

UGA Variety Trial Quality Report 2018 – 2019 Crop Season

Chris Tyson¹, Jason Lessl², Daniel Jackson², Teresita Chua Ona², Cynthia Chan², Andre Luiz Biscaia Ribeiro da Silva³, Jason Edenfiel⁴, Ben Reeves⁵, Aubrey Shirley⁶, Anthony Bateman³, Randy Hill⁷, Denny Thigpen⁷, Steven Powell⁸, Savannah Tanner⁹, and Zack Williams¹⁰

¹Vidalia Onion Area Agent; ²Agricultural and Environmental Services Laboratories, ³Department of Horticulture; ³Toombs County, ANR Agent; ⁴Candler County, ANR Agent; ⁵Tattnall County, ANR Agent; ⁶Vidalia Onion and Vegetable Research Center; ⁷Treutlen County, ANR Agent; ⁸Emanuel County, ANR Agent; ⁹Bacon County, ANR Agent

Introduction

Each season the University of Georgia, Agricultural and Environmental Services Laboratories evaluates the flavor-associated compounds in the short-day onions grown in the Variety Trial. These onion varieties are submitted by the participating seed companies, grown at the Vidalia Onion and Vegetable Research Center (VOVRC), and once harvested and dried, submitted to the Agricultural and Environmental Services Laboratories for analysis of the pungency-related compounds; pyruvic acid, lachrymatory factor, and methyl thiosulfinate content. Due to association of Vidalia onions with low pungency and sweet flavor, this annual evaluation provides useful information about the relative flavor quality of these onion varieties.

When the cells within the onion bulb are ruptured by mechanical means or during chewing, a complex chain of chemical reactions begins, resulting in the formations of highly volatile compounds responsible for onion pungency and flavor. One of the first chemicals to be formed is known as the onion lachrymatory factor (propanethial S-oxide), due to its tear-causing capability. The lachrymatory factor is responsible for the majority of the mouth burn and pungency of onions; however, due to its unstable nature, it quickly breaks down into further flavor-associated compounds, including the methyl thiosulfinates. Methyl thiosulfinates (specifically the C-4, methyl thiosulfinates) are a class of compounds, which each provide a specific flavor, and collectively producing the characteristic flavors of fresh onions. Pyruvic acid is a byproduct of this chemical pathway, and although pyruvic acid does not produce a flavor response itself, due to its formation at a similar ratio to the more unstable flavor compounds, it is commonly analyzed as a proxy for onion pungency.

This publication summarizes the flavor analysis results from the 2018-2019 growing season, as well as compares the performance of each variety over the past four growing seasons.

Materials and Methods

Forty five onion varieties were analyzed as part of the 2018 – 2019 variety trial. Each variety was grown at the VOVRC in quadruplicate plots, with each replicated harvested, dried, and submitted to the lab individually. Cores were taken from 10 onions within each replicated, composited, onion juice expressed, and analyzed following the procedures described in Kim *et al.* 2017¹.

¹Kim H, Jackson D, Adhikari K, Riner C, & Sanchez-Brambila G. 2017. “Relationship between consumer acceptability and pungency-related flavor compounds of Vidalia onions”, Journal of Food Science. 82 (10): 2396-2402.

Results and Discussion

The following tables compare the concentrations of flavor-associated compounds in onions grown as a part of the 2018-2019 variety trial. Additionally, the cumulative variety flavor quality rankings are provided for the past four growing seasons. For additional information regarding the performance of a given variety, please contact your Extension Agent or the Vidalia Onion and Vegetable Research Center. We would like to thank the participating seed companies as well as the Vidalia Onion Committee for their support of this trial.

Table 1. Pyruvic acid content in onions submitted to the UGA Agricultural & Environmental Services Labs as a part of the 2018-2019 variety trial.

