

2023 Colorado Potato Breeding and Selection Report



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Summary:

The Potato Breeding and Selection program at Colorado State University develops new potato cultivars with traits critical for sustainable and profitable potato production in Colorado and around the world. In 2023, seed from 246 parental combinations were obtained. In the field, 91,763 single plants were evaluated for the first time and 575 were selected to advance. Another 603 clones which represent preliminary, intermediate, and advanced stage selection material were evaluated. The program also participated in the Southwest Regional trials and the Western Regional trials for all market classes, and material was submitted to the National Chip Processing Trial (NCPT) and the National Fry Processing Trials (NFPT). Two new selections were submitted for Plant Variety Protection and one additional selection is currently in the process of being protected. The CSU Potato Breeding and Selection program hosted its annual Open House on December 1, 2023. Thirty people were in attendance which included growers, warehouse managers, consultants, and other industry stakeholders. Feedback was collected from all attendees to capture their impressions of the clones on display and any other thoughts they wished to share.

Collaborations with stakeholders at every level help to determine breeding objectives that address important challenges including disease resistance, storability, and consumer preference. The CSU Potato Breeding program participated in several grower trials, obtaining necessary feedback on clone performance. The NCPT and NFPT trials also included growers and processors in the evaluation of potato clones to further guide the selection process. Trialing CSU breeding material with other potato grower/producers will continue to be a major goal of the breeding program.

2023 Program Activities:

The Colorado Potato Breeding and Selection Program intercrossed 93 parental clones in 2023 in two separate crossing blocks. The emphasis of the first crossing block was russet (fresh and processing) and red cultivar development with emphasis on PVY resistance. Crosses were performed in both the San Luis Valley and in Fort Collins. The second crossing block also emphasized russet (fresh and processing), yellow, and specialty cultivar development again with an emphasis on incorporating PVY resistance. Seed from 246 combinations was obtained.

A subset of 110 crosses from 2020-2022 were planted in the greenhouse in 2023 to produce seedling tubers. These seedlings will undergo initial field selection in 2024. These families represent crosses segregating primarily for russets, yellows, reds, along with PVY resistance. Second- through third-size seedling tubers will be distributed to Idaho (USDA-ARS), Maine, Texas, Oregon, and Agriculture Agri-Food Canada.

Colorado grew 91,763 single-hills in the field representing 530 families in 2023, with 575 selected for subsequent planting, evaluation, and increase in future years. A portion of these seedlings were obtained from Agriculture Agri-Food Canada, USDA-ARS (Aberdeen, Idaho), Texas A&M University, University of Minnesota, and the University of Maine.

Another 603 clones were in 12-hill, preliminary, and intermediate stages of selection. At harvest, 105 were saved for further increase and evaluation in 2024.

Ten advanced selections were saved and will be increased in 2024. Another 134 selections and cultivars were maintained for germplasm development, breeding, and other experimental purposes including seed increases/maintenance.

Field trials conducted in 2023 included: Preliminary Post-Harvest Trial, Intermediate Russet Yield Trial, Intermediate Yield Chip Trial, Intermediate Red Trial, Intermediate Specialty Yield Trial, Advanced Russet Yield Trial, Southwestern Regional Russet Trial, Southwestern Regional Chip Trial, Southwest Regional Red Trial, Western Regional Russet Trial, Western Regional Red Trial, Western Regional Specialty Trial, Western Regional Chipping Trial, PVP Trial, San Luis Valley Chipping Trial, and the Tuber Maturity Trial. All trials are grown under “low input” conditions, primarily for reduced nitrogen and fungicide.

During the 2023 growing season, 768 clones, including two populations of single hills through advanced selections and germplasm, were genotyped using Rapid Genomics flex-seq technology. The 12-hills that showed minimal PVY symptoms (286 clones) are currently being tested in house with a PVY marker panel using high resolution melt PCR and sybr green melting dye. The panel included markers for resistance to PVY ($R_{y_{adg}}$, $R_{y_{sto}}$, and $R_{y_{fst0}}$). The markers were RYSC3 (linked to $R_{y_{adg}}$), Yes3_a and Yes3_b (linked to $R_{y_{sto}}$), and GP122 (linked to $R_{y_{fst0}}$). Of the clones tested, 115 were found to have PVY resistance; 46 containing $R_{y_{sto}}$, and 69 containing $R_{y_{adg}}$ and were validated with field disease observations. $R_{y_{fst0}}$ is still being tested.

A total of 115 samples were evaluated for two or more of the following postharvest characteristics: blackspot susceptibility, storage weight loss, dormancy, enzymatic browning, specific gravity, french fry color, and chip color. Advanced red selections were screened for red color retention in storage.

Several advanced and intermediate Colorado clones were evaluated in Regional Trials across the country, including russets, yellows, specialties, and chipping selections. The table below shows the different trials, number of locations, and number of Colorado clones evaluated in each.

2023 Regional Trials	Locations	CO entries
Southwest Regional Trial	5	3
Western Regional Trial	9	6
National Chip Processing Trial	10	3
Preliminary Chip Trial (EGSS)	2	12
National Fry Processing Trial	7	1

PVP for two russet selections are pending to be released in the US and Canada in collaboration with Canadian Eastern Growers. They are CO05189-3RU (Horizon Russet), and CO08231-1RU (Crystal Russet). We are in the process of protecting AC03433-1W (Snowcap).

The CSU Potato Breeding and Selection program hosted its annual Open House on December 1, 2023. Thirty people were in attendance which included growers, warehouse managers, consultants, and other industry stakeholders. Feedback was collected from all attendees to capture their impressions of the clones on display and any other thoughts they wished to share.

Dr. Jessica Chitwood-Brown left the Breeding Program in December 2023, she has taken a tomato breeding position with the University of Florida. One MS student and two PhD students joined the program in 2023. One MS student who is studying PVY is expected to graduate in the Fall. One MS student who has studied Vitamin C in potato graduated in 2023.

Impacts

The Colorado State University Potato Breeding and Selection Program is committed to developing potato varieties with disease resistance (PVY, PMTV, TVR) and climate resilience with the goal of reducing inputs such as nitrogen and water. The CSU potato program will continue to use applied and molecular breeding techniques to make selections and identify key traits. The collaboration with growers, other universities, private industry in the US and abroad is essential to the success of this program.

