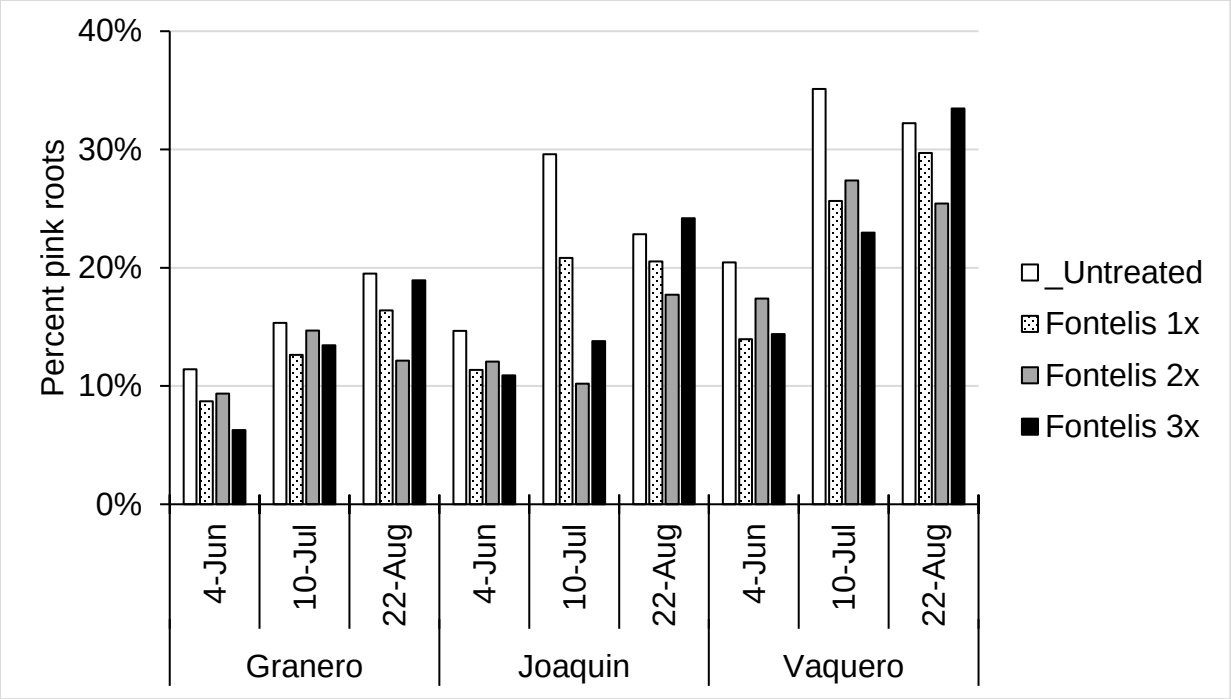

Figure 3. Percentage of roots on three onion varieties showing symptoms of pink root following different treatments with Fontelis® applications. Malheur Experiment Station, Ontario, OR, 2018.

