

Missaukee: A Round White Potato Variety Combining Chip-Processing With Resistance to Late Blight, *Verticillium* Wilt and Golden Cyst Nematode

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Abstract Previously identified as breeding line MSJ461-1, Missaukee is a round white chip processing potato variety resulting from a cross between Tollocan and NY88 and has foliar resistance to potato late blight (*Phytophthora infestans* de Bary). This variety has an attractive round shape and mildly netted, bright skin. Seven years of field testing in Michigan indicate that the yield of total marketable tubers in Missaukee is similar to that of Snowden. However, Missaukee has a lower incidence of internal defects than Snowden. Specific gravity ranged from 1.069 to 1.086 in Michigan trials and out-of-the-field chip scores were similar to those of Snowden. Missaukee showed some resistance to *Verticillium* wilt in 2-years of trials. DNA marker and greenhouse tests indicate that Missaukee is also resistant to the golden cyst nematode (*Globodera rostochiensis* Woll) pathotype Ro1.

Resumen Previamente identificada como la línea de mejoramiento MSJ461-1, Missaukee es una variedad de papa redonda, blanca, para proceso de fritura, como resultado de la cruce entre Tollocan y NY88 y tiene resistencia foliar al tizón tardío de la papa (*Phytophthora infestans* de Bary). Esta variedad tiene una forma redonda atractiva y piel brillante, ligeramente con red. Siete años de pruebas de campo en

Michigan indican que el rendimiento total de tubérculos comerciales en Missaukee es similar al de Snowden. No obstante, Missaukee tiene mas baja incidencia de defectos internos que Snowden. La gravedad específica fluctuó entre 1.069 a 1.086 en los ensayos de Michigan y fuera del campo los valores de fritura fueron similares a los de Snowden. Missaukee mostró alguna resistencia al marchitamiento por *Verticillium* en ensayos de dos años. Los marcadores de DNA y las pruebas de invernadero indican que Missaukee también es resistente al nematodo dorado de quiste (*Globodera rostochiensis* Woll) patotipo Ro1.

Keywords *Solanum tuberosum* · Cultivar ·
Phytophthora infestans · Late blight resistance

Background

Missaukee is a new round white chip processing potato variety (*Solanum tuberosum* L.), developed at Michigan State University that can be grown for chip processing both out-of-the-field from 10°C storage. Foliar resistance to potato late blight (*Phytophthora infestans* de Bary) combined with chip-processing quality is the primary strength of this variety. Missaukee produces uniform round tubers with a bright, mildly netted skin. The tubers have a white flesh with low incidence of internal defects and low total glycoalkaloids. The specific gravity ranges from 1.069 to 1.086 in Michigan with an average of 1.076 which is lower than Snowden (1.084 average). However, Missaukee will chip process out-of-the-field and from 10°C (50°F) storage with excellent chip color. Missaukee was also evaluated for three years in the United States Potato Board/Snack Food Association (USPB/SFA) National Trials. Previously evaluated as breeding line MSJ461-1, Missaukee is derived

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Fig. 1 Pedigree of Missaukee (MSJ461-1)