2023 SLVRC Data:

Field and Yield Data Summaries of Advanced Russet Selections								
Clone Name	Year	Total Yield (CWT/A)	% US No.1s	Marketable Yield* (CWT/A)	Tuber Maturity (DAP)	% Ext. Defects	% HH	PVY
CO15070-4RU	6	349	74	265	100	1.8	0.0	susc
CO16238-4RU	6	368	56	205	115	0.9	0.0	resist
CO15016-1RUsto	7	327	78	254	110	2.6	1.3	resist
AC12090-3RU	9	357	71	254		2.9	0.4	susc
CO13003-1RU	9	332	81	268		0.4	0.6	resist
CO12379-1RU	9+	335	63	210		1.2	0.0	susc
Canela Russet		375	84	313	115	1.6	0.5	susc
Reveille Russet		458	89	408		1.8	0.0	susc
Russet Norkotah		192	58	110		1.4	1.4	susc
Russet Norkotah 278		463	76	354	100	4.5	2.0	susc
Field and Yield Data Summaries of Advanced Red Selections								
CO15113-1R	6	295	55	164	120	0.6	0.0	susc
CO15084-4R	7	370	40	152	115	0.2	0.0	susc
Chieftain		307	85	41		0.9	0.0	susc

Modoc		180	48	91		0.7	0.0	susc
Field and Yield Data Summaries of Advanced Yellow Selections								
CO16154-2Y	6	320	61	195	110	2.6	0.0	resist
CO16212-1Y ⁺	6	213	8	17	115	2.4	0.0	susc
CO16279-5Y	6	389	56	218	110	3.6	1.8	susc
AC10376-1Y	9+	404	40	168		4.3	0.0	resist
Soraya		436	89	386		1.7	0.0	resist
Yukon Gold		289	88	255	105	0.8	0.0	susc
Field and Yield Data Summaries of Advanced Chip Selections								
AC15304-4W	6	339	62	208	110	2.4	0.7	susc
AC13125-5W	7	314	71	223	115			resist
AC13126-1Wadg	8	297	85	252	120	4.9	0.4	resist
AC11494-6W	9+	430	73	315		0.2	0.0	susc
CO12235-3W	9+	279	75	211		5.2	0.4	susc
CO12293-1W	9+	382	84	321		2.8	0.4	susc
Atlantic		332	84	279		1.0	2.0	susc
Snowden		374	67	249		0.4	1.3	susc

*Marketable yield is defined as yield over 4 oz, this does not take into account red and yellow markets for B size.

⁺ Denotes a B size variety

Post-Harvest Data Summaries of Advanced Russet Selections					
Clone Name	Blackspot Bruise ¹	Dormancy (days @ 45F)	Specific Gravity	Harvest Fry Color ²	Storage Fry Color ²
CO15070-4RU	4.7	62	1.082	0.5	1.5
CO16238-4RU	4.7	76	1.084	0.0	1.0
CO15016-1RUsto	4.5	62	1.078	1.0	1.0
AC12090-3RU	4.9	104	1.084	1.5	2.0
CO13003-1RU	4.1	62	1.086	0.0	0.5
CO12378-1RU	4.5	76	1.096	0.0	0.0
Canela Russet	4.6	118	1.098	1.0	1.0
Reveille Russet	5.0	111	1.080	0.0	2.0
Russet Norkotah 278	4.6	97	1.076	2.0	2.0
Russet Norkotah	5.0	76	1.065	3.0	3.0
Post-Harvest Data Summaries of Advanced Red Selections					
CO15113-1R	4.6	83	1.082		
CO15084-4R	4.5	83	1.081		
Chieftain	4.2	55	1.072		
Modoc	4.4	55	1.078		
Post-Harvest Data Summaries of Advanced Yellow Selections					
CO16154-2Y	4.5	41	1.095		
CO16212-1Y	4.2	41	1.085		
CO16279-5Y	4.1	41	1.093		
AC10376-1Y	4.6	76	1.080		
Soraya	4.9	76	1.074		
Yukon Gold	4.3	62	1.082		

Post-Harvest Data Summaries of Advanced Chip Selections				Chip Color Ratings ³			
				40	40R	50	50R
AC15304-4W	3.2	34	1.096	3.5	2.5	2.0	2.5
AC13125-5W	3.3	62	1.082	4.5	4.0	3.5	3.0
AC13126-1Wadg	3.4	34	1.094	3.5	4.0	2.0	2.0
AC11494-6W	2.8	27	1.097	3.5	2.5	2.5	2.0
CO12235-3W	3.6	76	1.092	3.5	2.5	1.5	3.0
CO12293-1W	4.0	48	1.091	4.5	2.0	1.5	2.5
Atlantic	3.3	62	1.096	4.0	4.0	3.0	3.0
Snowden	3.3	76	1.093	4.0	3.0	3.0	2.5

¹ Blackspot Bruise: Ten tubers for each clone tested are bruised on the stem and bud ends with a 150 g weight dropped from a height of 60 cm. Tubers are stored at 40F prior to bruising and warmed up for 24 hours prior to bruising. After bruising, tubers are stored at room temperature for two days prior to evaluation. Blackspot susceptibility is evaluated by cutting the tubers in half longitudinally and rating the extent of damage. Blackspot is rated on a 1 to 5 scale, with 5 indicating no discoloration.

² Fry color is determined at or shortly after harvest and after a minimum of eight weeks of storage at 45F. Fries are cooked for 3 ½ minutes at 375F. Fry color is rated on a 0-4 scale using the USDA color standards. Color ratings of <2 are acceptable.

³ Chip color is determined after an interval of storage at 40 and 50F and after reconditioning (R) for two weeks at 60F. Chips are cooked at 365F until bubbling slows. Chip color is rated using the Snack Food Association 1-5 scale. Ratings of <2.0 are acceptable.

Disease and Chemical analysis data in the following tables was obtained from the 2023 Western Regional Trials. The disease data was compiled by Jonathan Whitworth at USDA, Aberdeen, ID with contributions from Vidyasagar Sathuvalli of Oregon State University, Hermiston, OR; Solomon Yilma of Oregon State University, Corvallis, OR; Robert Wilson of University of California, Tulalake, CA, Rich Quick and Launa Cimrhakl of USDA, Prosser, WA. The Chemical analysis data was compiled by Chelsey Lowder of University of Idaho, Aberdeen, ID with contributions from Doug Scheuring and Isable Vales of Texas A&M University, College Station, TX.

