

Sensory Quality of Multiple Potato Genotypes following Three Methods of Preparation

Matthew D. Kleinhenz, Aida Sanchez-Vela, Aparna Gazula, Joseph C.
Scheerens, and Nathaniel Honeck

Department of Horticulture and Crop Science
The Ohio State University

**the
North-Central (NCR-84) and Northeast (NE-184)
Regional Projects Cooperating**



ACKNOWLEDGMENTS

Work described herein was funded by grants from the USDA Cooperative State Research, Education, and Extension Service (CSREES) and the Ohio Vegetable and Small Fruit Research and Development Program. Support was also contributed by The OSU-OARDC, OSU Extension, Department of Horticulture and Crop Science, Ohio Potato Growers Association, and allied potato industries.

Many people assisted with all aspects of the project. Special thanks to John Elliot and Bruce Williams of the Department of Horticulture and Crop Science OARDC Research Farm, and Kerilynn Perry.

~~~~~  
All programs of the Ohio Agricultural Research and Development Center are available to clientele without regard to race, color, creed, religion, sexual orientation, national origin, gender, age, disability or Vietnam-era status.

## **Background and Rationale**

Participants in the NCR84 and NE184 regional projects work to develop and facilitate the adoption of improved potato varieties throughout a large portion of the U.S. Changes in yield, external tuber appearance, and resistance to stress, insects, diseases, and the development of internal physiological disorders are leading indicators of progress in the projects.

Numerous potato varieties and experimental selections were grown at the OARDC in Wooster, OH in 2001 and scored using the above and other criteria (see Kleinhenz et al., 2001, HCS Series Bulletin 717 December 2001). In the current study, untrained consumer panels rated the sensory quality of a subset of these potato genotypes following their long-term storage, then preparation using three methods. Physical and chemical characteristics of potato tubers affect their reaction to cooking by boiling, baking and microwaving. It is possible that specific methods may be required to optimize the sensory quality of particular potato genotypes from the perspective of consumers.

## **Materials and Methods**

### **Tuber Production**

Seed potatoes were cut and treated with Mancozeb on May 1-2 and then cured and stored under recommended temperature and humidity conditions at the OARDC until planting on June 11. Soil type was a well-drained Wooster silt loam. The plots were harvested on October 1 and graded on November 1. Samples were held in refrigerated storage (44-48<sup>0</sup> F) for four months until evaluation.

### **Cooking and Consumer Panel Evaluation**

Each cooking method constituted an independent test completed on two dates and involving different genotypes. On the day of evaluation, approximately thirty marketable quality, U.S. #1-size potatoes per genotype were retrieved from storage, transferred to the kitchen facilities of Fisher Auditorium at the OARDC, and cleaned by brushing lightly under cool tap-water.

The testing protocol was approved by The Ohio State University Office of Research Risks Protection (ORRP). The sensory panel group consisted of male and female volunteers, both smokers and nonsmokers between the ages of 21-65. Panelists were OARDC employees or spouses of employees and each was permitted to select an evaluation period which fit their schedule. Evaluations were initiated each day at 10:30 am, 11:30 am and 12:30 pm.

### *Microwave Oven Preparation*

## ACKNOWLEDGMENTS

Work described herein was funded by grants from the USDA Cooperative State Research, Education, and Extension Service (CSREES) and the Ohio Vegetable and Small Fruit Research and Development Program. Support was also contributed by The OSU-OARDC, OSU Extension, Department of Horticulture and Crop Science, Ohio Potato Growers Association, and allied potato industries.

Many people assisted with all aspects of the project. Special thanks to John Elliot and Bruce Williams of the Department of Horticulture and Crop Science OARDC Research Farm, and Kerilynn Perry.

~~~~~  
All programs of the Ohio Agricultural Research and Development Center are available to clientele without regard to race, color, creed, religion, sexual orientation, national origin, gender, age, disability or Vietnam-era status.

Background and Rationale

Participants in the NCR84 and NE184 regional projects work to develop and facilitate the adoption of improved potato varieties throughout a large portion of the U.S. Changes in yield, external tuber appearance, and resistance to stress, insects, diseases, and the development of internal physiological disorders are leading indicators of progress in the projects.