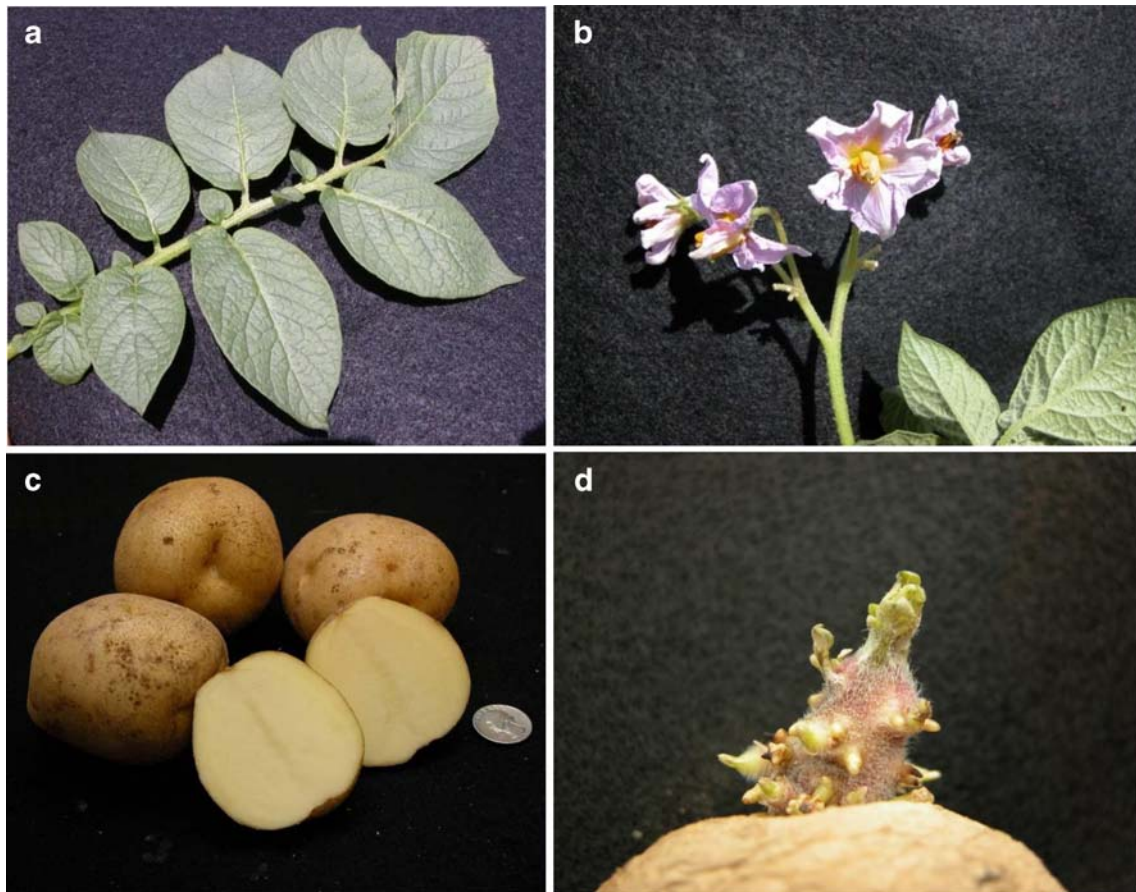
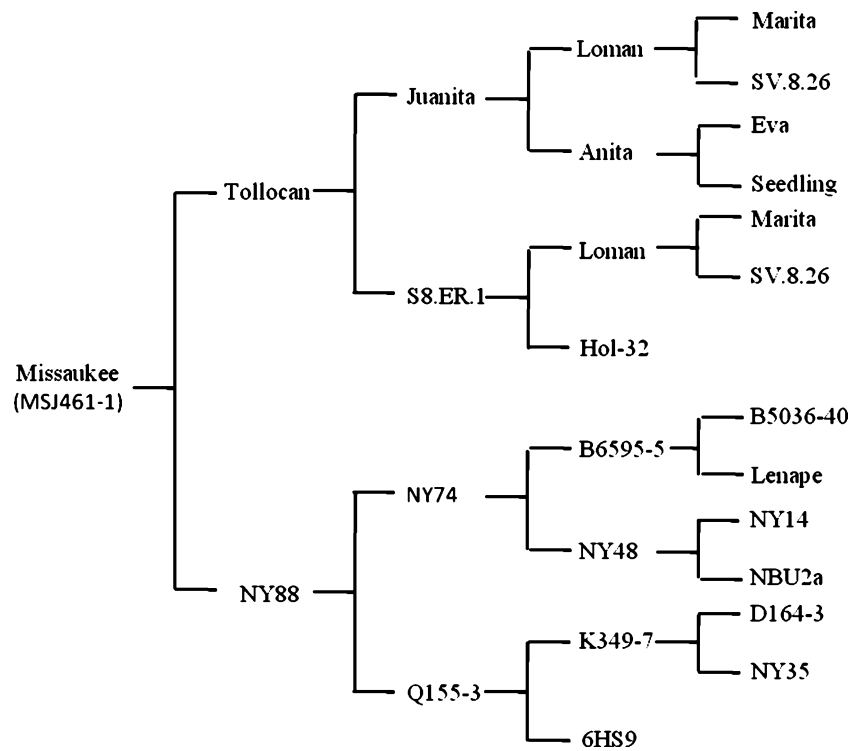


