

RESEARCH PROGRESS REPORT FOR 1983

Submitted by

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Research conducted in 1983 included the following:

- (a) Potato breeding;
- (b) seedling selection and clonal development;
- (c) Cytex evaluation;
- (d) Cytozyme evaluation;
- (e) a study to determine what effect water stress at the time of tuberization has on tuber set, yield, and grade of potatoes; and,
- (f) binding studies to develop a rating index for susceptibility of potato clones to blackleg.

POTATO BREEDING

Characteristics being emphasized in the Colorado program are yield, specific gravity, russeting, and fresh market/processing qualities. Twenty-three parental clones were selected for crossing in 1983. Seeds from 142 combinations were obtained. Seventy seedling families were grown in the greenhouse producing 10,928 tubers for initial selection in 1984. Surplus tubers were distributed to Idaho, Oregon and Minnesota.

Seedling tubers were obtained from Dr. R. E. Webb, Beltsville, Maryland, Dr. J. J. Pavsek, Aberdeen, Idaho, and Dr. R. E. Voss, Davis, California. The California seedlings were produced from true seed obtained from Colorado.

SEEDLING SELECTION AND CLONAL DEVELOPMENT

A total of 29,500 first-year seedlings were planted with 597 being selected for further observation. Another 441 clones were in various stages of preliminary testing. Eighty-four of these clones were selected for continued evaluation.

Advanced Yield Trial. Seventeen russeted entries, twelve advanced selections and five cultivars, were planted in the advanced yield trial. Data collected on yield, grade, specific gravity, stand, vine maturity, and tuber shape are presented in Table 1. Information collected on grade defects is presented in Table 2.

Selections showing promise and meriting further testing are: AC77149-2, AC77513-1, AC77514-1, AC77652-1, TC2-1, and WNC567-1. TC2-1 performed exceptionally well. It has a high yield potential, average percent No. 1 potatoes, high specific gravity, and a low amount of grade defects. Selections TC2-1 and AC77652-1 will be entered in the 1984 Western Regional Trials.

Chipping Study. Eleven selections in various stages of development and two standard cultivars were tested for chipping potential at harvest and after various storage regimes. Specific gravity was determined at harvest. Chip color was rated using the Potato Chip/Snack Food Association 1-5 scale. This data is summarized in Table 3.

None of the clones chipped satisfactorily directly out of 40°F storage or with reconditioning at 70°F for two weeks. Atlantic, Norchip, and BR7093-24 produced acceptable chips for all other storage regimes, however. Other clones showing chipping potential include: TXA17-1, A70369-2, BC9955-1, and BC9956-2. Clones WNC521-12 and WNC672-2 did not perform well in this test. However, large scale commercial tests indicate processing potential for these clones at harvest and after short storage periods.

Western Regional Trial. Colorado participated in the Western Regional Coordinating Committee (WRCC-27) for the sixth year in 1983. The purpose of the Committee is to promote regional cooperation in the uniform testing of potato selections and development of new cultivars.

Ten advanced selections and four standard cultivars were included in the test. Table 4 summarizes data on yield, grade, specific gravity, stand, vine maturity, tuber shape, and skin type. This table also includes the merit rating of the best selections in the trial. The merit rating is a subjective composite index indicating overall potential as a new cultivar. Table 5 summarizes information collected on grade defects for each clone.

A74212-1 was rated as the overall best entry. This russet selection was also rated best in 1982. In both years, this clone had a high yield potential, high percentage of No. 1 potatoes, and a very low amount of grade defects. Other selections showing promise were: A72685-2, NDD47-1, A74133-1, and ND534-4.

Potential Release. WNC285-18, a sibling of Centennial Russet, continues to show potential for naming and release although it did not receive a merit rating in the 1983 Colorado Western Regional Trial. This clone continues to perform quite well on lighter soils in California and the San Luis Valley. Alligator hide is a potential problem on heavier soils.

#### CYTEX

Cytex is a commercially available product promoted as a plant growth regulator for increasing potato yields. Cytex was evaluated for potential use in the San Luis Valley.

Cytex was foliarly applied to Russet Burbank potatoes at the rate of one gallon per acre. Total spray volume was 40 gallons per acre. Cytex was applied at tuber initiation and five weeks before vine kill. Data was collected on the yield, yield of U. S. No. 1 potatoes, and specific gravity.

