Money saving ideas to reduce potassium fertilizer cost for cranberry production

By

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Growers used to say that fertilizer was "cheap insurance". The statement is no longer true. Fertilizer, especially potassium and phosphorus, are expensive. Fertilizer prices have risen rapidly in the first six months of 2008, more than doubling since 2003, as shown in Figure 1.

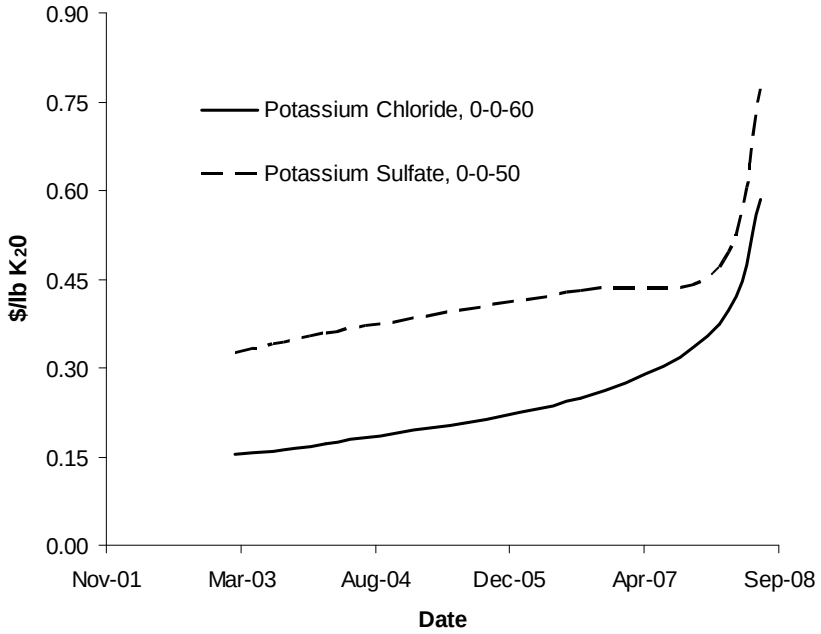

Figure 1. Retail price per pound of K_2O as bulk potassium sulfate (0-0-50) and potassium chloride (0-0-60) in the Willamette Valley from March 2003 through early July 2008.

Growers have changed from thinking of fertilizer as cheap insurance to asking, "How can I reduce my fertilizer cost?" No magic or "quick fix" exists even though the answer is simple and straightforward, apply fertilizer where it is needed or will provide an economic benefit. Potassium application on many cranberry beds can be reduced without a reduction in yield. The key to saving on potassium cost is knowing where to reduce.

Knowing when and where fertilizer is needed requires management and monitoring as used for nitrogen. Cranberry growers monitor leaf N to evaluate N status and adjust application rate. The same approach can be

used to manage potassium. Think of monitoring soil and tissue concentration of potassium as you monitor fuel or oil pressure in an engine or temperature for spring frost control.

A better analogy might be dieting. Approach a reduction in potassium application as you would approach a weight loss program. Don't make large or sudden changes. Change slowly or incrementally while monitoring tissue K and build confidence the reduction is producing desired results.

First, need a goal. We'll use OSU recommendations for soil and tissue K. The target is to have soil test K between 50 and 100 ppm and tissue K should be between 0.40 to 0.75%. Potassium is recommended at 0 to 60 lb K_2O/a if soil and tissue is in this range. Let's look at yield from two cranberry beds where soil and tissue K were in the recommended range and potassium was applied or withheld for three years.

Tale of two beds

Potassium chloride (0-0-60) was applied on two cranberry beds for three years beginning in 1996. The treatments supplied 0, 60, 120, 180 K_2O lb/a. The fertilizer was applied monthly beginning in mid-April at roughneck through full bloom in mid-June. One bed was in Coos County and had 5 year-old Stevens cranberry's growing in it. The second bed was in Curry County and had six year-old Stevens growing in it.

Yield was measured in 1998, after three years of treatments and was not different between treatments receiving potassium for three years and the treatment that did not receive any potassium for three years as shown in Figure 2. Yield from both beds was similar, so a single line is used to represent yield from both beds.