Fig. 2 Compound Leaf (a), Inflorescence (b), Tubers (c) and Light Sprouts (d) of Missaukee

Table 1 Full season agronomic performance trials of Missaukee, Pike, and Snowden at the Michigan State University Montcalm Research Farm, Entrican, Michigan

Entry	Yield (mt ha ⁻¹)		Percent of Total ^a					Specific gravity	Field chip score ^b	Tuber quality (%) ^c				
	US#1	Total	US#1	Bs	As	OV	PO			HH	VD	IBS	BC	Maturity ^d
2002 (1 May–23 September; 144 d)														
Missaukee	31	37	84	15	84	0	0	1.069	1.0	0	0	0	0	3.0
Pike	29	34	87	13	86	1	0	1.077	1.0	0	0	0	0	2.5
Snowden	29	34	86	13	81	5	0	1.073	1.0	8	10	0	5	2.5
LSD _{0.05}	6	6						0.002						
2003 (7 May–29 September; 145 d)														
Missaukee	36	39	92	8	78	14	0	1.076	1.0	3	0	0	0	3.5
Snowden	31	33	93	6	88	5	1	1.085	1.0	35	0	0	0	3.5
LSD _{0.05}	7	7						0.004						
2004 (3 May–20 September; 140 d)														
Missaukee	33	39	84	15	82	2	1	1.086	1.0	0	5	0	0	4.0
Snowden	31	35	87	11	83	4	2	1.095	1.0	5	25	0	0	3.5
LSD _{0.05}	5	5						0.003						
2005 (4 May–27 September; 147 d)														
Missaukee	37	43	87	13	87	0	0	1.075	1.0	0	0	0	0	3.3
Pike	25	29	84	16	84	0	0	1.081	1.0	0	0	0	0	2.0
Snowden	38	42	90	10	86	4	0	1.081	1.0	28	8	0	0	2.5
LSD _{0.05}	8	8						0.003						
2006 (8 May–6 October; 152 d)														
Missaukee	33	42	79	20	78	2	0	1.073	1.5	5	0	0	0	3.0
Pike	18	24	77	23	77	0	0	1.083	2.0	3	33	0	0	3.0
Snowden	29	36	81	18	77	4	1	1.081	2.0	10	48	5	0	2.5
LSD _{0.05}	6	5						0.004						
2007 (8 May–25 September; 141 d)														
Missaukee	48	53	90	9	79	11	1	1.075	1.0	0	5	10	0	3.7
Pike	28	32	88	11	85	3	1	1.082	1.0	3	10	0	0	2.5
Snowden	43	47	90	9	83	7	1	1.080	1.0	18	63	3	3	2.3
LSD _{0.05}	8	8						0.005						
2008 (8 May–24 September; 140 d)														
Missaukee	32	42	75	25	74	1	0	1.079	1.0	0	0	0	0	4.0
Snowden	33	39	85	13	76	8	2	1.091	1.0	13	38	0	0	4.5
LSD _{0.05}	9	9						0.003						
Mean														
Missaukee	36	42	84	15	80	4	0	1.076	1.1	1	1	1	0	3.5
Pike	25	30	84	16	83	1	0	1.081	1.3	1	11	0	0	2.5
Snowden	33	38	87	11	82	5	1	1.084	1.1	17	27	1	1	3.0

^a Size Distribution: B: <5.1 cm, A: 5.1–8.3 cm, OV: >8.3 cm, PO: Pickouts

^b Snack Food Association Chip Score Ratings 1–5; 1=Excellent; 5=Poor; ≥2.5=Unacceptable

^c Tuber Quality: HH: Hollow Heart, VD: Vascular Discoloration; IBS: Internal Brown Spot; BC: Brown Center. Percent of 40 oversize (>8.3 cm) tubers cut

^d Vine maturity taken typically at late August. 1=Early (vines completely dead), 5=Late (flowering)

*Mean comparisons were done using Fisher's Least Significant Difference ($\alpha=0.05$)

Table 2 Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for Missaukee and Snowden standards grown in FL, ID, ME, MI, NC, PA and RRV in 2004–2006 USPB/SFA National Trials