2023 Western Regional Potato Variety Trial - DISEASE EVALUATION AND METRIBUZIN REACTION																				
	Vert. Wilt/					Early Blight		Late Blight			Common Scab			Pectobacterium						
	Early Dying					AB ¹		Corvallis ⁴				AB ¹		Prosser			Fusarium	Soft	Metribuz	C. Root
	AB ¹		HRM ²		TUL ³	Foliar		Foliar		Tuber	HRM	% Serious		Corky Ringspot		Dry Rot ¹ (0-5)	Rot ¹	React. ⁶	Knot	
Clone	(0-9)	AUDPC	(0-9)	AUDPC	AUDPC	(0-9)	AUDPC	(1-9)	AUDPC	%	%PVY	Incid.	Defect	% Incid	DSI ⁵	F(sam)	(0-5)	AB	Nem. ⁷	
CLEARWATER R.	4.0	72	2.7	98	184	4.0	78	6.7	1406	40	95	0	0	65	54	S	5.0	2.0	R	S
RANGER R.	5.7	297	4.7	212	321	5.7	242	9.0	1982	35	95	12	10	54	41	S	2.9	1.7	R	S
R. BURBANK	6.7	363	5.0	254	1281	5.7	230	9.0	1975	28	75	0	0	60	44	S	2.7	1.1	R	S
AC12090-3RU	6.0	235	7.7	534	285	6.3	376	na	ND	ND	50	10	11	45	36	S	4.7	2.9	MS	S
CO13003-1RU	5.3	205	3.7	142	485	4.7	158	na	ND	ND	50	24	10	64	53	S	4.7	2.9	MS	S
R. NORKOTAH	9.0	525	na	na	2032	9.0	722	9.0	1653	25	na	11	4	43	32	S	3.1	1.7	MR	na
Entry Means	5.8	311	4.5	266	681	5.7	264	7.8	1557	29	57	12	6	62	50		4.0	1.9		
LSD (.05)	1.2					1.4		0.9	306	18							1.1	1.2		

¹Evaluations made at Aberdeen, Idaho by Jonathan Whitworth; scale as indicated with highest number being most severe. For 0 to 9: 0=no symptoms;

1= trace; 2=1-5%; 3=5-10%; 4=10-20%; 5=25-40%; 6=40-60%; 7=60-70%; 8=75-90%; 9=90-100% dead or dying with typical disease symptoms.

AUDPC: Area Under the Disease Progress curve based on foliar readings taken 104, 111, and 117 days after planting.

Common Scab and Net Necrosis serious defects are number of tubers with a 3 rating (0-5 scale) or higher, divided by total number of tubers examined.

For 0 to 5: 0=0%/none; 5=100%/severe as a combination of tuber area and degree impacted by Fusarium and Pectobacterium inoculations.

²Evaluations made at Hermiston, Oregon; scale as indicated with highest number being most severe. Readings 120 days after planting. AUDPC based on foliar readings taken 91, 106, and 121 days after planting.

³Evaluations made at Tulelake, California; AUDPC based on foliar early-dying rating taken 80, 84, 91, 98, 108 days after planting.

⁴Evaluations made at Corvallis, Oregon by Solomon Yilma; Ratings are averages for 4 reps: 1 = no foliar injury; 2 = 1-5% injury; 3 = 5-10% injury; 4 = 10-20%; 5 = 25-40%; 6 = 40-60%; 7 = 60-75%; 8 = 75-90%; 9 = 90-100% injury. Percent of late blight infected tubers at harvest based on 10 randomly selected tubers per replication.

⁵Visual readings made at Prosser, Washington by Rich Quick and Launa Cimrhakl: tubers cut lengthwise, quartered and scored (0-8) based on the number of wedge sides affected. Disease Severity Index (DSI) was calculated for each replication by summing the scores (S) of each tuber evaluated (T) and dividing that number by the number of tubers evaluated multiplied by the worst possible score (8) and multiplying by 100. $DSI = (\sum S)/(T*8)*100$

TRV Disease Rating Based on %DSI:R=Extreme Resistance (0-1%);MR=Moderate Resistance (1.1-5%);MS=Moderately Susceptible (5.1-10%);S=Susceptible (10.1-+%)

⁶Evaluations made at Aberdeen, Idaho; R=Resistant, MR=Moderately Resistant, S=Susceptible, MS=Moderately Susceptible, VS=Very Susceptible

⁷Columbia root knot nematode ratings from Hermiston, OR provided by Sagar Suthavalli; S= over 50 dots; MS less than 20 and 40 dots; MR 5 and 20.

**2023 Western Regional Potato Variety Trial - SOLIDS, DEXTROSE, SUCROSE, PROTEIN, VITAMIN C,
AND GLYCOALKALOIDS – ABERDEEN; ANTIOXIDANTS - TEXAS**

Clone	Solids	Sugars		Protein (%DWB) ¹	Vitamin C (mg/100g FWB) ¹	Texas ²		Glycoalkaloids ⁵ (mg/100g FWB) ¹
	Oven Dry %	Dextrose (%FWB) ¹	Sucrose (%FWB) ¹			mg Trolox equivalents/gfw ³	AOA Levels ⁴	
CLEARWATER R.	21.20	0.05	0.12	4.88	27.50	169.8	M	2.1
RANGER R.	20.49	0.11	0.18	5.08	35.0	225.1	M	3.6
R. BURBANK	18.14	0.08	0.13	4.30	18.64	160.3	M	2.1
AC12090-3RU	19.79	0.10	0.08	4.88	27.07	180.4	M	3.4
CO13003-1RU	19.80	0.02	0.08	4.68	19.73	147.6	M	1.5
R. NORKOTAH	19.16	0.06	0.07	4.48	22.26	302.4	H	3.1
Mean	19.8	0.07	0.11	4.7	25.0	197.6		2.6

¹ Evaluations made at Aberdeen, ID by Chelsey Lowder; DWB = Dry Weight Basis; FWB = Fresh Weight Basis

² The assay used at Texas A&M University was based on "Use of a Free Radical Method to Evaluate Antioxidant Activity" by Brand-Williams, et al. 1995, Levensm. Wiss. Technol. 28:25-30. Antioxidants soluble in methonal were extracted and allowed to react with the stable radical, 2,2-Diphenyl-1-picrylhydrazyl (DPPH). This provided a rapid evaluation of the antioxidant properties of the potato extracts based on absorbance.

³ µg Trolox equivalents/gfw - Absorbance was converted to trolox equivalents based on a standard curve using the following equation: $y = -.282(x) + 309.72$

⁴ VH=very high (>417), H=high (416-302), M=medium (301-127), L=low (127-67), VL=very low (<66) n=70 including fourteen check varieties

⁵ Glycoalkaloids: The 2023 Lenape check grown at Aberdeen was 57.6 mg/100g

2023 Western Regional Red/Specialty Disease Evaluations, Metribuzin Reaction															
	Aberdeen			Prosser ⁵			Evaluations made at Aberdeen, Idaho by Jonathan Whitworth								Tulelake
	Vert. Wilt/ Early Dying ¹	Early Blight ¹	Metr. Reaction ²	Corky Ringspot Evaluations			Vert. Wilt ⁶	AUDPC	Early Blight ⁷	AUDPC	Common Scab ⁸		Soft rot ⁹	Dry rot ⁹	Ealy Blight
	Foliar	Foliar		Avg % w/int	Avg % DSI	Designation					incidence(%)	% serious defects	Pecto- bacterium	Fusarium sambucinum	AUDPC
Clone/Variety															
Yellow Flesh															
Yukon Gold	3.0	2.8	VR	64.9	51.2	S	7.7	618	7.7	402	75.8	17.3	1.9	2.7	1478
AC10376-1Y	3.8	2.8	MR	30.8	16.0	S	6.3	411	6.0	344	7.6	3.1	2.0	3.1	1410
Mean	3.4	2.8		47.8	33.6		7.0	514	6.9	373	42	10	2.0	2.9	1444

¹Evaluations made at Aberdeen, ID by Potato Variety Team; scale as indicated with lowest number being most severe. For 1 to 5 5=no symptoms; 1=90-100% dead or dying with typical disease symptoms.