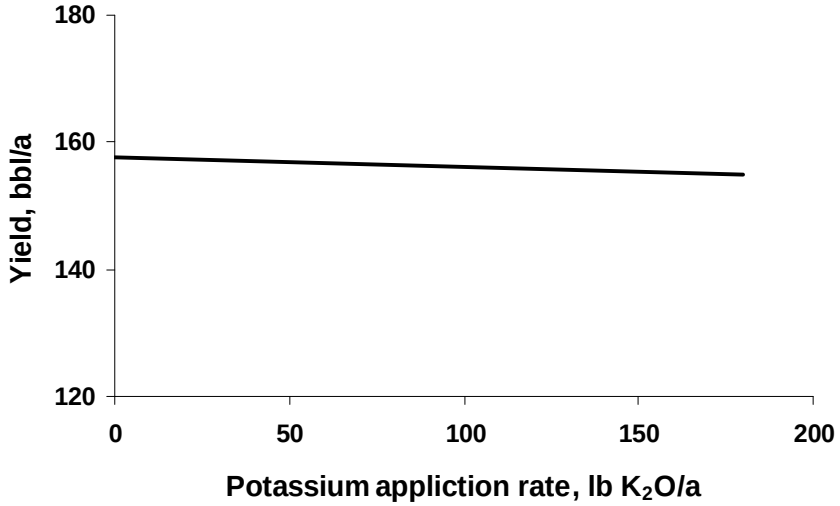

Figure 2. Cranberry yield influenced by potassium application from both sites in 1998, after three years of potassium treatments.

Let's look at soil and tissue data for an explanation to the unchanged yield. The initial potassium application did not change soil test K in the fall of the first year as shown in Table 1. This result was expected since soil test K was adequate and the fertilizer was top dressed.

Table 1. Potassium application rate and cranberry bed potassium soil test value in September 1996.

K_2O	Coos	Curry
lb /a	ppm	
0	73	54
60	76	53
120	79	52
180	79	62

After three years of application, tissue K increased slightly with increasing K application at the Coos County site. All tissue values, even those receiving no K fertilizer for three years, were within OSU's recommended range. Since tissue K was adequate without K application, addition of K fertilizer should not increase yield.

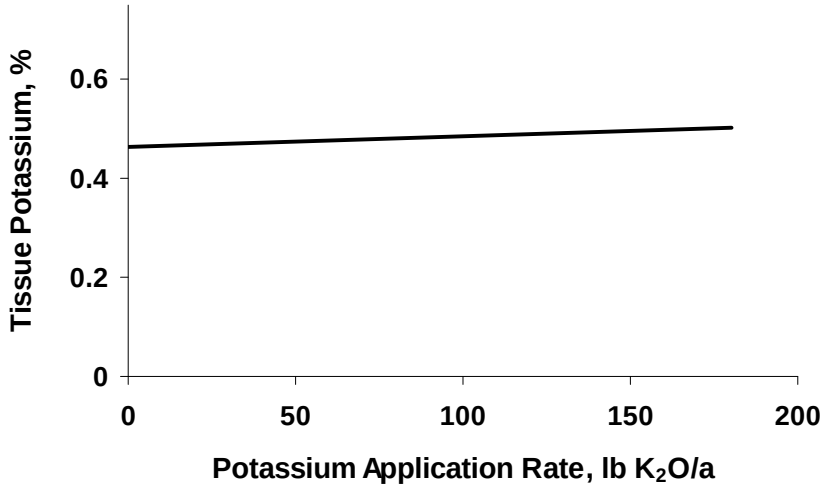

Figure 3. Cranberry leaf potassium concentration change with potassium fertilizer application rate at the Coos County site. Tissue concentration is from 1998, the third year of fertilizer treatment.

Cranberry yield did not increase with an increase in leaf or tissue K concentration as shown in Figure 4. Adding potassium when tissue potassium is sufficient, may increase leaf potassium concentration, but does not alter yield.

