

# Changes in Nutraceutical Compounds During Postharvest Storage of Blackberries

## Introduction

Blackberries are excellent sources of nutraceutical-rich polyphenolic compounds such as anthocyanins, flavonols and ellagitannins. This study investigated the changes in nutraceutical compounds of fresh blackberries during postharvest storage. Eleven blackberry genotypes ('Natchez', 'Osage', 'Ouachita', 'Prime-Ark® 45', 'Prime-Ark® Traveler', A-2418, A-2434, A-2450, A-2453, A-2491 and APF-268) from the University of Arkansas blackberry breeding program were evaluated.

## Materials & Methods

### Fruit

Blackberries were harvested in June 2015 from the University of Arkansas Fruit Research Station, Clarksville, and transported to the Department of Food Science, University of Arkansas, Fayetteville.

- Approximately 1000 g of fruit was harvested at the shiny-black stage from each genotype (solid soluble 6-11%).
- Five cultivars (Natchez, Osage, Ouachita, Prime-Ark® 45 and Prime-Ark® Traveler) and six selections were evaluated (A-2418, A-2434, A-2450, A-2453 and A-2491).
- Blackberries were randomized in triplicates (3 clamshells by genotype) for harvest day (day 0) and storage (day 7).

### Nutraceutical Analyses

- Nutraceutical analysis were performed at harvest day and after storage (7 d at 2° C and 90% RH).
- Fruit was frozen (-20° C) at harvest and after 7 d of storage for further analyses
- Flavonols and Ellagitannins.** Methodology by Hager et al. 2008; 2010.  
*J. Agric. Food Chem.* 56:661–69  
*J. Agric. Food Chem.* 58:1749–54
- Anthocyanins.** Methodology by Cho et al. 2008; Hager et al. 2008.  
*J.Sci. Food Agric.* 84:1771–82  
*J. Agric. Food Chem.* 56:689–95
- Total Phenolics.** Methodology proposed by Slinkard and Singleton 1997.  
*Amer. J. Enol. Viticult.* 28:49–55

### Statistical Analysis

- Data was analyzed using JMP® (version 12.0; SAS Institute).
- Tukey HSD was used for mean separation.



Fig. 1. Daniela Segantini harvesting blackberries

Table 1. F-test significance from ANOVA for nutraceutical compounds of blackberries at harvest (day 0) and after storage (7 d at 2° C 90% RH).

Source	P value			
	Total Phenolics	Total anthocyanins	Total flavonols	Total ellagitannins
Day	0.0002*	0.0462*	0.0007*	0.0093*
Genotype	<0.0001*	<0.0001*	<0.0001*	<0.0001*
Day*Genotype	0.6420	0.8164	0.5066	0.2411

Table 2. Level of total phenolics and total anthocyanins in blackberry genotypes at harvest (day 0) and after storage (7 d at 2° C 90% RH), Clarksville, AR, 2015

Genotypes	Total phenolics (mg/100g)			Total anthocyanins (mg/100g)		
	Day 0	Day 7	Average	Day 0	Day 7	Average
A-2418	395.5	401.6	398.5 abc <sup>2</sup>	198.1	206.7	202.4 abc <sup>2</sup>
A-2434	393.4	455.9	424.9 abc	177.4	176.3	176.9 cd
A-2450	420.8	584.7	502.7 a	259.9	283.8	271.8 a
A-2453	403.0	443.3	423.1 abc	230.9	277.2	254.1 ab
A-2491	354.1	370.2	362.1 bc	221.0	232.8	226.9 abc
APF-268	334.8	398.9	366.8 bc	183.1	200.4	192.0 bcd
Natchez	436.5	558.2	497.3 a	219.7	270.1	244.9 abc
Osage	391.8	448.9	420.3 abc	236.9	294.2	265.6 ab
Ouachita	344.4	368.6	356.5 bc	205.5	189.1	197.3 bcd
Prime-Ark® 45	428.8	514.5	471.7 ab	215.3	210.9	213.1 abc
Prime-Ark® Traveler	300.8	371.9	336.3 c	115.9	132.8	124.4 d
Average	382.2 B	446.7 A		205.8 B	224.9 A	

<sup>2</sup> Genotypes were evaluated in triplicate (n=3). Means with different letter(s) for each attribute are significantly different (p < 0.05) using Tukey's HSD.