²Metribuzin reaction measured at Aberdeen, ID. VR=very resistant, R=Resistant, MR=Moderately resistant, MS=moderately susceptible, S=susceptible VS=very susceptible.

⁵Avg % w/int= Visual readings taken for 'internals' - tubers cut lengthwise, quartered, and scored (0-8) based on the number of sides of the wedges that were affected. Avg % DSI= Disease Severity Index (DSI) was calculated for each replication by summing the scores (S) of each tuber evaluated (T) and dividing that number by the number of tubers evaluated times the worst possible score (8) and multiplying by 100. $DSI = (\sum S)/(T*8)*100$. TRV Disease Rating Based on % DSI: R = Extreme Resistance (0-1%); MR = Moderate Resistance (1.1-5%); MS = Moderately Susceptible (5.1-10%); S = Susceptible (10.1+%)

⁶Evaluations made at Aberdeen, Idaho by Jonathan Whitworth, Hermiston, Oregon by Sagar Sathuvalli; scale as indicated with highest number being most severe. For 0 to 9: 0=no symptoms;1=trace; 2=1-5%; 3=5-10%; 4=10-20%; 5=25-40%; 6=40-60%; 7=60-70%; 8=75-90%; 9=90-100% dead or dying with typical disease symptoms.

⁷Early Blight and Vert. Wilt AUDPC: Area Under the Disease Progress Curve based on foliar readings taken 3 separate days after planting.

⁸Common Scab serious defects are the number of tubers with a 3 rating (0-5 scale) or higher, divided by the total number of tubers examined.

⁹For 0 to 5: 0=none, 5=severe as a combination of tuber area and degree impacted by Pectobacterium or Fusarium sambucinum inoculations done at Aberdeen.

2023 Western Regional Red/Specialty Tuber Composition									
		Aberdeen							
		Solids	Sugars ¹					Texas ⁴	
		Oven Dry	Dextrose	Sucrose	Protein ²	Vitamin C ³	Glycoalkaloids ³	mg Trolox	AOA
Entry	Clone/Variety	(%)	(%FWB)	(%FWB)	(%DWB)	(mg/100g FWB)	(mg/100g FWB)	equivalents/gfw ⁵	Levels ⁶
Yellow Flesh									
	Yukon Gold	20.9	0.08	0.23	5.26	40.4	3.4	95.2	L
	AC10376-1Y	18.7	0.08	0.35	4.26	36.6	2.5	162.0	M
Mean		20	0	0	5	38	3	129	

¹ Evaluations made at Aberdeen, ID by Chelsey Lowder; % Fresh Weight Basis (FWB)

² % Dry Weight Basis

³ % Fresh Weight Basis (mg/100g FWB)

⁴ The assay used at Texas A&M University was based on "Use of a Free Radical Method to Evaluate Antioxidant Activity" by Brand-Williams, et al. 1995, Lebensm. Wiss. Technol. 28:25-30. Antioxidants soluble in methanol were extracted and allowed to react with the stable radical, 2,2-Diphenyl-1-picrylhydrazyl (DPPH). This provided a rapid evaluation of the antioxidant properties of the potato extracts based on absorbance.

⁵ µg Trolox equivalents/gfw - Absorbance was converted to trolox equivalents based on a standard curve using the following equation: $y = -282(x) + 309.72$

⁶ VH=very high (>417), H=high (302-350), M=medium (127-266), L=low (67-116), VL=very low (<55). n=70 including 14 check varieties

2023 Western Regional Chipping Potato Variety Trial - DISEASE EVALUATIONS, METRIBUZIN REACTION																
												Soft Rot	Dry rot			
					Early Blight							<i>Pecto-</i>	<i>Fusarium</i>			
	Vert. Wilt/Early Dying				AB ¹		Common Scab		Corky Ringspot			<i>bacteriu</i>	<i>sambucin</i>		Metr.	
	AB ¹		HERM		Foliar		AB ¹		PROS ³			AB1	AB1	PVY %	Reaction	C. Root ⁶
Clone	(0-9)	AUDPC	(0-9)	AUDPC	(0-9)	AUDPC	Incidence (%)	Serious Defects (%)	Incidence (%)	Serious Defects (%)	reaction	(0-5) ²	(0-5) ²	HERM ⁴	AB ⁵	Nematode
Atlantic	7.7	633	7.5	541	7.3	463	25.6	22.6	67.2	52.7	S	3	4.2	100	MS	S
Lamoka	6	333	6.3	389	5	187	45.8	21.4	52.5	36.9	S	2.5	4	90	MR	S
Snowden	6.3	390	5.5	280	5	112	30.8	9.8	--	--	--	3.1	3.6	75	MR	S
AC13126-1Wadg	5	161	4	144	4.7	137	46.5	28.2	46.1	26.3	S	1.1	3.1	10	MR	S
CO12235-3W	6.7	340	6	344	7	603	33.1	22.3	--	--	--	1.1	4.1	85	MR	S
CO12293-1W	5.3	172	3	116	5.3	195	37	16.3	3.3	0.5	R	1.2	3.8	85	R	S
MEANS	6	334	4.8	251	5.9	305	40.3	24.2	43.3	28.7		2	3.6	66.5		
LSD @ .05	1.2				1.4		29					1.2	1.1			
Castle Russet									0	0	R					

¹Evaluations made at Aberdeen, Idaho by Jonathan Whitworth, Hermiston, Oregon by Sagar Sathuvalli; scale as indicated with highest number being most severe. For 0 to 9: 0=no symptoms; 1= trace; 2=1-5%; 3=5-10%; 4=10-20%; 5=25-40%; 6=40-60%; 7=60-70%; 8=75-90%; 9=90-100% dead or dying with typical disease symptoms.

Early Blight and Vert. Wilt AUDPC: Area Under the Disease Progress Curve based on foliar readings taken 3 separate days after planting.

Common Scab serious defects are the number of tubers with a 3 rating (0-5 scale) or higher, divided by the total number of tubers examined.