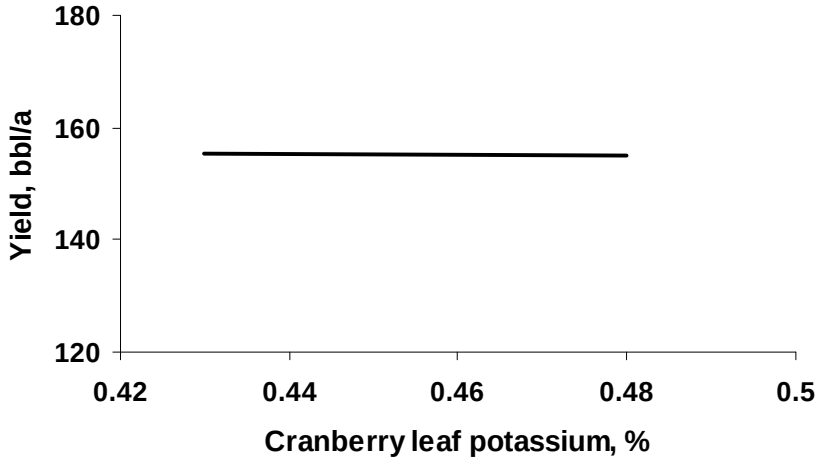

Figure 4. The relationship of cranberry yield and leaf potassium concentration at both sites in 1998.

Cranberry color as measured by Total anthocyanin content or TACY was not changed by leaf K concentration as shown in Figure 5 (Curry County site). All TACY measurements at the Coos county site were above 72 mg/g, the

maximum measured by the test. Leaf potassium was within OSU's "sufficient" range and should not have changed with the small change in leaf K concentration measured in the two beds.

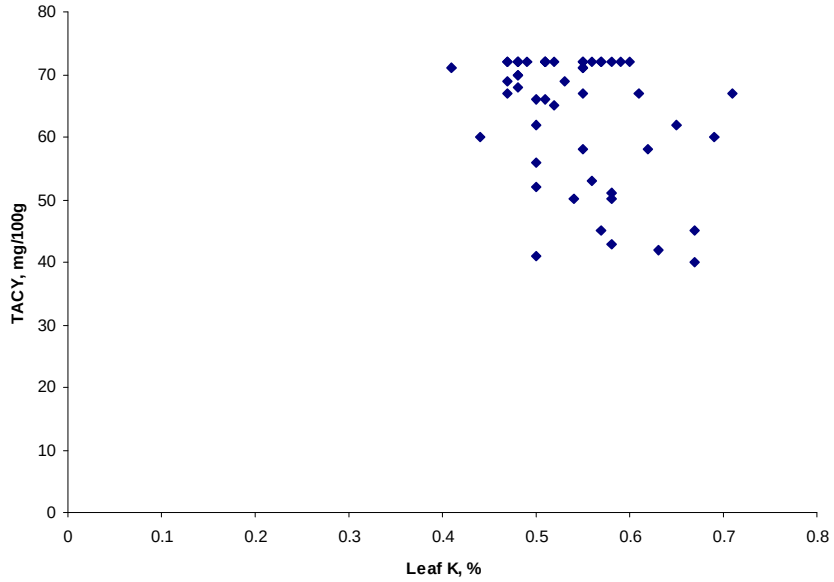

Figure 5. The change in TACY and leaf potassium concentration for the Curry County site in 1998.

Summary

Yield and berry color were not changed by potassium application when tissue K was between 0.4 and 0.75% and the soil test potassium was between 50 and 100 ppm. These results show that the soil and tissue measures of potassium can be used to monitor potassium need. When tissue and soil values in this range, potassium application is optional and can be reduced or eliminated for at least a year to two without reducing cranberry yield.

Remember the comparison of reducing potassium application to save money and dieting? Don't make large or sudden changes. Reduce slowly and monitor tissue potassium annually.

If you have tissue K in the upper end of the adequate range and have been applying potassium regularly, then you could reduce your fertilizer cost by reducing potassium rate.

Grower results from a low potassium "diet"

In 2003 a south coast Oregon cranberry grower was using about 130 lbs K_2O in various blends starting in the spring and finishing after fruit set. The potassium application was gradually reduced until only 70 lb K_2O/a, 20 lbs in the spring and 50 during fruit set, were used in 2007 and 2008. The grower said, "This bed consistently produces 300 barrels/acre. The range is from 295-330 b/acre through those years, even with the reduction in potassium application."

The grower added, "The potassium tissue concentration did not change and was within the Normal tissue concentration range of K for cranberries, 0.40 to 0.75%, during the time K application was reduced." Tissue potassium concentration is given in Table 2.