Table 3. Level of total flavonols and total ellagitannins in blackberry genotypes at harvest (day 0) and after storage (7 d at 2° C 90% RH), Clarksville, AR, 2015

Genotypes	Total flavonols (mg/100g)			Total ellagitannins (mg/100g)		
	Day 0	Day 7	Average	Day 0	Day 7	Average
A-2418	7.3	8.2	7.7 bc <sup>2</sup>	29.2	37.0	33.1 ab <sup>2</sup>
A-2434	6.1	9.8	7.9 bc	31.3	33.9	32.6 ab
A-2450	10.7	16.8	13.7 ab	22.5	35.9	29.2 bc
A-2453	7.0	9.9	8.5 abc	16.5	19.9	18.2 d
A-2491	6.8	8.7	7.7 bc	21.5	22.1	21.8 cd
APF-268	7.4	14.1	10.8 abc	35.3	36.8	36.1 ab
Natchez	8.8	12.4	10.6 abc	38.9	46.7	42.8 a
Osage	9.3	11.0	10.2 abc	18.7	20.8	19.7 cd
Ouachita	5.1	7.6	6.3 c	18.4	21.5	19.9 cd
Prime-Ark® 45	10.1	19.5	14.8 a	40.6	33.5	37.1 ab
Prime-Ark® Traveler	6.3	11.2	8.8 abc	24.7	30.2	27.4 bcd
Average	7.7 B	11.8 A		27.1 B	30.7 A	

<sup>2</sup> Genotypes were evaluated in triplicate (n=3). Means with different letter(s) for each attribute are significantly different (p < 0.05) using Tukey's HSD.

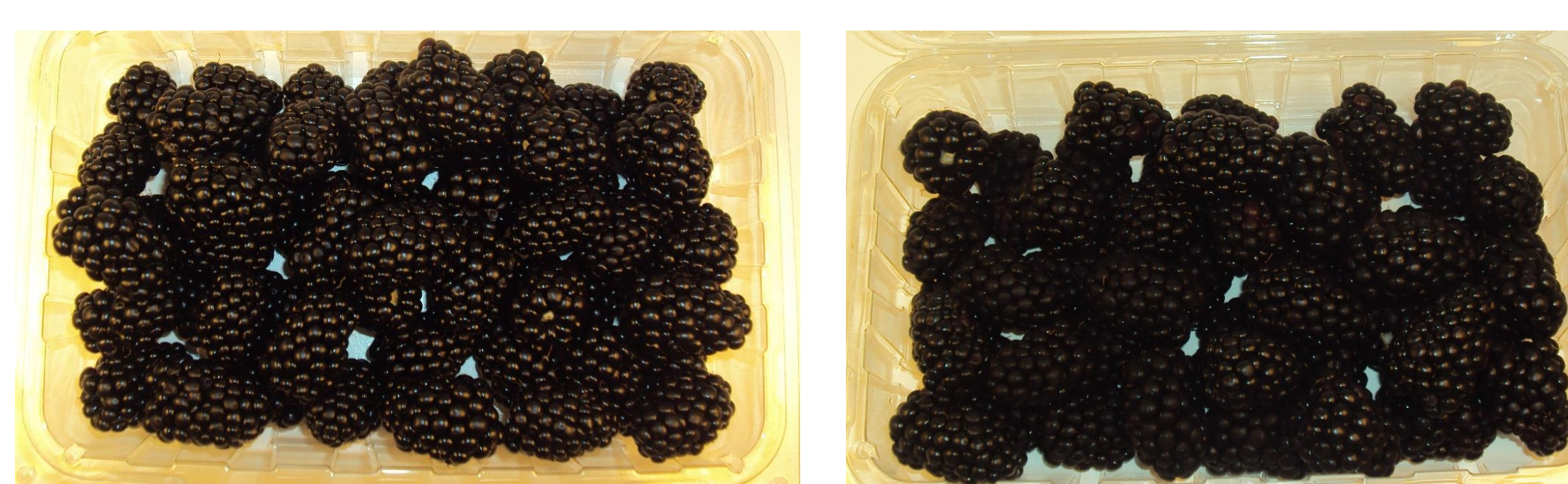


Fig. 2. 'Prime-Ark® 45' at harvest (day 0; left) and after storage (7 days at 2° C 90% RH; right).

## Results

- The level of total phenolics, total anthocyanins, total flavonols and total ellagitannins increased after 7 d of storage.
  - The average total phenolics increased 17%.
  - The average total anthocyanins increased 9%.
  - The average total flavonols increased 53%.
  - The average total ellagitannins increased 13%.
- Some authors suggested that temperature and genetic background may affect the level of nutraceutical compounds of blackberries during storage (Plijac-Zegarac and Samec, 2011; Kim et al., 2015).  
*Food Res. Intl.* 44:345–350  
*Postharvest Biol. Technol.* 110:257–263
- The level of nutraceutical compounds also ranged among the genotypes

↑ A-2450      ↓ 'Prime-Ark® Traveler'

↑ 'Prime-Ark® 45'      ↓ 'Ouachita'

↑ 'Natchez'      ↓ A-2453

## Conclusions

These blackberry genotypes can be stored for 7 d without loss of nutraceutical compounds.

## Acknowledgments

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