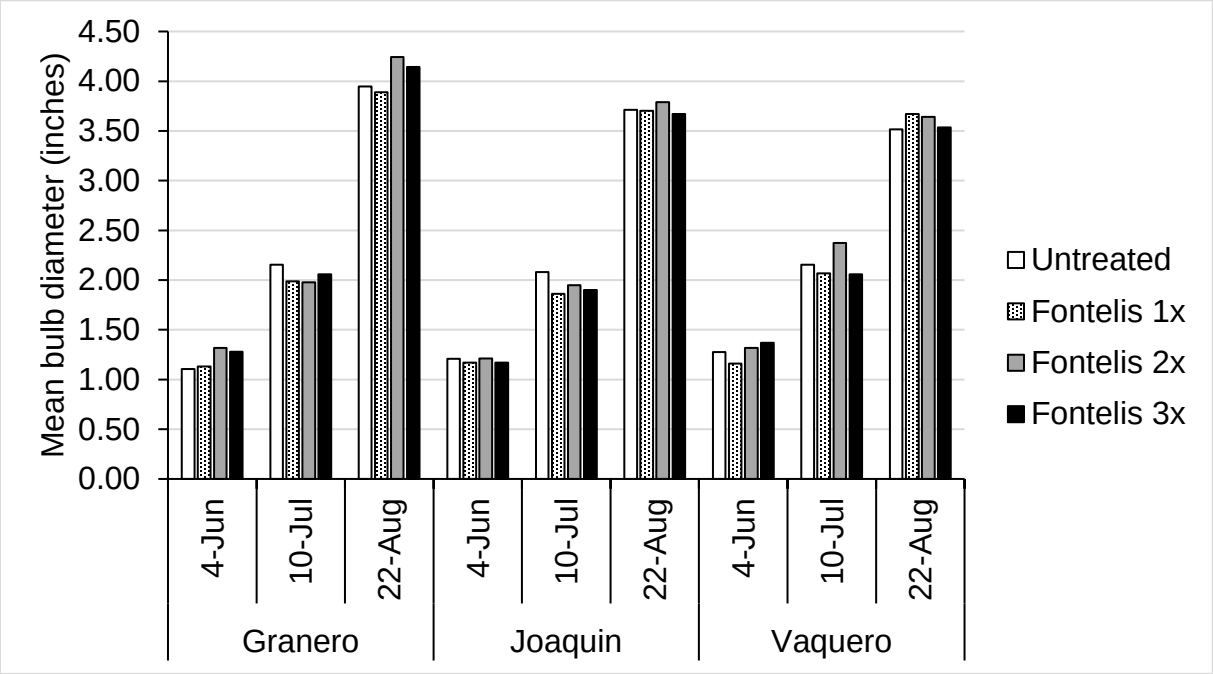

Figure 4. Effects of Fontelis® applications on onion bulb size, as measured by bulb diameter, over the growing season. Malheur Experiment Station, Ontario, OR, 2018.

