Determining flavor and quality of two blackberry varieties treated with new pre-harvest technologies

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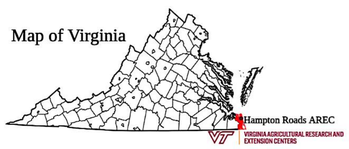
Introduction

- Blackberry (*Rubus* spp.) is a popular fruit among consumers with various health benefits[1].
- Blackberry production and profitability is threatened by several pests, post-harvest losses, and disorders such as white drupelet disorder (WDD)[2].
- Aroma profile and fruit quality characteristic of Virginia grown blackberry is not known. The flavor composition and chemical properties of blackberry can vary greatly depending on variety, climate, temperature, pre-harvest treatments, and solar radiation[3].

Objectives

- To evaluate the influence of shade cloth and foliar treatments: calcium and salicylic acid on fruit yield, WDD, aroma profiles and other chemical compositions of VA blackberries. PrimeArk® Freedom and PrimeArk® Traveler; two thornless primocane cultivars were selected for the study.

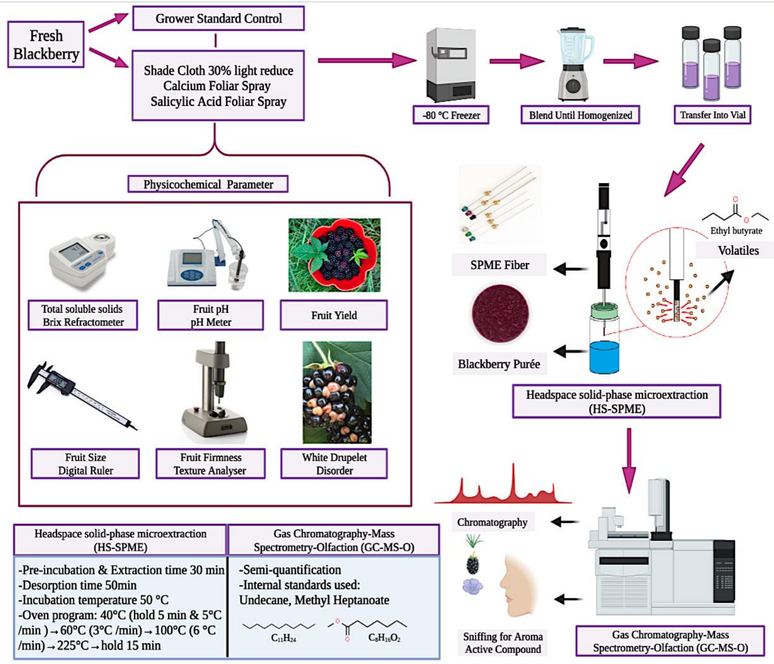
Materials and Methods




Grower Standard Control

Shade Cloth Treatment


Foliar Spray Treatment



Headspace solid-phase microextraction (HS-SPME)	Gas Chromatography-Mass Spectrometry-Olfaction (GC-MS-O)
-Pre-incubation & Extraction time 30 min -Desorption time 50min -Incubation temperature 50 °C -Oven program: 40°C (hold 5 min & 5°C /min)→60°C (3°C /min)→100°C (6 °C /min)→225°C→hold 15 min	-Semi-quantification -Internal standards used: Undecane, Methyl Heptanoate $C_{11}H_{24}$ $C_8H_{16}O_2$

Acknowledgements

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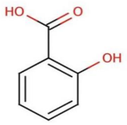
Experimental Design

Location: Hampton Roads AREC in VB, VA.
Plot design: Completely randomized design with three replicates per treatment.
Cultivars: (Primocane, Semi Erect, thornless)
PrimeArk® Freedom (U.S. plant patented as 'APF-153T')
Prime-Ark® Traveler (U.S. plant patented as 'APF-190T')

20 40.078 Ca Calcium


Salicylic acid

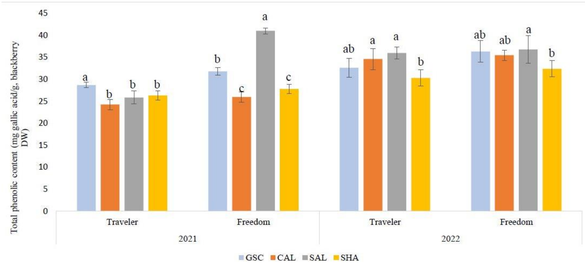
Application rates and dates for treatments applied during the 2021 and 2022 seasons.

Treatment	Application Rate	2021	2022
Calcium (CAL)	2 fl. oz./gallon	6/15; 6/24; 7/1; 7/13	6/15; 6/25; 7/5; 7/14
Salicylic acid (SAL)	0.032 oz./gallon (2mM)	6/15; 7/13	6/15; 7/14
Shade cloth (SHA)	30% light reduction	Installed on 6/2	Installed on 6/15

I. Phenolic Content Analysis

Total phenolic content of PrimeArk® Freedom and PrimeArk® Traveler

-Growing season by treatment interaction was significant for total phenolic content.
-Different letters in the same variety and same year represent statistical differences ($p < 0.05$) based on one-way ANOVA with Least significant difference (LSD).
-GSC, grower standard control.