Year	State	Entry	Yield (mt ha ⁻¹)		Percent Grade and Size Distribution ^a					Specific Gravity	Field Chip Color	
			No. 1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
2004	FL	Missaukee	17	34	52	17	51	2	2	1.077	64	–
2004	ID	Missaukee	50	65	76	19	69	7	5	1.092	–	1.7
2004	ME	Missaukee	23	35	66	11	62	4	23	1.073	69	–
2004	MI	Missaukee	49	54	91	8	84	7	1	1.079	66	1.5
2004	PA	Missaukee	34	51	67	4	67	7	22	1.085	65	–
2004	RRV	Missaukee	29	35	83	10	83	1	5	1.095	65	–
2004	average		34	46	73	12	69	5	10	1.084	66	1.6
2004	FL	Snowden	34	44	77	11	74	4	0	1.086	63	–
2004	ID	Snowden	13	24	55	44	52	3	0	1.088	–	1.4
2004	ME	Snowden	11	30	36	22	36	0	43	1.075	–	–
2004	MI	Snowden	47	49	95	4	80	15	1	1.087	63	1.0
2004	PA	Snowden	32	42	76	3	76	8	13	1.091	67	–
2004	RRV	Snowden	27	31	85	6	85	4	5	1.100	63	–
2004	average		27	37	71	15	67	6	10	1.088	64	1.2
2005	FL	Missaukee	17	34	52	44	52	0	2	1.070	–	–
2005	ID	Missaukee	40	54	73	23	68	6	3	1.090	–	1.5
2005	ME	Missaukee	32	39	82	18	81	1	0	1.063	70	–
2005	MI	Missaukee	45	53	85	15	84	1	0	1.073	62	2.0
2005	NC	Missaukee	29	43	67	25	67	0	8	1.067	–	2.0
2005	PA	Missaukee	18	28	65	25	65	0	10	1.086	64	–
2005	RRV	Missaukee	30	35	85	14	86	0	1	1.097	60	–
2005	average		30	41	73	23	72	1	3	1.078	64	1.8
2005	FL	Snowden	22	30	72	24	73	0	2	1.079	–	–
2005	ID	Snowden	36	49	73	27	70	2	0	1.089	–	1.5
2005	ME	Snowden	22	24	93	5	93	0	2	1.066	70	–
2005	MI	Snowden	42	45	94	6	89	5	0	1.082 ⁶⁸	2.0	–
2005	NC	Snowden	32	44	71	22	71	0	7	1.079	–	1.0
2005	PA	Snowden	28	37	77	6	77	4	13	1.084	65	–
2005	RRV	Snowden	24	29	83	10	82	5	4	1.104	72	–
2005	average		29	37	80	14	79	2	4	1.083	69	1.5
2006	FL	Missaukee	31	42	79	19	79	0	5	1.078	64	–
2006	ID	Missaukee	62	70	88	8	69	20	3	1.090	–	4.4
2006	ME	Missaukee	24	28	87	12	86	1	0	1.073	–	–
2006	MI	Missaukee	49	54	92	8	89	3	0	1.077	55	2.5
2006	NC	Missaukee	41	52	79	16	78	0	6	1.072	63	2.0
2006	PA	Missaukee	26	33	78	13	78	3	7	1.080	–	1.0
2006	RRV	Missaukee	25	29	86	8	86	3	3	1.084	62	–
2006	TX	Missaukee	16	27	56	44	56	0	–	1.072	72	–
2006	WI	Missaukee	46	69	67	4	67	0	29	1.077	68	–
2006	average		36	45	79	15	76	3	7	1.078	64	2.5
2006	FL	Snowden	34	40	88	11	88	0	11	1.082	66	–
2006	ID	Snowden	48	56	87	11	70	17	2	1.090	–	3.5
2006	ME	Snowden	29	33	88	11	86	2	2	1.075	69	–
2006	MI	Snowden	38	43	88	12	87	1	0	1.081	57	3.0
2006	NC	Snowden	39	46	84	14	83	1	2	1.080	66	1.0
2006	PA	Snowden	28	35	80	17	80	0	3	1.094	–	1.0

Table 2 (continued)

Year	State	Entry	Yield (mt ha ⁻¹)		Percent Grade and Size Distribution ^a					Specific Gravity	Field Chip Color	
			No. 1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
2006	RRV	Snowden	18	21	88	5	90	2	4	1.080	60	–
2006	TX	Snowden	24	36	67	33	67	0	–	1.078	72	–
2006	WI	Snowden	52	65	80	2	80	0	18	1.076	70	–
2006	average		34	41	83	13	81	3	5	1.082	66	2.1
Overall average	Missaukee		33	44	75	17	72	3	7	1.080	65	2.0
	Snowden		30	38	78	14	76	4	6	1.084	66	1.6

