

**Title: Methods for Rapid Screening of Muscadine Grapes for Browning and Pigment Profile**

**Progress Report**

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**Research Proposal**

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**Objectives:** Determine ways to slow browning of susceptible bronze muscadine grape cultivars and what phenolic compounds are associated with the browning.

**Approach:** Muscadine grapes of the cultivars ‘Tara’, ‘Summit’, and ‘Late Fry’ were purchased from a local commercial grower. Fruit were stored at 1 and 4°C (33 and 39° F) at 90% RH for 14 and 28 days. Treatments consisted of 1) holding fruit at constant temperature, 2) warming to 20°C for one day after 14 days storage and 3) application of a modified atmosphere by enclosing clamshells of fruit in plastic, pulling a vacuum and replacing air with nitrogen gas and carbon dioxide. Colorimeter values were determined on grapes before and after storage using a Konica-Minolta CR 400 and expressed as L (light-dark), a\* (red-green), b\* (yellow-blue) and the color (hue). Fruit were rated for overall appearance where 1 was best and 3 was unmarketable, and for the number of firm grapes (determined by gentle squeezing). The percent grapes with leak, decay, or shriveled berries was determined as well as percent weight loss. Composition was done by genogrinding partially frozen grape peel and pH, SSC and total phenolic content determined.

The phenolic composition of the hulls (peels) of the four muscadine cultivars and three treatments will be determined in order to identify potential substrates correlated with an increase in visual browning of the peel. Peel of freeze dried muscadine grapes will be excised, ground to a fine powder, and extracted with acidified methanol. Extracts will be run on high performance liquid chromatography to separate phenolic compounds and identified using standards.

**Results:** There was a gradual increase in the percent dark berries over storage time. Analysis of colorimeter readings of the grapes indicates that hue decreased slightly for ‘Granny Val’, a cultivar that maintains green fruit throughout storage (Table 1). In contrast, the hue of ‘Summit’ and ‘Tara’ decreased substantially with storage. Colorimeter readings of muscadines within a cultivar determined to be light, medium, or dark in color or green vs bronze showed shifts in the hue from a slightly green color (90-105°) to an orange range of 60° (Table 2).

Reducing weight loss or increasing carbon dioxide failed to stop muscadine fruit browning in varieties most susceptible such as ‘Summit’. A comparison of storage life indicates more firm and fewer leaky grapes at 1 C as well as weight loss (Table 3). Positive correlations were highest between total phenolic content and pH or torn stem scar but were not correlated with percent light or dark berries. The percent dark berries was not correlated with overall ratings.

Total phenolic content was highest in ‘Summit’ compared to the other cultivars, but total phenolic content did not change significantly for days of storage or temperature for any of the cultivars (Table 3). Identification and quantification of phenolic profiles by HPLC is still underway but preliminary results indicate no differences in profiles over time. The soluble solids content (SSC) ranged from 15 to 20% but did not show differences with storage temperature treatment.

The lower total phenolic content of ‘Summit’ compared to other muscadine cultivars tested may indicate that phenolics are used in the browning of the peel without further synthesis of more phenolics. It is possible that non enzymatic processes are part of the peel browning process in bronze muscadine grapes.

**Impact Statement:** Bronze muscadine cultivars differed in peel color and degree of color change with storage. The total phenolic content differed between cultivars but was not affected by storage temperature or time. Results indicate that other components in muscadine peel such as chlorophyll content or non enzymatic browning may be important in slowing changes in muscadine peel color.

Table 1. Changes in muscadine peel color after 0 and 28 days storage at 4 °C.

Color variable	Days of Storage	
	0	28
Granny Val		
L	46	46
a	-5	-4
b	17	17
hue	104	101
Summit		
L	42	45
a	3.5	0.1
b	15.7	15
hue	78	89

Table 2. Colorimeter values for ‘Summit’ grape peel.

Visual color	Color values			
	l	a	b	hue
Bronze	43.9	1.2	14.7	85.4
Green	47.2	-1.2	16.8	93.4
Light	38.9	2.6	13.5	80.2
Medium	37.3	4	12.8	73.3
Dark	33.6	6.8	11.5	60

Table 3. Muscadine ratings and peel composition after storage at 1 or 4C.

Temp	Days of storage	% Weight loss	Overall rating	% Firm berries	% Leaky berries	% Dark berries	SSC	pH	Total phenolic content (mg gallic acid equiv/kg)
Granny Val									
1	14	1.64	1.3	55.3	11.3	2.9	14.85	4.08	1128.06
4	14	2.30	1.6	55.0	6.1	2.1	15.40	4.06	902.88
1	122*	1.71	2.5	56.6	18.0	20.8	16.00	4.36	860.23
4	122	1.98	2.3	77.0	18.1	26.9	15.47	4.43	1160.83
1	28	3.15	2.3	46.3	4.2	11.6	15.20	4.03	827.95
4	28	4.84	2.7	69.0	11.1	11.7	15.45	4.02	1124.14
Late Fry									
1	14	1.07	2.0	69.2	15.4	45.9	16.30	4.34	1678.05
4	14	1.86	1.4	61.5	5.1	69.2	17.40	4.62	1604.22
1	122	2.40	2.0	47.8	10.9	72.3	17.35	4.81	1529.28
4	122	2.18	1.5	46.2	6.0	55.5	16.30	4.95	1695.45
1	28	2.45	1.7	89.9	12.8	70.3	16.80	4.56	1692.59
4	28	4.94	1.7	73.5	2.6	88.3	16.22	4.51	1467.80
Summit									
1	14	1.31	2.0	68.9	3.6	85.6	18.30	3.77	996.10
4	14	1.98	2.0	19.7	0.0	100.0	18.10	3.95	845.24
1	122	1.30	2.0	79.7	0.0	81.2	18.19	3.76	864.37
4	122	1.05	1.3	67.8	2.5	93.2	17.57	4.14	1080.31
1	28	3.38	1.9	84.9	3.4	85.3	18.30	4.05	952.32
4	28	4.20	1.8	59.4	0.9	89.4	18.63	4.12	931.03
Tara									
1	14	1.13	2.0	70.0	2.2	100.0	15.60	3.48	1165.76
4	14	1.92	1.8	45.0	3.8	89.6	15.70	3.66	1305.39
1	122	1.19	2.0	54.2	6.3	100.0	15.25	3.51	1367.86
4	122	1.19	2.0	54.2	6.3	90.7	15.25	3.51	1367.86
1	28	3.48	3.0	60.8	2.0	33.4	16.90	3.82	1099.79
4	28	5.43	3.0	31.8	7.6	34.0	16.10	3.86	1168.82

\*122 is 12 days at 4 or 1C plus 2 days at 20 C/