Title: Determining optimum date for foliar sampling of primocane fruiting blackberry in the Mid-South_ Year 2

Progress Report:

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Research

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Objective:
The objective of this project is to begin progress toward the development of fertilizer recommendations for primocane-fruiting blackberry. To this end we propose to:

- Determine the sampling date with the least variation of elemental concentrations in the leaves of primocane-fruiting blackberries in North Carolina and Arkansas.

Justification:
The Northern hemisphere is the most important part of the world where blackberries are grown, and the amount and types of cultivars are diverse. Various kinds of blackberries with special characteristics have been developed by researchers and special programs in the U.S. During the last decade, the University of Arkansas has developed a new type of blackberry genotype: the primocane fruiting (PF) blackberry. This genotype has the potential to extend the fresh market season annually, which makes PF blackberries an attractive crop. However, there are some important plant nutritional parameters that need to be researched in order to optimize yield and financial returns. There is information on the optimum rate and time of application of nitrogen (N) fertilization for floricane-fruiting blackberries and raspberries, but nothing specific for PF blackberries. It is important to know the optimum stage of development for collecting foliar sample of blackberry leaves in order to make the necessary recommendations to improve the yield and fruit quality.

Methodology:
Foliar samples were collected from several locations in Arkansas and North Carolina (Table 1). The foliar sampling protocol was similar to that used for FF blackberry in Clark et al. (1988). Leaves were sampled on five dates throughout the season in each location for each genotype, in April, May, June, July, and August. Leaves were collected from the fifth node from the apical bud. Ouachita, a floricane-fruiting cultivar for added for comparison.

In Arkansas, plants were managed according to several cultural practices. In Fayetteville, Arkansas, three plantings of Prime-Ark 45 were sampled. One planting is located under a high tunnel where the canes are mown to ground level in May. The second planning is also under high tunnel conditions, but the canes are not mown. The third planning is outside under no cover and is mown. Mowing in combination with high tunnels is recommended in Arkansas to delay harvest until optimum fall temperatures for fruit development (four replications). In Clarksville, Arkansas, samples were collected from Prime-Ark® 45, from Prime-Jan®, and Ouachita (for the comparing between cultivars and between FF and PF types)(three replications). All three genotypes were in field conditions (not under any covering) and were not be mown in the spring. In North Carolina, Prime-Ark® 45 samples were collected from three locations, Owl's Den Farm and Toluca Blackberry Farm, and Faith Farms (four replications).

All samples were sent to the soil testing research laboratory of the University of Arkansas for nutrient analysis (N, P, K, Ca, Mg, S, Na, Fe, Mn, Zn, Cu and B).

State	**Location**	**Treatment and cultivar**
Arkansas	Fayetteville	Prime-Ark® 45, high tunnel, mown in May
		Prime-Ark® 45, high tunnel, not mown
		Prime-Ark® 45, field, mown
	Clarksville	Prime-Ark® 45, field, not mown
		Prime-Jan®, field, not mown
		Ouachita, field, not mown
North Carolina	Owl's Den Farm	Prime-Ark® 45
		Prime-Jan®
	Toluca Blackberry Farm	Prime-Ark® 45
		Prime-Jan®
	Location 3	Prime-Ark® 45
		Prime-Jan®

Results:
Year 1 (2011) of this research project has been completed and a thesis defense followed on Nov. 19, 2012. Data was collected for Year 2 (2012) but has not been completely analyzed. Results from 2011 season indicate all elements were within the sufficiency ranges indicated for floricane fruiting blackberries. Although there was a high degree of fluctuation for all the elements according to sampling date, periods of relative stability of nutrient concentration by LSD means mostly occurred during the month of July (Table 1, 2, and 3). Phenologically, these plants were 10% to 50 % bloom.

Table 1. Mean nutrient concentrations of macro and micronutrients in one-year-old 'Prime-Ark® 45' blackberry leaves collected in Fayetteville, Ark. under high tunnel conditions, and sampled from June to August 2011.