Table 2. Annual tissue potassium concentration for time of potassium fertilizer reduction.

Year	Tissue potassium
	%
2004	0.56
2005	0.61
2006	0.54
2007	0.53

Annual testing of cranberry uprights is necessary when potassium fertilizer is reduced. Changes in tissue concentration probably will not be noted for at least three years if potassium was sufficient in soil and tissue and more than 80 lb K_2O/a was applied annually.

Similar Results from Wisconsin Potassium Application

Teryl Roper, former University of Wisconsin Extension specialist, established plots in two 'Stevens' beds. He applied consistent rates of nitrogen and phosphorus to the plots and varied only potassium application, between 0 and 800 pounds of K_2O per acre. Treatments also compared potassium sulfate and potassium chloride at 200 and 400 pounds per acre. Fertilizer was applied at roughneck, bloom, fruit set, and in early August.

Potassium application increased both tissue K and soil K, but not always significantly. The results were more pronounced in 2006 than in 2007. They also found that increasing the application rate of potassium did not increase yield or fruit size in either year. Because some of the treatments were potassium sulfate and some were potassium chloride, they were able to determine if chloride was detrimental to cranberries. No effect of chloride as opposed to sulfate forms of potassium fertilizer was measured within the range tested.

Some growers believe that large late season applications of potassium will result in better fruit color. To test this hypothesis fruit was analyzed for

color. No effect of potassium fertilizer rate on fruit color was measured in either 2006 or 2007.

The research in Wisconsin did not measure a change in yield, fruit size, or fruit color from potassium application. Also, both the sulfate and chloride forms are acceptable fertilizers for cranberry at the rates tested.

An earlier trial in Wisconsin performed by industry researchers showed a 5% yield reduction when a single mid-July application of 180 lb K_2O/a was made. The yield decreased 10% when 270 lb/a K_2O was applied in a single mid-July application. In addition to yield, growth reduction and hardening were measured. No reduction in tissue N, hardening, or other growth reducing properties of potassium were measured until 1440 lb K_2O /a was applied. This amount of potassium burned and killed vines.

Potassium doesn't slow growth or increase berry size

Oregon research supports the idea that when soil and tissue potassium are adequate, potassium application doesn't "shut down" or "put the crop to sleep", stop overgrowth from excess N, increase bud set, berry color or berry size. This statement is supported by Figures 5, 6, and 7. Figure 6 shows that berry size does not change with potassium application at either location after two years of potassium treatments. The line representing berry weight at the Coos County site appears to increase. It changes from 1.32 grams/berry when no potassium was applied to 1.38 grams/berry when 360 lb K_2O was applied. The change was not different statistically.

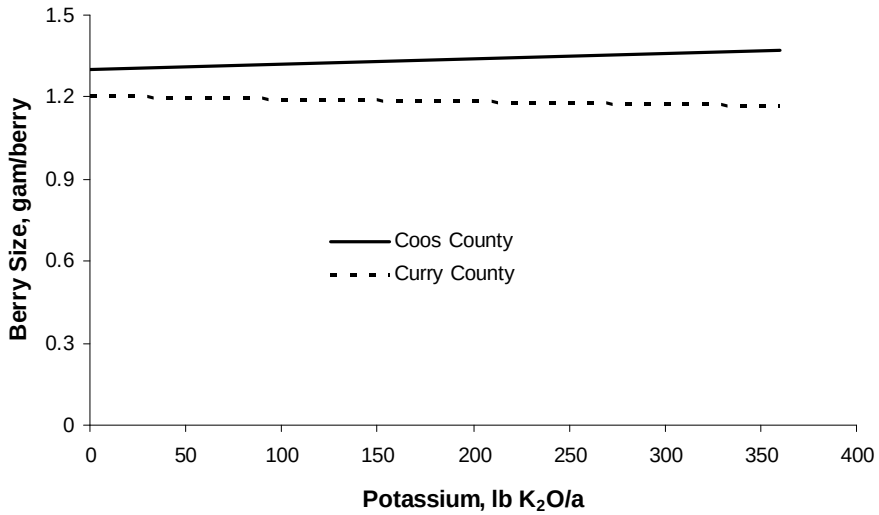

Figure 6. The relationship of berry size to application of potassium fertilizer rate from 1997 harvest.