Variety	Pyruvic Acid μmole/ g
Mata Hari (Red)	6.3 a [†]
3662	6.1 ab
DPSapelo Sweet	6.0 abc
Sofire (Red)	5.7 abcd
J3017	5.7 abcde
Emy5545	5.6 abcde
Quick Start	5.6 abcde
Granex Yellow PRR	5.5 abcde
Vulcana	5.5 abcde
Dulciana	5.5 abcde
J3015	5.4 abcdef
Fast Track	5.4 abcdef
Emy55045	5.4 abcdef
WI-129	5.4 abcdef
XON-109Y	5.2 abcdef
J3016	5.2 abcdef
Candy Ann	5.2 abcdef
Pirate	5.2 abcdef
DP1407	5.1 abcdef
J3009	5.1 abcdef
Sweet Emotion	5.1 abcdef
Althea	5.1 abcdef
New Frontier	5.1 abcdef
Sweet Caroline	4.9 abcdef
Plethora	4.9 abcdef
J3014	4.9 abcdef
Century	4.8 abcdef
Emy55033	4.7 abcdef
Vidora	4.7 abcdef
Sweet Jasper	4.7 abcdef
Candy Kim	4.7 abcdef
Candy Joy	4.7 abcdef
Emy55126	4.6 abcdef
Macon	4.6 abcdef
Allison	4.6 abcdef
2002	4.5 abcdef
J3013	4.5 abcdef
Sweet Azalea	4.3 bcdef
Sweet Harvest	4.3 bcdef
Sweet Agent	4.2 bcdef
Sweet Magnolia	4.1 bcdef
Red Duke (Red)	4.1 cdef
J3010 (Red)	4.0 def
Red Hunter (Red)	3.8 ef
Red Sensation (Red)	3.5 f

[†]Letters that are the same between varieties indicate that those varieties are not significantly different according to Tukey test ($P \leq 0.05$)

Table 2. Lachrymatory factor (Propanethial S-Oxide) content in onions submitted to the UGA Agricultural & Environmental Services Labs as a part of the 2018-2019 variety trial.

Variety	Lachrymatory Factor $\mu\text{mole/g}$
3662	5.7 a
Ganex Yellow PRR	5.1 ab
Mata Hari	5.0 abc
Sofire	5.0 abc
J3009	5.0 abc
Sapelo	5.0 abc
J3016	5.0 abc
Pirate	4.9 abc
Vulcana	4.9 abc
Emy 55455	4.9 abc
J3017	4.9 abc
Dulciana	4.8 abcd
Sweet Caroline	4.5 abcde
J3015	4.5 abcde
Emy 55045	4.4 abcde
XON-109Y	4.3 abcde
Sweet Azalea	4.2 abcdef
Athena	4.2 abcdef
Century	4.1 abcdef
Plethora	4.0 abcdef
J3014	3.9 abcdef
Sweet Magnolia	3.9 abcdef
Quick Start	3.9 abcdef
Fast Track	3.8 abcdef
1407	3.8 abcdef
Sweet Jasper	3.7 abcdef
Emy 55033	3.7 abcdef
Allison	3.7 abcdef
Sweet Emotion	3.6 abcdef
Candy Ann	3.5 abcdef
New Frontier	3.4 bcdef
Macon	3.4 bcdef
Vidora	3.3 bcdef
Emy 55126	3.3 bcdef
2002	3.1 bcdef
J3013	3.1 bcdef
Red Duke	3.0 bcdef
Wannamaker	2.9 bcdef
Sweet Harvest	2.8 bcdef
Candy Joy	2.8 bcdef
J3010	2.8 cdef
Candy Kim	2.7 cdef
Sweet Agent	2.5 def
Red Sensation	2.4 ef
Red Hunter	2.0 f

†Letters that are the same between varieties indicate that those varieties are not significantly different according to Tukey test ($P \leq 0.05$)

Table 3. Methyl thiosulfinate content in onions submitted to the UGA Agricultural & Environmental Services Labs as a part of the 2018-2019 variety trial.

