The Effects of Calcium Applications to Cranberry Growth, Yield and Fruit Quality

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Oregon cranberry growers use a number of different fertilization regimes, but they are all interested in fertilization practices that will increase fruit sugar content (ºBrix), fruit quality and size, and overall yield.

One of the more common local fertilization practices is to routinely apply calcium, in the form of gypsum, on a yearly basis. While current Pacific Northwest recommendations for calcium are up to 100 lbs/acre of gypsum, many growers apply 3 to 4 times the recommended amounts. There is a commonly held belief that adding large amounts of gypsum will increase yields, improve soil drainage, and alleviate crunchy vines due to applications of the herbicide, Casoron®.

There is little research on the effects of calcium on cranberries. Cranberry plants appear to have a very low requirement for calcium, but calcium content in leaves varies greatly between growing regions, apparently due to differences in organic matter in the various growing regions (Eck, 1990). The effects of calcium on fruit quality and size have not been studied. Hanson and Berkheimer (2004), in highbush blueberries, a related crop, showed that the addition of 500 lbs/acre of gypsum had no effect on berry size, yield, firmness, or incidence of fruit rot compared to a non-treated control.

If little or no calcium is needed for adequate cranberry growth and fruit quality, growers will save both time and money without harm to their crop. However, if calcium does improve yield or size, or alleviates Casoron® damaged plants, beds will be more productive; increasing growers' economic returns.

<u>Methods:</u>

Two local 'Stevens' or "Stevens/mixed' cranberry beds were utilized for this study. One bed was in the Bandon region and the other bed was in the Langlois area.

Replicated plots were laid out in each bed in early 2008. Plots received a 50 lb/acre application of Casoron, or no Casoron, and then had overlaid on the plots an application of gypsum at one of the following rates: 0, 25, 50, 100, 200 and 300 lbs gypsum/acre – in total, 12 different treatments. Treatments were replicated four times. All plots received the same application treatments in 2009. All other applications or additions to the beds followed standard grower practices for plant health and yield.

Fruit from the plots was hand harvested at the end of each growing season, and yield, in barrels per acre, and the incidence of fruit rot were evaluated from a one square foot area of each treatment plots ºBrix (sugar content) data from the fruit was also collected . Five root samples per plot were collected to evaluate the effects of calcium on beds that may be affected by crunchy vines due to Casoron applications. The root samples were collected using a one inch diameter soil probe. Root samples were cleaned of all soil and then dried to an unchanging weight. Soil and leaf tissue samples were collected in mid-August through mid-September of 2008 and 2009. Upright growth was measured in 2009 on the Langlois farm. Three fruiting uprights per plot were measured. Minirhozotron tubes were installed within treatment plots at the Langlois farm to more closely monitor root growth in 2009. Tubes were installed only within 4 treatments; 1) 200 lbs./acre of calcium as gypsum; 2) no added calcium; 3) 200 lbs./acre gypsum with 50 lbs./acre of

Casoron; and 4) no gypsum with 50 lbs./acre of Casoron. All data were analyzed using Statistical Anlysis Software (SAS).

Results:

Tissue analysis

In 2008 there were no significant differences seen in any leaf tissue nutrients from either farm; except for phosphorus (P) in the Langlois farm. At that site, a significant difference was seen in plant P uptake. Plots that did not receive any Casoron had a larger amount of P in leaf tissue than those plots that had received a Casoron application. In 2009, significant differences were seen in magnesium (Mg), boron (B) and copper (Cu) leaf tissue samples from the Langlois farm. Plots that did not receive any Casoron had higher levels of the nutrients within the tissue. All tissue sample nutrients were within normal ranges for both farms, with the exception of copper (Cu), which was low one year at the Bandon farm.

Soil Analysis

In 2008 significant differences in soil nutrients were only seen in zinc (Zn) on the Bandon farm. Zinc concentrations were affected by the interaction of the gypsum and the Casoron In 2009, significant differences were only seen in phosphorus (P), potassium (K) and magnesium (Mg) – and only on the Langlois farm. Phosphorus concentrations were affected by the interaction between the gypsum and the Casoron, while the K and Mg were only affected by the gypsum applications. As the applied rate of Ca, as gypsum, increased, soil K and Mg decreased.

