

# Evaluation of advanced potato breeding clones for storage and processing performance.

Martin Glynn  
USDA/ARS  
Potato Research Worksite

Dr. Joe Sowokinos  
Department of Horticultural Science  
University of Minnesota

East Grand Forks, MN. – The concentration of reducing sugars that are found in a potato cultivar during storage determines its processing potential for chips, fries, or fresh markets (Sowokinos and Glynn, 2000). The darkening effect that undesirable reducing sugars have on the color of chip and fry products is well known. Potatoes that resist sweetening when cold-stressed generally have a greater ability to resist sweetening when subjected to field stress such as temperature, moisture, infertility and early dying (Sowokinos et al., 2000).

Potato breeding is an expensive and labor-intensive process. Tens of thousands of potato clones are grown annually by breeders in an effort to find a “single clone” that may meet all of the horticultural requirements necessary to make a successful cultivar (i, e., yield, solids content, disease resistance, etc.). Once a new clone has undergone several years of field trials, it often fails because of storage and marketing-related problems. This study reports on the storage potential of advanced clones provided by state and federal breeders and is funded, in part, by the Northern Plains Potato Growers Association.

## Material and Methods:

Eighty-four advanced clones from Maine, Michigan, Minnesota, New York, Idaho, Wisconsin, Oregon, Texas and Alberta, Canada were grown under irrigation south of Avilla, ND. All potatoes were harvested mid-September, suberized two weeks at room temperature and then placed into 45° F, 42° F and 38° F storage. Tubers were evaluated for sugar content, Agtron color values, and chip appearance at four intervals (i.e. harvest, 3, 6 and 7 month's storage). Potatoes were also reconditioned at 55° F for one month following 6 months of storage at 42° F and 38° F. All storage and processing evaluations were conducted at the USDA/ARS Potato Research Worksite, East Grand Forks, MN, following 7-months of storage.

## Results

The individual clones demonstrated a wide range of ability to accumulate sugars from starch when subjected to cold stress. Following seven months of storage at 42° F, the concentration of glucose ranged from 0.038 mg/g in W 4013-1 (Table 1) to 6.97 in Stampede Russet (Table 3). **This shows greater than a 180-fold difference in a potato clone's ability to accumulate sugars when placed into cold storage.** Based on sugar content and chip appearance, the clones were categorized into three classes.

Class A: Clones that have the ability to process following 42° F storage (Table 1).

Class B: Clones that have the ability to process following 45° F storage, but not from 42° F (Table 2).

Class C: Clones that do not chip acceptably from either 45° F or 42° F storage (Table 3).

Table 1 shows the 'Class A' clones that process successfully from 42° F without reconditioning. Reconditioning, however, did have a positive effect by improving most of the Agtron scores. Nine of the top 32 performers were from North Dakota (ND 7519-1, ND 5255-59, ND 7799c-1, ND 8304-2, ND 8305-1, NDA 5507-3Y, Sport 860 is ND 860-2-8, Dakota Pearl, and N8-14 (a selected clone of NorValley)). Michigan had six clones (MSJ 147-1, MSN 191-2Y, MSK 409-1, MSJ 126-9Y, MSK 061-4 and MSL 007-13). Wisconsin, six (W 4013-1, W 2133-1, W 2438-34, W 2324-1, W 2978-3 and W 2310-3). Others in the top ten were from USDA ( B 2490-7, B 1992-106 and B 2489-4, Minnesota (MN 02 586, MN 02 588), New York (NY 139, NY 138). Idaho and Maine each had one (A 91814-5 and AF 2211-4), respectively.

Table 2 shows the 'Class B' clones that process from 45° F but not from 42° F. Snowden is a well known cultivar in this class. Other Class B clones were from Minnesota, North Dakota, Maine, USDA, Canada, and Michigan. Although these clones do not have the sweetening-resistance potential of those clones listed in Table 1 (class A), their level of performance is still acceptable when chipped out of storage temperatures of 45° F or above. Consequently, the clones in Table 2, can and do play an important role in meeting industry's needs.