Numerous potato varieties and experimental selections were grown at the OARDC in Wooster, OH in 2001 and scored using the above and other criteria (see Kleinhenz et al., 2001, HCS Series Bulletin 717 December 2001). In the current study, untrained consumer panels rated the sensory quality of a subset of these potato genotypes following their long-term storage, then preparation using three methods. Physical and chemical characteristics of potato tubers affect their reaction to cooking by boiling, baking and microwaving. It is possible that specific methods may be required to optimize the sensory quality of particular potato genotypes from the perspective of consumers.

Materials and Methods

Tuber Production

Seed potatoes were cut and treated with Mancozeb on May 1-2 and then cured and stored under recommended temperature and humidity conditions at the OARDC until planting on June 11. Soil type was a well-drained Wooster silt loam. The plots were harvested on October 1 and graded on November 1. Samples were held in refrigerated storage (44-48⁰ F) for four months until evaluation.

Cooking and Consumer Panel Evaluation

Each cooking method constituted an independent test completed on two dates and involving different genotypes. On the day of evaluation, approximately thirty marketable quality, U.S. #1-size potatoes per genotype were retrieved from storage, transferred to the kitchen facilities of Fisher Auditorium at the OARDC, and cleaned by brushing lightly under cool tap-water.

The testing protocol was approved by The Ohio State University Office of Research Risks Protection (ORRP). The sensory panel group consisted of male and female volunteers, both smokers and nonsmokers between the ages of 21-65. Panelists were OARDC employees or spouses of employees and each was permitted to select an evaluation period which fit their schedule. Evaluations were initiated each day at 10:30 am, 11:30 am and 12:30 pm.

Microwave Oven Preparation

Genotypes included in the microwave oven test were: Katahdin, V 0168-3, B 1871-1, Russet Norkotah, AF 1775-2, Chieftain, AF 1763-2, Atlantic, MN 19315, Dakota Rose, NY 112, and NorValley.

A standard three-tine kitchen fork was used to produce nine randomly-located, 3-mm deep holes in each intact (skin-on) tuber. Tubers were then placed into one of three programmable, 1150-Watt Goldstar microwave ovens (MA-2117B; 2.1 ft³, recessed turntable). Based on preliminary tests to identify an optimal cooking time-x-tuber weight combination, a 2-kg group of potatoes (consisting of tubers from all six genotypes) was cooked in each oven each day for 28 min on high power.

Regardless of cooking method, half-tuber samples of a single genotype were provided to judges in random order within 30 min of preparation. Individual samples were placed on a 18 cm x 23 cm white styrofoam tray pre-coded with a unique numerical identifier. A total of thirty-three judges participated in the microwave test with seventeen judges evaluating all samples.

Convection Oven Preparation (baking)

Genotypes included in the convection oven test were: Katahdin, B 1829-5, NY 112, AF 1775-2, AF 1763-2, Chieftain, NY 112, V 0168-3, Atlantic, MN19315, Dakota Rose, and NorValley.

After cleaning, intact, unwrapped tubers totaling 500 g per genotype were randomly placed onto three shelves in a convection oven (Cleveland, model ME227X, 9.1 ft³) and heated at 220 C for 45 min. A total of twenty-nine judges participated in the convection oven test with thirteen judges evaluating all samples.

Boiling Preparation

Genotypes included in the boiling test were: AF 1758-7, NY 103 (Eva), W 1242, Kennebec, Superior, AF 1763-2, ND 5084, B 1806-8, B 1816-5, T 15-1, and Keuka Gold (NY 101).

After cleaning and peeling with a standard vegetable peeler, 1-kg batches of tubers of each genotype were placed into 9.46 L aluminum pots containing approximately 7.6 L boiling water. All tubers of each genotype were prepared in one of six pots. Pots were previously loaded with cold tap water brought to and maintained at a rolling boil using three, 2-burner hot plates (Munsey model R92, 1,650 Watts). Based on preliminary tests, potatoes were boiled for 1 hr. A total of twenty-five judges participated in the boiling test with twenty judges evaluating on both days.

After receiving a sample and ballot (see Appendix 1), judges chose a seat at one of three 80 cm x 180 cm folding tables positioned in a dining area near the kitchen facility. The dining area was lit by a combination of standard fluorescent fixtures and sunlight provided by large unshaded windows. Panelists were instructed to not discuss the

evaluation or their reaction to samples with other panelists. Panelists were permitted to ask project staff for clarification on the ballot or procedure, but few questions were encountered. Plastic cutlery, salt shakers and bottled water were readily available to panelists. After completing the ballot for a sample, panelists discarded the coded tray, returned their ballot to project staff, and obtained another sample (if needed).