²For 0 to 5: 0=none, 5=severe as a combination of tuber area and degree impacted by Pectobacterium or Fusarium sambucinum inoculations done at Aberdeen

³Corky ringspot readings Prosser, WA by Rich Quick and Launa Cimrhakl

⁴PVY readings Hermiston, OR from tuber sprouts by Sagar Suthavalli

⁵Metribuzin Reaction measured at Aberdeen, ID by Chelsey Lowder. VR=very resistant, R=Resistant, MR=Moderately resistant, MS=moderately susceptible, S=susceptible VS=very susceptible

⁶Columbia root knot nematode ratings from Hermiston, OR provided by Sagar Suthavalli; S= over 50 dots; MS less than 20 and 40 dots; MR 5 and 20.

2023 Aberdeen Regional Chip Trial - SOLIDS, DEXTROSE, SUCROSE, PROTEIN, VITAMIN C, AND GLYCOALKALOIDS - ABERDEEN, IDAHO; ANTIOXIDANTS - TEXAS								
							Texas	
	Solids	Sugars					Antioxidant Equivalents ⁴	
	Oven Dry	Dextrose	Sucrose	Protein	Vitamin C	Glycoalkaloids ³	µg Trolox	
	(%)	(%FWB) ¹	(%FWB) ¹	(%DWB) ²	(mg/100g FWB)	(mg/100gFW B)	equivalents /gfw 5	AOA 6
Clone	(%)	(%FWB) ¹	(%FWB) ¹	(%DWB) ²	(mg/100g FWB)	(mg/100gFW B)	equivalents /gfw 5	AOA 6
Atlantic	22.09	0.021	0.106	5.44	22.19	4.68	135.3	M
Lamoka	22.26	0.008	0.095	5.41	23.08	5.85	130.1	M
Snowden	21.56	0.038	0.135	5.25	25.1	6.4	101.9	L
AC13126-1Wadg	20.16	0.012	0.102	6.93	17.39	3.45	158.6	M
CO12235-3W	21.48	0.006	0.085	6.8	21.58	3.23	239.9	M
CO12293-1W	20.69	0.026	0.143	5.84	21.79	1.89	155.5	M
Means	21.52	0.018	0.11	5.78	23.61	4.01	129.1	

¹ FWB = fresh weight basis

² DWB = dry weight basis

³ Lenape Check = 57.6

⁴ The assay used at Texas A&M University was based on "Use of a Free Radical Method to Evaluate Antioxidant Activity" by Brand-Williams, et al. 1995, Levensm. Wiss. Technol. 28:25-30. Antioxidants soluble in methanol were extracted and allowed to react with the stable radical, 2,2,-Diphenyl-1-picrylhydrazyl (DPPH). This provided a rapid evaluation of the antioxidant properties of the potato extracts based on absorbance.

⁵ µg Trolox equivalents/gfw - Absorbance was converted to trolox equivalents based on a standard curve using the following equation: $y = -272.42x + 292.13$

⁶ VH=very high (>417), H=high (416-302), M=medium (301-127), L=low (126-67), VL=very low (<66). n=70 including 14 check varieties.

2023 Tuber Maturity Trial

Historically potato maturity has been categorized as vine maturity which does not represent the physiological maturity of the tubers. Physiological maturity can affect skin set, storage, tuber size and quality. Determining tuber maturity informs producers of the best practices to manage, when to vine kill and when to harvest a variety for maximum quality traits. In 2023 all the year 6 and 7 clones were evaluated alongside relevant commercial checks. The vines were killed 3 weeks prior to harvest and then hand dug at 90, 100, 110, and 120 days after planting. The tubers were then counted, weighed, measured, evaluated for specific gravity and skinning. The following tables summarize the yield, tuber counts and specific gravity collected.

Russets												
	Yield (g)				Tuber number per hill				Specific Gravity			
Clone	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days
CO15070-4RU	1346	2026	1308	1864	12	17	11	14	1.073	1.076	1.076	1.077
CO16238-4RU	950	1455	2236	1500	10	12	18	11	1.059 ^c	1.074 ^b	1.080 ^{ab}	1.082 ^a
CO15016-1RUsto	1586	1893	1566	1706	12	14	11	10	1.071	1.073	1.076	1.075
Canela Russet	1473 ^{b*}	2187 ^b	1493 ^{ab}	2831 ^a	12	14	12	13	1.076 ^b	1.083 ^b	1.093 ^a	1.095 ^a
Russet Norkotah 278	2442	2019	1997	2658	22	17	15	15	1.070	1.074	1.073	1.073

Reds												
	Yield (g)				Tuber number per hill				Specific Gravity			
	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days
CO15084-4R	1330	1713	2241	2494	29	25	30	26	1.067 ^c	1.073 ^b	1.080 ^a	1.083 ^a
CO15113-1R	906 ^b	1728 ^{ab}	2270 ^a	1997 ^{ab}	13	13	20	17	1.071 ^c	1.073 ^{bc}	1.083 ^{ab}	1.086 ^a
TC17742-1PW/PW ¹	1390	1302	1644	1907	27	18	20	24	1.063 ^b	1.068 ^b	1.078 ^a	1.082 ^a
Sangre-S10	1347	1769	1945	2023	15	16	13	17	1.058 ^b	1.062 ^b	1.070 ^a	1.073 ^a

¹TC17742-1PW/PW is a specialty with purple and white skin and flesh

Chippers												
	Yield (g)				Tuber number per hill				Specific Gravity			
	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days
AC13125-5W	1346	1766	1878	2274	17	17	15	15	1.069 ^b	1.075 ^{ab}	1.079 ^a	1.081 ^a
AC13126-1Wadg	1722	2424	2404	2630	16	17	16	15	1.077 ^c	1.082 ^{bc}	1.089 ^{ab}	1.091 ^a
AC15304-4W	2008	1660	1557	2699	14	23	14	20	1.076 ^c	1.082 ^b	1.092 ^a	1.092 ^a