Table 3 lists 'Class C' clones that do not chip successfully from either 42° F or 45° F storage. Cultivars such as Red Pontiac, Russet Burbank and Russet Norkotah are in this class. Their higher inherent 'basal level' of sugars serves to direct their end use more towards fry and/or fresh markets.

## **Summary**

The thirty-two 'Class A' clones listed in Table 1 provide the quality advantages listed below.

- Decreased microbial spoilage.
- Retention of dry matter
- Reduced shrinkage
- Decreased need for sprout inhibition
- Decreased physiological aging
- Increased marketing window.

For a new potato cultivar to be successful, however, it must also demonstrate a variety of other horticultural and marketing qualities that are required by the processor and the consumer. Contact the respective potato breeder (listed below) if you are interested in any particular quality traits demonstrated by the potato clone of interest.

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**References**

Sowokinos, J. R. and M. Glynn 2000 Marketing potential of advanced potato breeding clones. *Valley Potato Grower*. 65(110):6-8

Sowokinos, J. R., S. K. Gupta and M. Glynn. 2000. Potato clones with a new anti-sweetening gene (Asgene) *Valley Potato Grower* 65(115):4-6.

State	Breeder	Phone	E-Mail
MN	Dr. Christian Thill	612-624-9737	thill005@umn.edu
ND	Dr. Susie Thompson	701-231-8160	Asunta.Thompson@ndsu.nodak.edu
USDA/ID	Dr. Richard Novy	208-397-4181	novy@uidaho.edu
WI	Dr. Jiwan Palta	715-369-0619	ppalta@wisc.edu
	Dr. Felix Navarro		fmnavarro@wisc.edu
Alberta/CAN	Dr. Benoit Bizmungu	403-317-2276	bizimungu@agr.gc.ca
MI	Dr. Dave Douches	517-355-6887	douchesd@pilot.msu.edu
ME	Dr. Greg Porter	207-764-5917	Porter@maine.edu
OR	Dr. Isabel Zales	541-737-5835	Isabel.Zales@Oregonstate.edu
TX	Dr. Creighton Miller	979-845-3828	cmiller@taexgw.tamu.edu
NY	Dr. Walter DeJong	607-254-5384	wsd2@cornell.edu

For other experimental details contact:

MN	Dr. Joe Sowokinos	218-773-247	sowok001@umn.edu
USDA	Mr. Martin Glynn	218-773-2473	glynnm@fargo.ars.usd

**Table 1. 2007-08 Class A Cones:** Potato clones that process successfully following 7 months storage at 42° F. Clones are aligned in order of increasing glucose values from 42° F storage.

CLONE	SOURCE	CC <sup>1</sup>	AGTRON	GLUCOSE mg/g
W 4013-1	WI	1	71	0.03
MSJ 147-1	MI	1	69	0.05
W 2133-1	WI	1	68	0.05
SPORT 860	ND	1	67	0.06
DAKOTA PEARL	ND	1	68	0.06
W 2438-34	WI	1	68	0.07
MSN 191-2Y	MI	1	66	0.09

ND 7519-1	ND	1	68	0.10
CO 95051-7W	CO/OR	1	65	0.15
MSK 409-1	MI	1	65	0.15
MSJ 126-9Y	MI	1	66	0.16
N 8-14	ND	1	65	0.19
B 2490-7	USDA	1	65	0.21
B 1992-106	USDA	1	65	0.29
NY 139	NY	1	65	0.38
A 91814-5	ID	2	64	0.40
B 2489-4	USDA	2	63	0.46
ND 5255-59	ND	2	62	0.51
W 2310-3	WI	2	62	0.52
MSK 061-4	MI	2	63	0.53
ND 7799c-1	ND	2	59	0.63
NY 138	NY	2	59	0.68
MN 02 586	MN	2	59	0.74
ND 8304-2	ND	2	58	0.78
W 2324-1	WI	2	58	0.79
ND 8305-1	ND	2	57	0.80
MSL 007-13	MI	2	57	0.81
AF 2211-4	ME	2	56	0.83
MN 02 588	MN	2	56	0.85
W 2978-3	WI	2	56	0.91
NDA 5507-3Y	ND/ID	2	56	0.91
PREMIER RUSSET	ID	2	56	0.95

<sup>1</sup>CC = Represents chip color relating to the Potato Chip/Snack Food Association five-code color chart: 1 and 2 are acceptable color, 3 is marginal, 4 and 5 are unacceptable color.