Date	N	P	K	Ca	Mg	S	Na	Fe	B
	%						mg.kg^{-1}		
14 Jun	2.88c[z]	0.22b	1.99c	0.47b	0.29b	0.200d	14.88b	55.39a	28.14a
29 Jun	2.88c	0.24c	1.91c	0.44b	0.32d	0.220e	9.95ab	89.29b	30.53b
11 Jul	2.67b	0.19a	1.78b	0.47bc	0.30bc	0.179b	9.12ab	51.44a	31.82b
25 Jul	2.66b	0.21b	1.73b	0.52dc	0.30bc	0.198d	14.78ab	66.13a	34.07c
4 Aug.	2.43a	0.19a	1.55a	0.21a	0.27a	0.176ab	87.19c	55.88a	39.09d
26 Aug.	2.31a	0.19a	1.57a	0.56d	0.36e	0.181c	2.73a	72.54ab	38.56d

[z]Means separated by LSD, *P*= 0.05. Each value is a mean of 16 sample concentrations.
Means within elements with the same letter are statistically similar.

Table 2. Mean nutrient concentrations of macro and micronutrients in 'Prime-Ark® 45' blackberry leaves collected in Fayetteville, Ark. under ambient conditions, sampled from June to August 2011.

Date	N	P	K	Mg	S	Fe	Mn	Zn
	%					mg.kg^{-1}		
10 Jun	2.73b[z]	0.28d	1.56b	0.278a	0.153a	60.69a	177.22c	33.09a
24 Jun	2.29a	0.23b	1.52b	0.279a	0.171b	63.70ab	132.99a	33.21a
7 July	2.40a	0.22b	1.64bc	0.298b	0.179bc	61.62abc	126.77a	34.68a
25 July	2.40a	0.24bc	1.69c	0.301b	0.182c	57.10a	147.2ab	42.86b
4 Aug.	2.19a	0.19a	1.63bc	0.316c	0.188c	59.83ac	118.42a	33.71a
27 Aug.	2.36a	0.24bc	1.42a	0.335d	0.200d	66.87bc	161.95b	41.72b

[z]Means separated by LSD, *P*= 0.05. Each value is a mean of 12 sample concentrations.
Means within elements with the same letter are statistically similar.

Table 3. Mean nutrient concentrations of macro and micronutrients in 'Prime-Ark® 45 blackberry leaves collected in North Carolina under ambient conditions, sampled from June to August 2011.

Date	N	P	K	Ca	Mg	Na	Fe	B
	% [z]					mg.kg^{-1}		
20 May	3.26	0.29a	1.91a	0.44a	0.31a	16.82a[z]	37.71b	33.14a
4 Jun	2.91	0.28a	1.97a	0.38a	0.34ab	12.50a	63.08a	39.58ab
22 Jun	2.63	0.23ac	1.59b	0.48ac	0.37b	6.05a	62.79a	36.38ab

5 Jul	2.51	0.19c	1.65b	0.62cd	0.40c	17.51a	55.08a	41.61bd
22 Jul	2.36	0.18c	1.40bc	0.75d	0.41c	25.37a	63.81a	47.90d
4 Aug.	2.50	0.18c	1.37bc	0.67d	0.44d	114.42b	68.58a	60.08e
22 Aug.	2.48	0.17c	1.22c	0.66d	0.41c	119.92b	63.92a	58.80e

[z]Means separated by LSD, *P*= 0.05. Each value is a mean of 12 sample concentrations. Means within elements with the same letter are statistically similar.

The same experiment was conducted during the 2012 (same locations) season to determine if similar results can be obtained. However, complete laboratory results are not yet available. If results indicate no large variation from season to season, then recommendations for best to collect leaves for foliar analysis for primocane fruiting blackberries in the Southeast will be made.

Impact Statement:
This project was part of a M.S. student thesis. Although defended, the thesis has not been completed, but should be completed by Jan 8th 2013. Year 2 of this project has not been completed thus no impact for this two-year study can be produced at this time.

Literature Cited
Clark, J. R., J. B. Buckley III, and E. W. Hellman. 1988. Seasonal Variation in Elemental Concentration of Blackberry Leaves. Hortscience 23(6):1080.