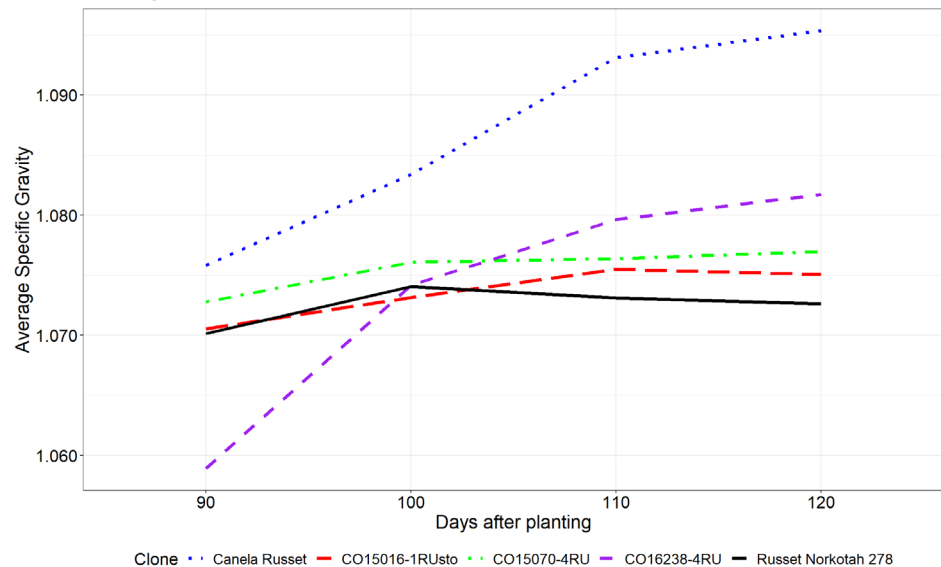
Yellows												
	Yield (g)				Tuber number per hill				Specific Gravity			
	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days	90 days	100 days	110 days	120 days
CO16154-2Y	1795	2465	2102	1215	23	23	17	12	1.079	1.082	1.090	1.087
CO16212-1Y	797	1079	1300	1209	36	30	34	31	1.063 ^b	1.073 ^{ab}	1.079 ^a	1.082 ^a
CO16279-5Y	1574	2118	1976	1567	27	21	21	16	1.080 ^b	1.085 ^{ab}	1.094 ^a	1.092 ^{ab}
Yukon Gold	1795	1946	1899	2532	12	11	14	13	1.078	1.081	1.082	1.083

*Numbers with the same letter are not significantly different from each other p=0.05

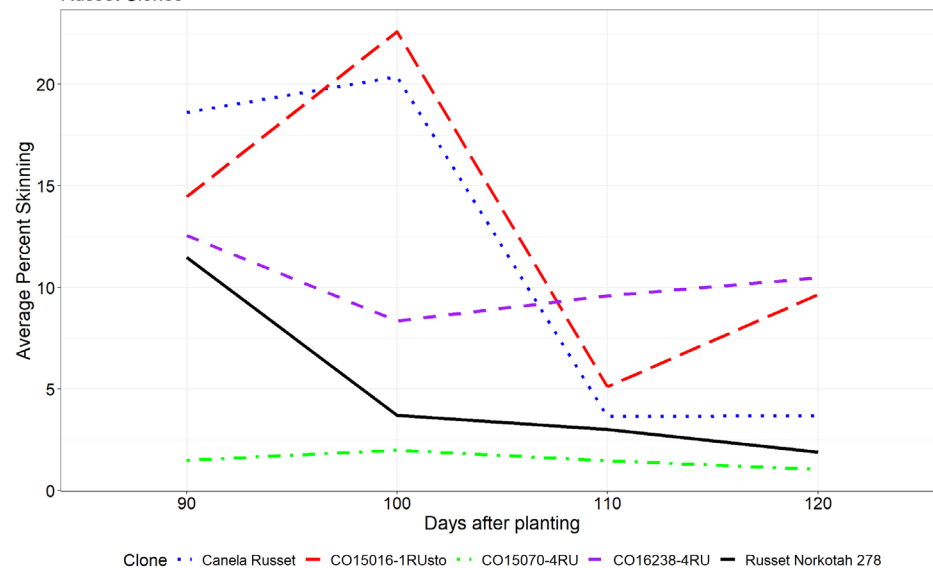
To measure skinning a drum lined with digger chain spun using an electric motor to simulate running over harvesting and sorting equipment. The tubers were placed in the spinning drum for two minutes and then photographed. The photos were analyzed with ImageJ software program to determine the percentage of skinned area. Specific gravity proved to be a good metric for determining tuber maturity. There were obvious points where the specific gravity leveled off. Weight and tuber count did not show a clear assessment of tuber maturity. This could be due to human error during harvest, that we hope to remedy with a better plot design. Some clones exhibited a clear decrease in percentage of skinning, but it was not consistent across market classes. We will continue this trial and try to develop an improved method for skinning.

The following graphs show the specific gravity data side by side with the percentage of skinning data over the different harvest intervals.

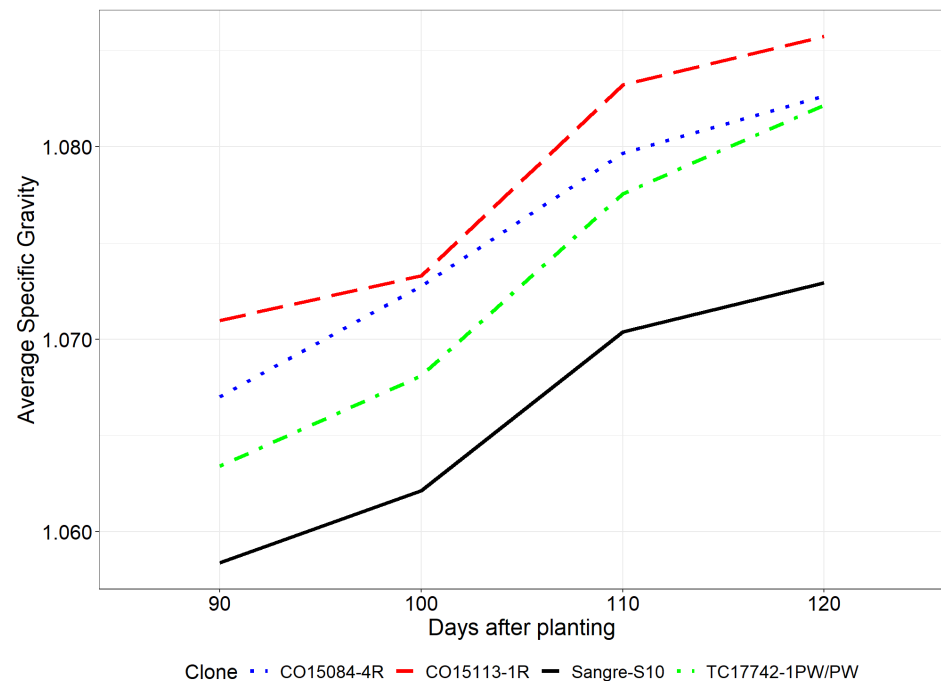
Changes in Specific Gravity at Different Harvest Intervals
Russet Clones