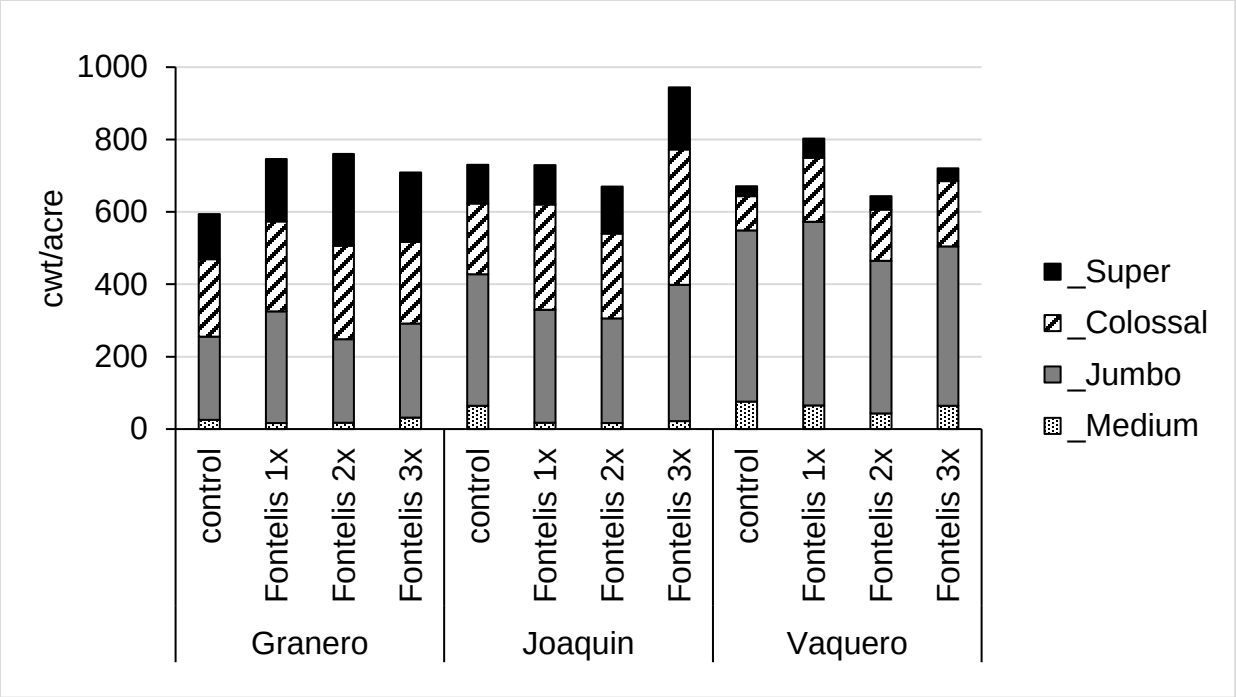

Figure 5. Yield in cwt per acre according to variety and number of Fontelis® treatments for pink root management. Malheur Experiment Station, Ontario, OR, 2018.

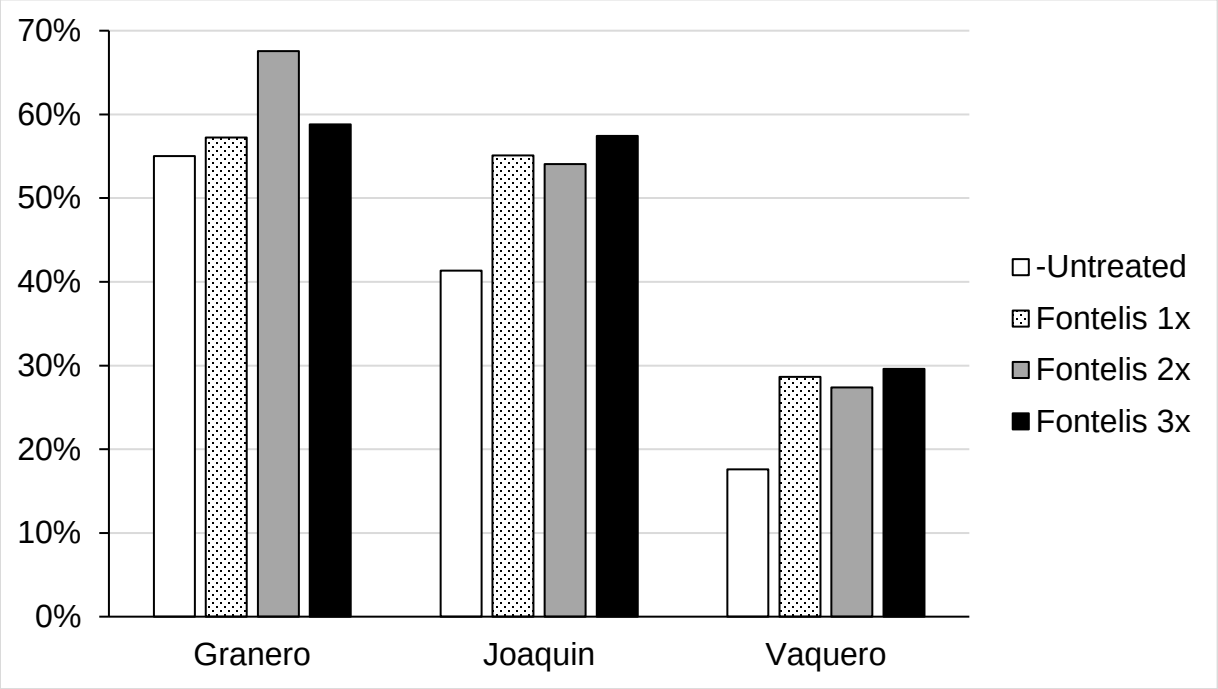

Figure 6. Percentage of colossal and supercolossal size bulbs by variety and number of Fontelis® treatments for pink root management. Malheur Experiment Station, Ontario, OR, 2018.