^a Size categories: Small is under 4.8 cm dia.; Mid-Size 4.8 to 8.9 cm dia.; and Large is over 8.9 cm dia

from a cross between NY88 and Tollocan (Fig. 1) (Van Berloo et al. 2007; W. De Jong, pers. comm.). NY88 is a breeding line from the Cornell University potato breeding program with round white tubers and good chipping quality. Tollocan is a late-maturing, late blight resistant Mexican variety.

The seedling generation was grown in 1998, followed by two years of selection and seed multiplication at the Lake City Extension Station, Lake City, MI. The name Missaukee was selected for this cultivar because it was selected at the Lake City Experiment Station in Missaukee County, Michigan. Since 2002, Missaukee has been tested in replicated agronomic trials at the Montcalm Research Farm, Entrican, MI and disease trials at the potato common scab (*Streptomyces scabies* Thaxter) nursery, Michigan State University Soils Farm, East Lansing, MI and late blight trials at the Michigan State University Muck Soils Research Farm, Bath, MI. In

2004, Missaukee was entered into multi-state agronomic trials that continued through 2006.

Varietal Description

Plant Vine and Foliage

Growth habit: medium to tall height, erect vines with a balance between stems and foliage visible. *Stems:* anthocyanin coloration is weak as are stem wings. *Leaves:* dark green (Royal Horticulture Society [RHS] Color Chart value 147A) with medium density, short pubescence and a medium to open leaf silhouette; petiole anthocyanin coloration is nearly absent; leaf stipules are small (Fig. 2). *Terminal leaflets:* medium ovate with an acuminate tip and cordate base, with slight margin waviness. *Primary leaflets:* 3–4 pairs per leaf,

Table 3 Demonstration storage chip results (20004–2006)

	Sample Dates:					
	11/3/2004	12/1/2004	1/12/2005	2/9/2005	3/9/2005	5/19/2005
Temp:	14.4°C	14.4°C	14.4°C	14.4°C	13.3°C	12.8°C
Line ^a	SFA Chip Scores ^{b,c}					
Atlantic	1.5	1.0	1.0	1.0	1.0	2.5
Missaukee	1.0	1.0	1.0	1.5	1.0	2.0
Pike	1.0	1.0	1.0	1.0	1.0	2.0
	Sample Dates:					
	11/8/2005	12/14/2005	1/10/2006	2/8/2006	3/8/2006	5/15/2006
Temp:	10.0°C	11.1°C	8.9°C	8.9°C	11.1°C	11.7°C
Line ^a	SFA Chip Scores ^{b,c}					
Atlantic	1.5	1.5	1.5	1.0	1.0	1.5
MSJ461-1	1.5	1.5	1.5	1.0	1.0	1.0
Pike	1.0	1.0	1.0	1.0	1.0	1.0

^a Tubers of Atlantic, Missaukee and Pike were stored in the same bin in the Demonstration Storage Facility

^b Snack Food Association Chip Score (1=excellent; 5=poor)

^c Chip scores were based on two-slice samples taken from each of five tubers collected at the indicated sample date

Table 4 Simulated blackspot bruise results for Missaukee, Snowden and Pike 2002–2008

Year	Snowden ^a		Pike ^a		Missaukee ^a	
	% Bruise Free	Average Spots/Tuber	% Bruise Free	Average Spots/Tuber	% Bruise Free	Average Spots/Tuber
2002	64	0.6	76	0.3	52	0.6
2003	20	1.3	84	0.3	52	0.5
2004	12	1.7	28	1.1	32	1.1
2005	28	1.5	68	0.5	48	0.7
2006	21	1.4	55	0.8	37	1.3
2007	36	1.5	52	0.8	20	1.8
2008	24	1.8	44	0.9	36	1.0
Average	44	1.2	60	0.6	44	0.8

^a 25 A-size tubers were collected at harvest, held at 10°C at least 12 h, placed in a six-sided plywood drum and rotated 10 times to produce simulated bruising. Samples were abrasively peeled and scored

narrowly ovate leaf shape, with acuminate tip and cordate base. *Secondary and tertiary leaflets*: 3–6 pairs per leaf. *Vine maturity*: full season (135 days).