II. Physicochemical Analysis

Treatment and year effect on physiochemical parameters

	PrimeArk® Traveler						PrimeArk® Freedom					
Treatment[1]	Fruit[4] Size (mm^2)	Fruit Brix	Fruit pH	Fruit Firmness (kg)	Brix/%TA[2] 2021	Brix/%TA[2] 2022	Fruit Size (mm^2)	Fruit Brix	Fruit pH	Fruit Firmness (kg)	Brix/%TA 2021	Brix/%TA 2022
GSC	548.4 b	10.3 a	3.3	0.09	24.6 a	14.6 a	716.3	9.5	3.3	0.07 a	14.7 a	11.2 a
CAL	551.6 b	10.3 a	3.3	0.09	23.2 a	12.8 b	764.6	9.5	3.3	0.08 a	14.8 a	12.0 a
SAL	551.9 b	10.3 a	3.3	0.10	22.8 a	12.5 bc	706.7	9.6	3.3	0.07 a	16.1 a	9.7 b
SHA	593.2 a	9.5 b	3.3	0.09	17.6 b	12.0 c	740.8	9.2	3.3	0.06 b	12.5 b	9.7 b
Pr > F[3]	0.0381*	0.0016*	0.2235	0.7326	<0.0001*		0.4172	0.1453	0.6888	0.0171*	<0.0001*	

[1] GSC: Grower standard control; CAL: Calcium; SHA: Shade cloth; SAL: Salicylic acid
[2] Growing season by treatment interaction was significant for Brix/%TA. For all other parameters, only the treatment main effect was evaluated, and data were pooled over the two growing seasons.
[3] Treatment was considered significant when $P \leq 0.05$. was used to determine the difference. Means not connected by the same letter are significantly different using Least significant difference (LSD). P value ≤ 0.05 is marked with *.
[4] The physicochemical data were analyzed using fruits harvested from 15 June to 25 July.

	PrimeArk® Traveler				PrimeArk® Freedom			
Growing Season[1]	Fruit Size[3] (mm^2)	Fruit Brix	Fruit pH	Fruit Firmness (kg)	Fruit Size (mm^2)	Fruit Brix	Fruit pH	Fruit Firmness (kg)
2021	600.5 a	9.7 b	3.2 b	0.1 a	776.0 a	9.1 b	3.2 b	0.1
2022	522.1 b	10.6 a	3.3 a	0.08 b	688.2 b	9.7 a	3.4 a	0.1
Pr > F[2]	<.00012	<.0001	0.0002	0.0012	0.0036	0.0004	0.0005	0.8573

[1] Growing season by treatment interaction was significant for Brix/%TA. For all other parameters, only the year main effect was evaluated.
[2] Year was considered significant when $P \leq 0.05$. was used to determine the difference. Means not connected by the same letter are significantly different using Least significant difference (LSD).
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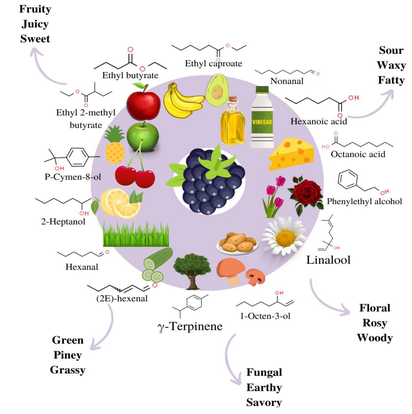
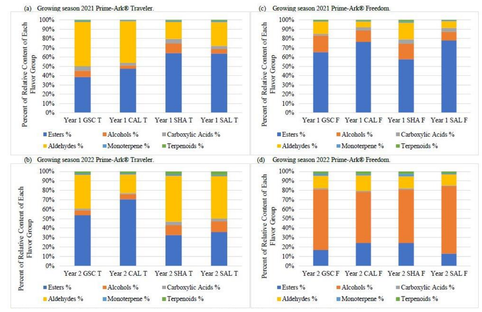
Results

III. Aroma Analysis

Aroma active compounds in Freedom and Traveler blackberries



Content percentage of each aroma group in different treatments



Conclusions

[1] Shade cloth **increased** the fruit size of Prime-Ark® Traveler and the TA compared to GSC.

[2] Shade cloth significantly **reduced** the TSS Brix content (°Bx) for both varieties and **reduced** fruit firmness in 'Prime-Ark® Freedom' compared with GSC. For 'Prime-Ark® Freedom' SHA treatment showed **reduced** WDD incidence. **No differences** were found on yield, pH for either of the varieties.

[3] Shade cloth and Calcium showed a **decreased trend** of phenolic content.

[4] Higher temperatures and lower rainfall in 2022 relative to 2021 decreased fruit size and firmness but increased the concentration of sugars and acids in both varieties.

[5] In both varieties, the same **16 aroma-active compounds** were considered as odor-important by intensity.

[6] Shade cloth had an increased peak area ratio of several aroma-active compounds: **ethyl butyrate** and **2-heptanol,** compared to GSC in both varieties.

[7] Overall, Prime-Ark® Freedom had higher levels of "fruity" compounds such as **ethyl butyrate** and **ethyl hexanoate**, as well as "floral" compounds like **phenylethyl alcohol** and **linalool**, while Prime-Ark® Traveler had higher concentrations of "green" and "earthy" compounds such **as hexanal**, **trans-2-hexenal**, and **nonanal.**

References

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