Yield and °Brix

In both years and at both farms there were no significant differences seen from any of the treatment applications in either cranberry yield or °Brix content.

Dry root weight and upright growth

Upright growth was only measured in 2009 on the Langlois farm. No differences were seen in upright growth from any of the treatments. Root weight differences were seen on the Langlois farm in 2008 and on the Bandon farm in 2009. Because the method of determining root weight was difficult to well quantify, minirhozotron tubes were installed in the Langlois treatment plots in March of 2009. Completed data from the minirhozotron tubes is still being analyzed, but early, initial results are showing a delay in root growth in treatment plots that received Casoron applications and plots that received both Casoron and gypsum. The first appearance of roots in plots that received no Casoron were in June and plots that received both Casoron and 200 lbs/acre of gypsum showed first roots in late July/August (Fig. 2).

Discussion:

High rates of calcium do not increase cranberry yield or °Brix content, and do not appear to be affecting the overall health of the cranberry plants. Even treatment plots that did not receive any calcium applications for two years did not show deficient tissue levels. There was no benefit seen to adding any amount of calcium (as gypsum) to cranberries, so the current recommendation of applying 0-50 lbs/acre of gypsum per year to cranberries, when tissue calcium levels are not deficient, would still be accurate – whether Casoron has been applied or not.

Separate issues are seen with Casoron. Additions of 50 lbs/acre of Casoron affect the uptake of certain nutrients (P), but also, not to deficient levels. One question still to be answered is whether the lower nutrient uptake in Casoron plots is due to a general lack of roots or the timing of new root production. As the minirhozotron data is analyzed, we may be able to answer some of these questions.

One limitation of this study is the overlap between the yield, °Brix and tissue nutrient data collection (2008 and 2009) and the minirhozotron data collection (2009-current year). Minirhozotron root data from 2009 may not be as accurate as in later years, as the installation of the tubes may impact root growth and development. The continued study of cranberry root development is encouraged.

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Literature cited:

Eck, P. 1990. The American Cranberry. Rutgers University Press.

Hanson, E. and Berkheimer, S. 2004. Effect of Soil Calcium Applications on Blueberry Yield and Quality. Small Fruits Review. (3) 133-139.

Fig. 1. Cranberry yield.

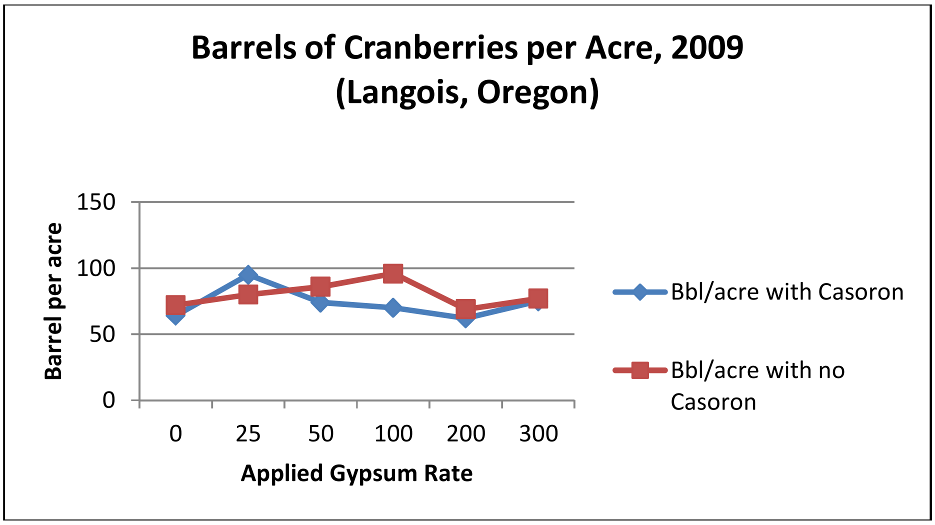

Fig. 2. Cranberry dates of first new root appearance