Results

Varieties were ranked from high-low according to their quantitative results and purchase intent responses from the judges. The rankings were then added for a total score and the lowest score was considered the best performing variety in each cooking method. The information that the rankings were based on is contained in tables found later in the report.

Based on the rankings, the following varieties were given the best scores:

Microwave preparation:	Russet Norkotah, Katahdin, AF 1763-2
Convection Oven preparation:	B 1829-5, NY 112, Katahdin
Boiling preparation:	Kennebec, AF 1758-7, MN 19525

Table 1. Preference scores of 12 genotypes of potato grown in Wooster, OH in 2001 and stored for four months under refrigerated conditions as given by untrained panelists. These varieties were prepared with a microwave.

Variety	Skin Appearance	Interior Appearance	Interior Color	Taste	Texture	Skin Flavor	Skin Texture	Aftertaste
AF 1763-2	7.15 a	6.27 ab	7.15 a	6.42 ab	5.73 abc	6.19 a	5.96 a	5.65 abc
AF 1775-2	6.50 ab	5.46 bcd	6.25 bcde	6.54 ab	6.11 abc	5.82 ab	5.54 ab	6.18 a
Atlantic	5.75 bcd	6.25 acb	6.57 abcd	5.36 c	5.61 abc	4.57 cde	4.50 cde	5.11 bcd
B 1871-1	5.87 bc	6.17 abc	6.27 bcde	6.30 abc	6.37 ab	5.47 abc	5.40 abc	5.83 ab
Chieftain	5.72 bcd	6.48 a	7.00 ab	6.28 abc	6.54 a	5.54 abc	5.88 ab	5.63 abc
Dakota Rose	4.19 e	6.07 abc	7.00 ab	6.19 abc	5.22 c	5.27 abc	4.93 bcd	5.74 abc
Katahdin	6.83 a	6.20 abc	6.70 abc	6.20 abc	6.63 a	5.17 bcd	5.57 ab	5.37 abcd
MN 19315	4.87 ed	5.52 abcd	5.96 cdef	5.52 bc	5.43 bc	4.18 de	4.30 def	4.57 de
NorValley	4.20 e	5.08 d	5.64 ef	5.92 abc	5.64 abc	4.79 cd	3.87 ef	4.88 cde
NY 112	4.11 e	5.29 cd	5.21 f	5.93 abc	5.82 abc	3.74 e	3.37 f	3.96 e
Russet Norkotah	6.52 ab	5.92 abcd	6.96 ab	6.64 a	6.48 ab	6.13 ab	5.75 ab	6.04 ab
V 0168-3	5.43 cd	5.43 bcd	5.78 def	6.48 ab	6.39 ab	5.48 abc	5.30 abcd	5.87 ab

Means within the same cooking method, column, and the same letter are not significantly different according to the Fisher's Protected Least Significant Difference Test ($\alpha = 0.05$).

Table 2. Preference scores of 12 genotypes of potato grown in Wooster, OH in 2001 and stored for four months under refrigerated conditions as given by untrained panelists. These varieties were prepared with a convection oven.

Variety	Skin Appearance	Interior Appearance	Interior Color	Taste	Texture	Skin Flavor	Skin Texture	Aftertaste
AF 1763-2	5.94 ab	6.29 abc	6.53 ab	6.47 a	5.82 abc	5.47 abc	5.41 a	5.53 ab
AF 1775-2	4.85 bc	5.55 abcd	6.35 abc	6.10 ab	6.10 ab	4.95 ab	5.25 ab	5.15 abc
Atlantic	4.68 c	6.11 abc	6.32 abc	6.00 ab	6.21 ab	5.11 ab	4.21 bc	5.47 ab
B 1829-5	6.22 a	6.50 a	6.89 a	6.83 a	6.67 a	5.33 ab	4.94 ab	5.82 a
Chieftain	5.11 bc	6.33 ab	6.67 ab	6.24 ab	6.56 ab	4.83 ab	5.17 ab	5.78 a
Dakota Rose	3.50 c	5.00 d	5.94 bc	5.11 b	4.72 c	4.17 b	3.72 c	4.17 c
Katahdin	5.67 abc	6.11 abc	6.53 ab	6.44 a	6.56 ab	5.35 ab	5.00 ab	6.06 a
MN 19315	6.45 a	5.32 bcd	6.41 abc	6.00 ab	6.14 ab	4.91 ab	4.95 ab	4.45 bc
NorValley	4.79 c	5.26 cd	5.63 c	6.05 ab	6.26 ab	4.50 ab	4.58 abc	5.00 abc
NY 112	6.62 abc	6.57 a	7.10 a	6.90 a	6.95 a	4.80 ab	5.05 ab	5.43 ab
NY 112	4.90 bc	6.43 a	6.71 ab	6.24 ab	6.90 a	4.67 ab	4.62 abc	4.90 abc
V 0168-3	5.50 abc	6.45 a	6.65 ab	5.95 ab	5.50 bc	5.40 ab	5.20 ab	5.00 abc