**Table 2. 2007-08 Class B Cones:** Potato clones that process successfully following 7 months at 45° F. Clones are aligned in order of increasing glucose values from 42° F storage.

CLONE	SOURCE	CC <sup>1</sup>	AGTRON	GLUCOSE mg/g
ND 5775-3	ND	3	54	1.03
BNC 49-2	USDA	3	54	1.12
W 2683-2	WI	3	54	1.15
CO 97043-14W	CO/OR	3	53	1.20
MSJ 036-A	MI	3	52	1.21
WV 4298-1	CAN/ALB	3	52	1.31
B 2477-8	USDA	3	51	1.32
CO 96052-1RU	CO/OR	3	49	1.32
ND 7192-1	ND	3	49	1.35
AF 2291-10	ME	3	47	1.35
BNC 48-1	CAN/ALB	3	47	1.37
VHB 0950-2	CAN/ALB	3	47	1.56
SNOWDEN	WI	3	46	1.58

<sup>1</sup>CC = Represents chip color relating to the Potato Chip/Snack Food Association five-code color chart: 1 and 2 are acceptable color, 3 is marginal, 4 and 5 are unacceptable color.

**Table 3. 2007-08 Class C Cones:** Potato clones that do not chip successfully following 7 months storage at either 45° F or 42° F storage. Clones are aligned in order of increasing glucose values from 42° F storage.

CLONE	SOURCE	CC <sup>1</sup>	AGTRON	GLUCOSE mg/g
CO 96141-4W	CO/OR	3	45	1.66
MN 15620	MN	3	45	1.77
ATLANTIC	USDA	3	45	1.84
CvV97065-1	CAN/ALB	3	44	1.87
AOA 95154-1	ID/OR/ID	4	45	1.93
CV 98112-3	CAN/ALB	3	45	2.08
AF 2426-1	ME	4	27	2.10
ND 8201-2	ND	4	30	2.15
CO 97065-7W	CO/OR	3	24	2.19
AOTX 95265-2ARU	ID/OR/TX	3	36	2.33
AOTX 95265-4RU	ID/OR/TX	3	22	2.57
VC 1009-1W/Y	CAN/ALB	3	25	2.60
RUSSET BURBANK	CO/OR	3	30	2.62
SHEPODY	CAN/NB	5	27	2.77

ATTX 98500-2P/Y	ID/TX/TX	5	27	2.86
B 2452-3	USDA	5	23	3.08
B 2451-6	USDA	5	35	3.13
AF 2413-4	ME	5	29	3.27
ATTX 961014-1R/Y	ID/TX/TX	5	27	3.27
RIO ROJO		4	22	3.32
RUSSET NORKOTAH	ND	4	30	3.35
AF 2290-8	ME	4	27	3.41
IRISH COBBLER		4	31	3.43
CO 95172-3 RU	CO/OR	4	30	3.47
MN 02 419	MN	5	27	3.56
A 95109-1	ID	5	23	3.77
D.R NORLAND	ND	5	26	3.85
AF 2199-6	ME	5	33	3.87
A 96510-4Y	ID	5	22	3.91
YUKON GOLD		4	37	4.04
W 2564-2	WI	5	31	4.14
AF 2431-2	ME	5	23	4.35
A 95409-1	ID	5	24	4.73
RED PONTIAC	USDA/MI/FL	5	20	4.98
HIGHLAND RUSSET	ID	5	20	6.04
NDTX 4271-5R	ND/TX	5	20	6.17
NDTX 4784-7R	ND/TX	5	17	6.82
STAMPEDE RUSSET	ID	5	26	6.97

<sup>1</sup>CC = Represents chip color relating to the Potato Chip/Snack Food Association five-code color chart: 1 and 2 are acceptable color, 3 is marginal, 4 and 5 are unacceptable color.