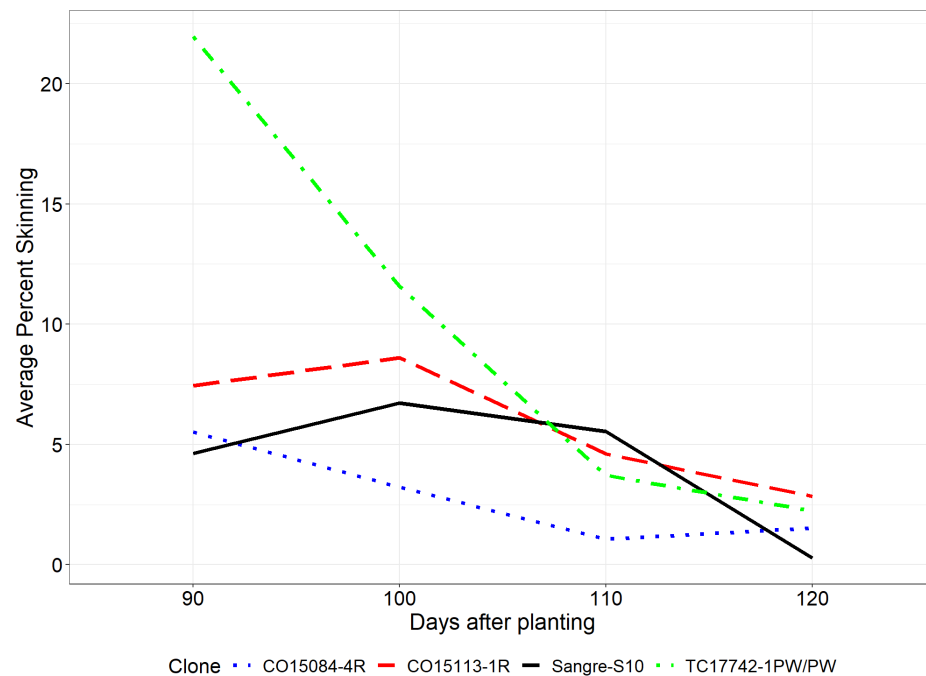
Changes in Percent Tuber Skinning at Different Harvest Intervals
Russet Clones



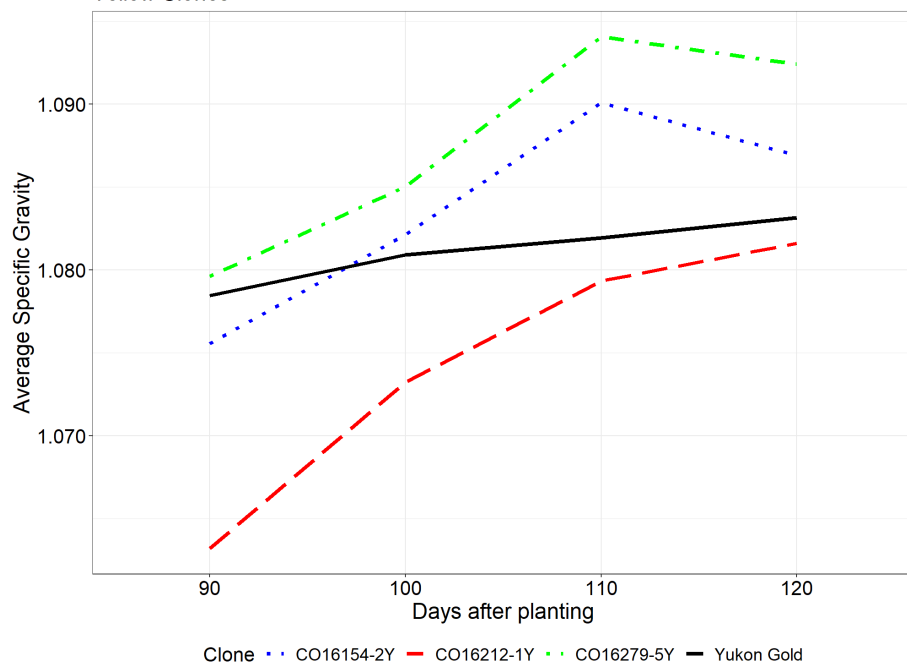
Changes in Specific Gravity at Different Harvest Intervals
Red Clones



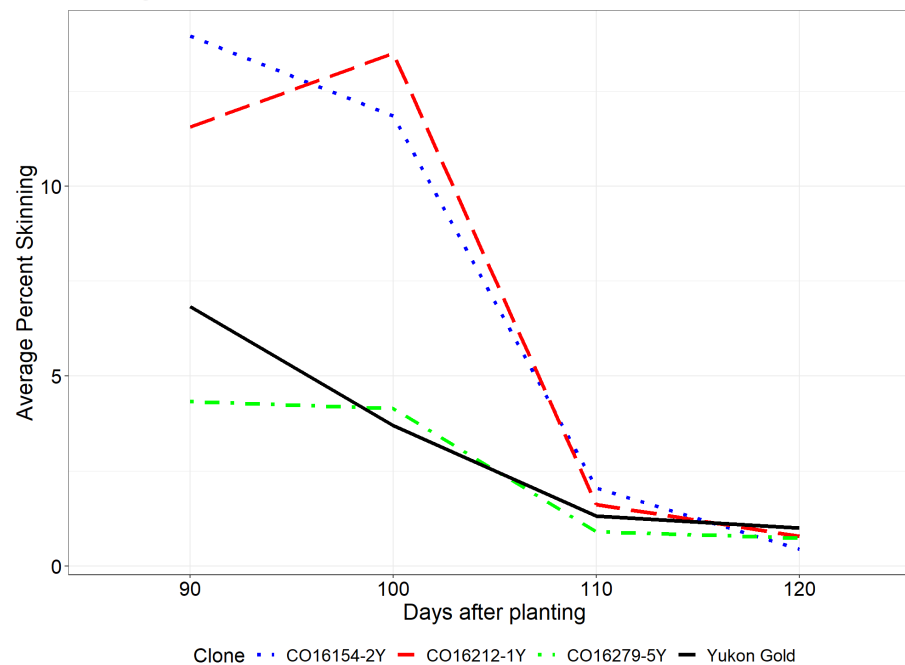
Changes in Percent Tuber Skinning at Different Harvest Intervals
Red Clones