Means within the same cooking method, column, and the same letter are not significantly different according to the Fisher's Protected Least Significant Difference Test (alpha = 0.05).

Table 3. Preference scores of 12 genotypes of potato grown in Wooster, OH in 2001 and stored for four months under refrigerated conditions as given by untrained panelists. These varieties were prepared by boiling.

Variety	Interior Appearance	Interior Color	Taste	Texture	Aftertaste
AF 1758-7	7.32 a	7.00 a	7.78 a	6.42 ab	6.74 a
AF 1763-2	6.79 ab	6.68 ab	6.00 cd	6.00 ab	5.84 abcd
B 1806-8	6.83 a	6.56 ab	6.61 bcd	6.78 a	5.88 abcd
B 1816-5	5.50 c	5.67 b	6.17 bcd	6.89 a	5.72 abcd
Kennebec	7.37 a	7.26 a	6.84 abc	6.53 a	6.16 abc
Keuka Gold (NY 101)	5.76 bc	6.59 ab	5.72 d	5.29 b	5.18 cd
MN 19525	7.22 a	7.39 a	7.22 ab	6.53 a	6.50 ab
ND 5084-3R	6.33 abc	6.61 ab	5.61 d	5.83 ab	5.00 d
NY 103 (Eve)	6.95 a	6.74 a	5.84 cd	6.32 ab	5.63 abcd
Superior	6.79 ab	6.84 a	5.72 d	6.53 a	5.53 bcd
T 15-1	5.56 ab	6.94 a	6.33 bcd	6.06 ab	6.33 ab
W 1242	7.17 a	7.00 a	6.84 abc	6.32 ab	6.56 ab

Means within the same cooking method, column, and the same letter are not significantly different according to the Fisher's Protected Least Significant Difference Test ($\alpha = 0.05$).

Table 4. Percentage of respondents who indicated that they would be willing to buy potato genotypes when asked during sensory evaluation.

Variety	----- Cooking Method -----			
	Microwave	Bake	Soup	Salad
	----- % of people that would buy -----			
AF 1758-7			73 (16/22)*	67 (14/21)
AF 1763-2	50 (13/26)	55 (11/20)	64 (14/22)	62 (13/21)
AF 1775-2	53 (16/30)	57 (13/23)		
Atlantic	32 (9/28)	39 (7/18)		
B 1806-8			70 (16/23)	70 (16/23)
B 1816-5			70 (16/23)	78 (18/23)
B 1829-5		61 (11/18)		
B 1871-1	60 (18/30)			
Chieftain	52 (14/27)	53 (10/19)		
Dakota Rose	29 (8/28)	27 (6/22)		
Katahdin	61 (19/31)	70 (14/20)		
Kennebec			68 (15/22)	67 (14/21)
Keuka Gold (NY101)			39 (9/23)	35 (8/23)
MN 19315	29 (7/24)	35 (8/23)		
MN 19525			60 (12/20)	60 (12/20)
ND 5084-3R			55 (12/22)	50 (11/22)
NorValley	23 (6/26)	24 (5/21)		
NY 103 (Eve)			68 (15/22)	48 (10/21)
NY 112	26 (7/27)	58 (14/24)		
NY 112		50 (11/22)		
Russet Norkotah	58 (15/26)			
Superior			64 (14/22)	55 (11/20)
T 15-1			52 (12/23)	52 (12/23)
V 0168-3	61 (14/23)	48 (11/23)		
W 1242			68 (15/22)	52 (11/21)

* Number of affirmative answers/number of respondents.