The idea that potassium application will stop or reduce growth has never been supported and the data in Figure 7 shows an opposite trend. The data is an average for both sites.

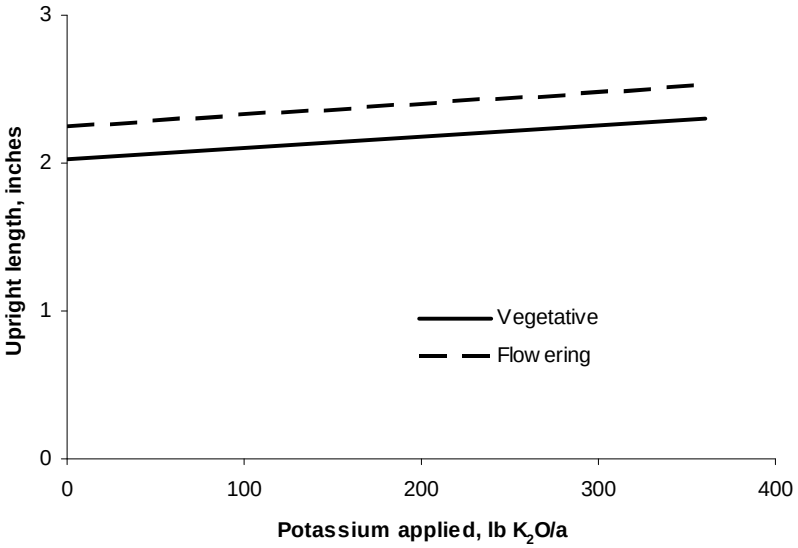

Figure 7. Average upright length with potassium application rates at harvest in 1997.

Application of 360 lb K_2O/a did not change growth of either flowering or vegetative upright length supports the idea that potassium fertilizer can't be used as a growth retarding treatment.

Another idea commonly voiced is that potassium will enhance bud set. If potassium is adequate, we did not find any difference in upright number with potassium treatments as shown in Figure 8.

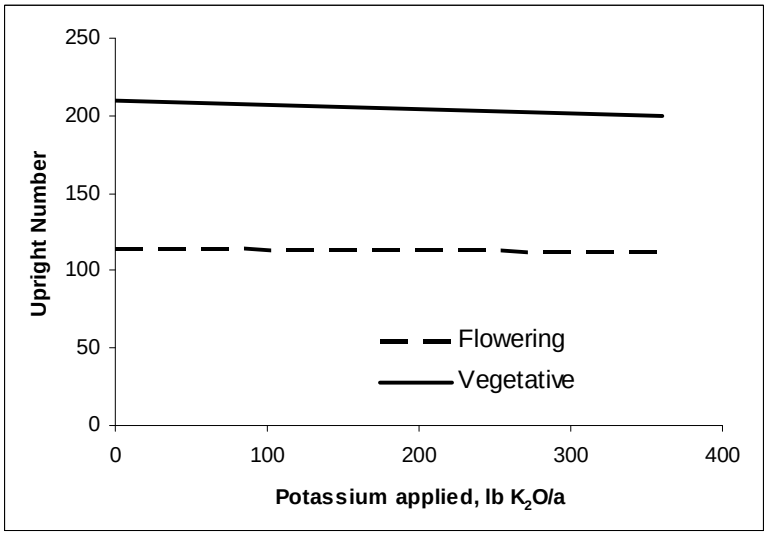

Figure 8. Average upright number for both sites for potassium application at harvest in 1997.

Other ideas for saving $ by reducing potassium

If bud set is influenced by potassium, upright number and yield should be changed. Potassium application did not change either upright number or yield.

Don't apply potassium fertilizer to harden vines or counteract overgrowth. Research has not documented potassium providing any benefit for retarding growth or hardening plants.

Reduce or remove foliar application. If tissue K is adequate, potassium is not needed from a soil or foliar application. Foliar products are usually more expensive per pound of nutrient than dry fertilizer materials.

Compare the cost of potassium chloride and potassium sulfate. Usually, potassium chloride or muriate of potash (0-0-60) is less expensive per pound of K than is potassium sulfate. Application of 20 to 30 lb/a K_2O as potassium chloride three to four times a year allows leaching of chloride between applications.