Inflorescence

Seven to 12 inflorescence per plant; mean of 10 florets per inflorescence. *Corolla*: semi-stellate in shape with a violet color (RHS Color Chart value 87C) (Fig. 1). *Calyx*: anthocyanin coloration medium. *Anthers*: narrow cone shape with a yellow-orange color (RHS color Chart value 17A). *Stigma*: capitate and green (RHS Color Chart value 146A). *Fertility*: pollen production is moderate and female fertility is high; fruit set in the field is low.

Tubers

Shape: round; average tuber length x width x thickness is 60×59×48 mm with an average weight of 124 g. *Skin*:

flaky with a buff color (RHS Color Chart value 162B). *Eyes*: eyes are medium-shallow, similar to Atlantic, with a predominantly apical distribution and an average of 7 eyes per tuber; tuber eyebrows have slight prominence. *Flesh*: white (RHS Color Chart value 10D).

Agronomic Production

Field experiments were conducted at Montcalm Research Farm in Entrican, MI, a central Michigan site on a sandy loam soil representative of commercial, irrigated potato production. The agronomic trials were used to measure total and marketable yields, to determine tuber size distribution, specific gravity, blackspot bruising, and to evaluate tuber appearance and incidence of external and internal defects. Missaukee was evaluated with other breeding lines and check varieties planted in a randomized complete block design with four replications. The

Table 5 Late Blight Evaluations of Missaukee, Snowden and Atlantic at the Michigan State University, Muck Soils Research Farm, Bath, MI

Year	Snowden RAUDPC Mean ^{ab}	Atlantic RAUDPC Mean ^{ab}	Missaukee RAUDPC Mean ^{ab}	LSD _{0.05}
2002	18.4	22.8	0.0	7.0
2003	18.2	39.3	NA	8.4
2004	15.7	22.4	0.8	10.3
2005	16.6	23.2	0.2	10.1
2006	NA ^c	NA ^c	NA ^c	
2007	33.2	35.6	1.9	9.6
2008	23.3	22.3	2.0	8.0
Average	20.9	22.6	1.0	

^a Ratings indicate the average plot RAUDPC (Relative Area Under the Disease Process Curve)

^b *Phytophthora infestans* genotypes US-1, US-6, US-8, US-10, US-11 and US-14 were used for inoculations

^c 2006 plots were destroyed by flooding due to excess rain in late July through early August



Fig. 3 Missaukee flanked by susceptible clones in inoculated late blight field trials (30 DAI) at the Michigan State University Muck Soils Research Farm, Bath, Michigan

plots were 7 m in length with 30.5 cm between-plant spacing and 86.4 cm inter-row spacing. Total nitrogen fertilization was 200 kg/Ha each season and supplemental irrigation was supplied as needed.

Seven years (2002–2008) of full season (140–145 days after planting) agronomic data recorded at the Michigan State University Montcalm Research Farm for Missaukee are summarized in Table 1 with Pike and Snowden used as check varieties. The yield of marketable tubers was similar to Snowden; however the incidence of hollow heart (HH) in oversized tubers was less in Missaukee than in Snowden. In addition, the variety was also tested at sites in Florida (FL), Idaho (ID), Maine (ME), North Carolina (NC), Pennsylvania (PA) and the Red River Valley (RRV) as part of the USPB/SFA National Trials. The results of these trials suggested that the marketable yield and size distribution of Missaukee were similar to those of Snowden.

Out-of-the-field chip-processing quality was evaluated on tubers from Montcalm Research Farm trials (Table 1). While the mean specific gravity for Missaukee over the seven years

was less than that of Snowden and Pike, chip quality scores were similar for the three varieties. Results from multi-state agronomic trials supported these findings (Table 2). Missaukee, Atlantic and Pike tubers from the Montcalm Research Trials were also stored between 8.9 and 14.4°C in the Demonstration Storage Facility at the Montcalm Research Farm to evaluate chip-processing quality over the course of seven months. Missaukee chip scores were similar to Atlantic and Pike at every sampling date (Table 3).