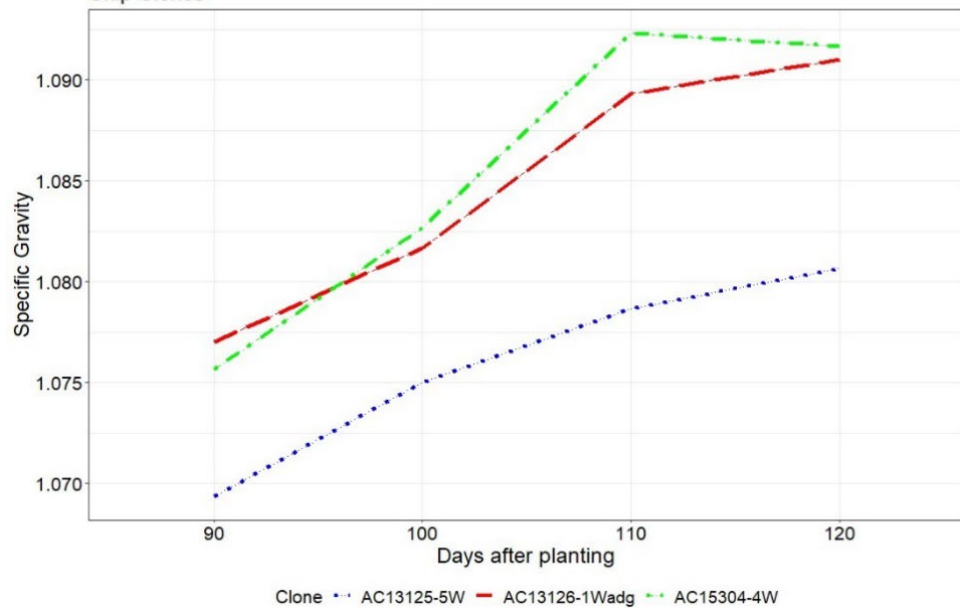
Changes in Specific Gravity at Different Harvest Intervals
Yellow Clones



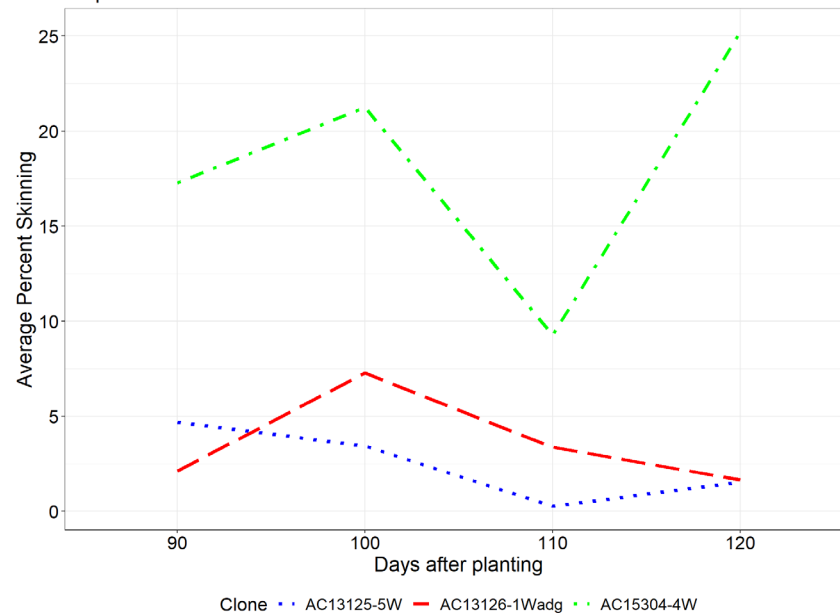
Changes in Percent Tuber Skinning at Different Harvest Intervals
Yellow Clones



Changes in Specific Gravity at Different Harvest Intervals
Chip Clones



Changes in Percent Tuber Skinning at Different Harvest Intervals
Chip Clones



Tuber Maturity Estimate based on Specific Gravity and % Skinning					
Clone	TMAT SG (DAP)	TMAT Skin (DAP)	Clone	TMAT SG (DAP)	TMAT Skin (DAP)
CO15070-4RU	100	90	AC13125-5W	120	110
CO16238-4RU	120	100	AC13126-1Wadg	120	120
CO15016-1RUsto	110	110	AC15304-4W	110	110
Canela Russet	120	110	CO16154-2Y	110	110
Russet Norkotah 278	100	100	CO16212-1Y	120	110
CO15084-4R	120	110	CO16279-5Y	110	110
CO15113-1R	120	120	Yukon Gold	100	110
Sangre-S10	120	120	TC17742-1PW/PW ¹	120	110

CPAC Grower Variety Trial

In 2022 we launched a Grower Variety Trial with the assistance of CPAC and several local growers. It is an incentive-based program to promote the evaluation of advanced Colorado potato selections and provide CSU with valuable feedback. CO10087-4RUsto was dropped from the program in 2022 due to low yields. In 2023 five different commercial growers participated and three clones were trialed. A third party, Agro Engineering, dug 10-foot test plots from each field and shared the results compiled in the tables below. All the test plots were dug after vine kill but prior to harvest. In the fields with the CSU varieties, another russet check variety was grown and evaluated for a comparison.

2023 CPAC Grower Variety Trial Results:

Russet Varieties	Total Yield (CWT/A)	Marketable Yield* (CWT/A)	Yield >8oz (CWT/A)	Tubers/ Plant	Seed Spacing (inches)	Days to vine kill
Location 1						
CO11009-1RU	391	303	78	11.1	14	121
Reveille Russet	431	427	365	5.4	14	121
Location 2						
CO11009-1RU	254	190	60	7.3	16-18	94
Russet Norkotah Sel 8	393	370	241	6.1	16-18	94
Location 1						
CO13003-1RU	392	284	40	10.5	34	115
Russet Norkotah 296	464	430	332	6.7	34	115
Location 2						
CO13003-1RU	471	294	56	12.4	12	112
Russet Norkotah 278	546	491	230	9.5	12	112

Yellow Variety	Total Yield (CWT/A)	Yield 4-10 oz (CWT/A)	Avg. Tuber Diameter (inches)	Tubers/ Plant	Seed Spacing (inches)	Days to vine kill
Location 1						
AC10376-1Y	429	183	2.2	13.2	12-13	110
Tacoma	524	432	2.5	10.0	12-13	110
Location 2						
AC10376-1Y	320	64	2.0	15.4	10	99
Columba	350	268	2.4	8.2	10	99

*Marketable yield is all yield over 4 oz.

We will continue this trial and add one more russet variety in 2024: CO12378-1RU. This program will eventually include local seed growers and seed storage evaluations to give the full picture of how these clones perform in a commercial setting. This information will help the Colorado Potato Breeding Program release commercially relevant varieties for our stakeholders.

Cultural Information of 2023 Yield Trials at the San Luis Valley Research Center:

Planting date: 5/16/23

Total Fertilizer applied: 180N-80P-60K

Vine Kill date: 9/6/23

Total Irrigation applied: 17.75"

Harvest date: 10/3/23

Seed spacing: 34" x 12"

Herbicides	Insecticides	Fungicides
Metribuzin 75	Sefina Inscalis	Amistar Top
Tuscany	Movento HL	Revus Top
Boundary 6.5 EC		
Dual II Magnum		

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Areas II and III

Potatoes USA

Stones Farm Supply



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