Variety	Methyl Thiosulfinates nmole/ g
Candy Kim	109.3 a
Candy Joy	107.3 ab
Wannamaker	103.5 abc
Candy Ann	97.3 abcd
Quick Start	82.8 abcde
1407	82.7 abcde
Sapelo	79.7 abcdef
J3013	69.6 abcdefg
Sweet Emotion	67.5 abcdefg
Sofire	65.4 abcdefg
Fast Track	64.4 abcdefg
J3015	57.9 abcdefg
Mata Hari	57.0 abcdefg
Sweet Harvest	56.0 abcdefg
New Frontier	54.2 abcdefg
J3014	51.8 abcdefg
Athena	47.7 abcdefg
Vidora	44.0 abcdefg
Sweet Agent	42.9 bcdefg
Emy 55033	39.3 cdefg
Red Hunter	33.1 defg
Macon	32.6 defg
J3017	30.6 efg
Red Duke	29.3 efg
2002	28.4 efg
Pirate	27.4 efg
J3010	26.5 efg
Emy 55126	26.0 efg
Allison	25.4 efg
Emy 55455	24.7 efg
3662	24.2 efg
Ganex Yellow PRR	23.7 efg
Sweet Jasper	20.7 efg
Red Sensation	19.9 efg
Vulcana	19.4 efg
J3009	19.2 efg
XON-109Y	19.2 efg
Emy 55045	18.6 efg
J3016	16.4 fg
Century	16.3 fg
Plethora	15.2 fg
Dulciana	15.1 fg
Sweet Azalea	14.1 fg
Sweet Caroline	13.9 g
Sweet Magnolia	9.7 g

†Letters that are the same between varieties indicate that those varieties are not significantly different according to Tukey test ($P \leq 0.05$)

Table 4. Overall quality ranking of the 2019 variety trial onions based on Pyruvic acid, Lachrymatory factor, and Methyl Thiosulfinates.

Variety	Rank
Red Sensation (Red)	1
Red Hunter (Red)	2
J3010 (Red)	3
Red Duke (Red)	4
Sweet Agent	5
2002 (White)	6
Sweet Magnolia	7
Emy 55126	8
Allison	9
Sweet Azalea	10(t)
Macon	10(t)
Sweet Jasper	10(t)
Sweet Harvest	13
Plethora	14(t)
Vidora	14(t)
Emy 55033	16
Century	17
J3013	18
Sweet Caroline	19
New Frontier	20
Candy Kim	21(t)
XON-109Y	21(t)
Candy Joy	23(t)
Emy 55045	23(t)
J3014	25
J3016	26
Dulciana	27(t)
J3009	27(t)
Sweet Emotion	27(t)
Pirate	30(t)
Athena (White)	30(t)
Vulcana	32
WI-129-Wannamaker	33
Emy 55455	34
Fast Track	35(t)
Granex Yellow PRR	35(t)
1407	37(t)
Candy Ann	37(t)
J3017	37(t)
3662	40
J3015	41
Quick Start	42
Mata Hari (Red)	43(t)
Sofire (Red)	43(t)
Sapelo	45

Table 5. Overall quality ranking of variety trial onions grown for four consecutive years (2016-2019) based on Pyruvic acid, Lachrymatory factor, and Methyl Thiosulfinates.

Variety	Rank
Sweet Agent	1
Sweet Magnolia	2
Vidora	3(t)
Sweet Azalea	3(t)
Sweet Harvest	5
Plethora	6
Century	7
1407	8
New Frontier	9
Allison	10
XON-109Y	11
Pirate	12(t)
Sweet Jasper	12(t)
Sweet Caroline	14
Candy Joy	15
Candy Kim	16
Candy Ann	17
Fast Track	18
Granex Yellow PRR	19(t)
Macon	19(t)
Sapelo	21
Emy 55455	22