Simulated blackspot bruise results are reported in two ways: percentage of bruise free tubers and average number of bruises per tuber. Varieties with bruising levels of greater than 1.5 bruises per tuber and less than 20% bruise free tubers are classified as very sensitive to bruising during handling. Missaukee had a blackspot bruise sensitivity similar to that of Snowden but was more sensitive to bruising than Pike (Table 4).

Disease Resistance

Replicated field trials were conducted at the Michigan State University Muck Soils Research Farm, Bath, Michigan to evaluate the response of Missaukee to potato late blight (*Phytophthora infestans* de Bary). Each year the field trials were inoculated with a cocktail of *P. infestans* genotypes including US-1, US-6, US-8, US-10, US-11 and US-14. In six years of field trials, Missaukee showed foliar resistance to potato late blight (Table 5) based on relative area under the disease progress curve (RAUDPC) values (Kirk et al. 2001; Campbell 1990; Madden and Hughes 1995). Figure 3 shows Missaukee flanked by susceptible clones in a late blight field trial at about 30 days after inoculation (DAI). Missaukee has also been tested for tuber late blight reaction in inoculated tuber tests using *P. infestans*. In over eight years of tuber tests, Missaukee tubers have been susceptible to late blight, similar to susceptible control varieties (data not shown).

Table 6 Performance of Missaukee, Snowden and Atlantic in Scab Disease Trials, Scab Nursery, East Lansing, MI 2006–2008

Year	Snowden			Atlantic			Missaukee			
	Mean Rating ^a (0–5)	Worst Rating ^a (0–5)	N ^b	Mean Rating ^a (0–5)	Worst Rating ^a (0–5)	N ^b	Mean Rating ^a (0–5)	Worst Rating ^a (0–5)	N ^b	LSD0.05
2006	2.8	3	16	2.8	3	16	1.8	2	4	0.9
2007	2.6	3	18	2.4	3	16	1.8	3	4	0.9
2008	2.6	3	16	2.4	3	12	2.1	3	8	0.9
Average	2.7			2.5			1.9			

^a Scab Disease Rating: 0: No Infection; 1: Low Infection (<5%); 3: Intermediate Infection; 5: Highly Susceptible

^b Number of plots evaluated

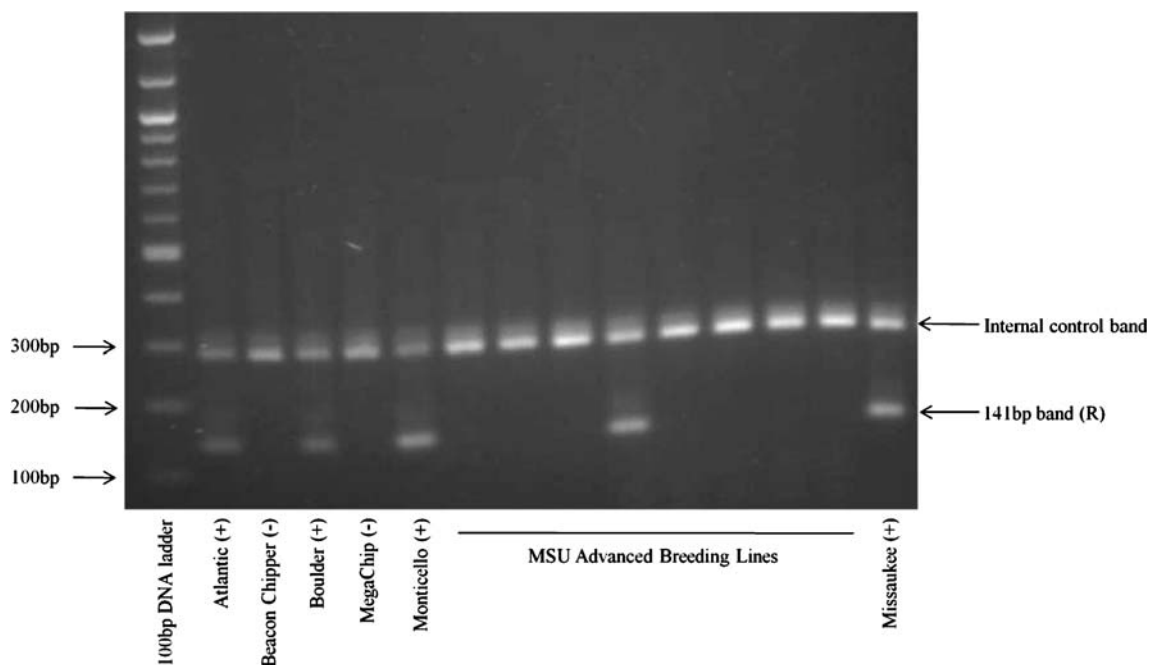


Fig. 4 Results of a PCR analysis for a marker linked to the H1 gene for resistance to golden cyst nematode (*Globodera rostochiensis* Woll). PCR products were loaded into 2% agarose gels and run for 1.5 h at 105 V. Cultivars with a 141 bp band are classified as resistant

The response of Missaukee to common scab (*Streptomyces scabies* Thaxter) was assessed in replicated trials at the Michigan State University Soils Farm scab nursery in East Lansing, MI. Based on three years of data, Missaukee had scab incidence ratings similar to both Snowden and Atlantic which were classified as susceptible (Table 6).

Missaukee was included in two years (2006–2007) of replicated *Verticillium* wilt trials conducted in Wisconsin under the direction of Dr. S. Jansky. For this variety, the average colony forming units (CFU) determined from sap samples were 3.5 and 1.7 in 2006 and 2007, respectively. In the same trials, Atlantic had yearly averages of 56.5 CFU (2006) and 102.9 CFU (2007). Based on these results, Missaukee showed a level of resistance to *Verticillium* wilt greater than that of Atlantic.

DNA was extracted from Missaukee and used to screen for a PCR-based marker (Walter DeJong, pers. comm.) closely linked to the H1 gene for golden cyst nematode (*Globodera rostochiensis* Woll) resistance (Ellenby 1952; Janssen et al. 1991). For this marker test, the presence of a 141 bp band indicates that a variety should be resistant to the golden cyst nematode, whereas absence of the band indicates that the variety should be susceptible. The results of the marker screen indicate that Missaukee should be resistant to golden nematode (Fig. 4). Molecular marker data was validated by a greenhouse trial conducted at Cornell University in which Missaukee was scored as

resistant to the golden cyst nematode pathotype Ro1 (Dave Thurston, pers. comm.).

Electrophoretic Patterns

Leaf and tuber tissue were sampled from Missaukee to construct an electrophoretic fingerprint. The procedures and allelic designations used are according to Douches and Ludlam (1991). The transcript for seven enzyme loci is described as: *Mdh-1²1²1⁴1⁴*, *Mdh-2²2²2²2²*, *Pgd-3¹3²3²3²*, *Pgi-1²1²1²1²*, *Got-1³1³1⁴1⁴*, *Got-2⁵2⁵2⁵2⁵*, *Pgm-1³1³1³1³*, *Pgm-2²2²2²2³*. The electrophoretic fingerprint was unique to Missaukee and was added to a database of electrophoretic patterns. This database is maintained by the Michigan State University Potato Breeding and Genetics Program and contains information on over 250 lines and varieties.

Chemistry

Total tuber glycoalkaloids (TGA) were measured on Atlantic and Missaukee tubers collected at harvest from 2001 to 2007. These samples were sent to Dr. Ken Deahl at the USDA/ARS/PSI Vegetable Laboratory (2002, 2003) and Dr. Brian Perkins at the University of Maine (2001, 2005–2007). For these TGA analyses, the extraction and

rapid high-performance liquid chromatographic (HPLC) determination method was used (Carman et al. 1986). The levels of TGA in Missaukee ranged from 4.0 to 6.7 mg% (mg TGA 100 g FW⁻¹) with an average of 5.5 mg%. For Atlantic, TGA levels ranged from 6.1–11.6 with an average of 7.1 mg%.

Seed Availability

Virus-free tissue culture plantlets are maintained at the Michigan State University Potato Breeding and Genetics program. Small amounts of seed for testing can be obtained from Dave Douches at Michigan State University (517-353-0271 ext. 1198, douchesd@msu.edu). In addition, seed can also be obtained from Sklarczyk Seed Farm (8714 M32 East, Johannesburg, MI 49751; Tel: 989-731-5452). Plant Variety Protection for Missaukee is being considered.

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nematode greenhouse tests. All experiments comply with the current laws of the country in which they were performed.

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