Table 6 summarizes the results. Cytex application did not affect yield, grade, or specific gravity of the crop.

TABLE 1. Yield, grade, specific gravity, stand, maturity, and tuber shape for advanced yield trial clones.

Clone	Total Yield		Yield U.S.No.1		Yield U.S.No.2		Specific Gravity	Stand %	Vine Maturity <sup>1/</sup>	Tuber Shape <sup>2/</sup>
	Cwt/A	U.S.No.1 Cwt/A	U.S.No.1 >10 oz Cwt/A	U.S.No.1 <4 oz Cwt/A	U.S.No.2 & Culls Cwt/A					
AC71861-4	400	262	65.5	31	65	72	1.082	98	3.5	Ob
AC71997-1	345	219	62.9	26	104	22	1.090	100	4.3	Ob
AC7426-3	283	178	63.2	9	97	8	1.087	100	1.5	Ob
AC77149-2	359	298	82.9	60	48	14	1.078	100	2.5	Ob
AC77513-1	404	323	80.0	59	52	29	1.097	97	3.8	L-Ob
AC77514-1	385	331	85.8	74	41	13	1.092	100	3.0	L-Ob
AC77652-1	316	254	80.1	52	45	18	1.080	97	2.3	Ob
BC9668-1	527	264	80.6	38	47	17	1.078	99	2.5	Ob
TC2-1	403	314	77.9	54	78	11	1.104	99	3.8	Ob
WNC567-1	367	282	76.5	32	64	21	1.085	99	2.3	L-Ob
WNC630-2	343	277	80.6	30	53	12	1.094	100	3.8	Ob
WNC708-6	319	264	82.4	41	32	24	1.089	100	2.5	Ob
Centennial Russet	358	289	80.8	72	58	11	1.089	98	3.0	Ob
Nooksack	311	261	83.9	82	18	31	1.104	100	4.8	Ob
Russette	396	307	77.5	29	72	16	1.097	99	3.0	Ob
Russet Burbank	366	221	60.6	23	104	41	1.089	99	2.5	L
Targhee	334	233	69.4	38	76	25	1.093	99	5.0	Ob-L
Mean	354	269	75.9	44	62	22	1.090	99	3.2	
LSD (0.05)	36	46	7.1	26	17	17	-	NS	0.7	

<sup>1/</sup> Vine maturity is based on amount of dead foliage on August 31: 1 = Very Early; 2 = Early; 3 = Medium; 4 = Late; 5 = Very Late.

<sup>2/</sup> Tuber Shape: Ob = Oblong; L = Long

TABLE 2. Grade defects for the advanced yield trial clones.

Clone	External Defects <sup>1/</sup> %	Type External Defects Observed <sup>2/</sup>	Hollow Heart <sup>3/</sup> %	Internal Discoloration <sup>3/</sup> %
AC71861-4	18.0	GC*, MS, AH	-	1.6
AC71997-1	6.5	GC, SG, MS*	6.7	-
AC7426-3	2.7	MS*	-	0.4
AC77149-2	3.9	GC*, SG, MS*	6.8	-
AC77513-1	7.1	GC, MS*	7.2	-
AC77514-1	3.3	GC, MS*	10.7	-
AC77652-1	5.7	GC*, SG, MS	2.6	-
BC9668-1	5.1	GC*, SG, MS	2.2	-
TC2-1	2.7	SG, MS*	0.8	0.3
WNC567-1	5.7	GC*, MS*, AH	-	-
WNC630-2	3.5	GC, MS*, AH, SB	2.2	-
WNC708-6	7.6	CG*, MS, AH	0.7	-
Centennial Russet	3.0	CG*, MS*	2.0	-
Nooksack	10.0	GC*, MS	0.5	-
Russette	4.1	GC*, MS	2.2	-
Russet Burbank	11.1	GC, SG*, MS	0.4	-
Targhee	7.5	GC*, SG, MS, AH	0.3	-

<sup>1/</sup> Percent external defects based on proportion of total sample weight with significant defects.

<sup>2/</sup> GC = Growth Crack; SG = Second Growth; SB = Shatter Bruise; MS = Misshapen; AH = Alligator Hide. Most prevalent defects for each clone are asterisked.

<sup>3/</sup> Percent hollow heart and internal discoloration calculated as follows: (Weight of tubers >10 ounces with defect/total sample weight) x 100.

TABLE 3. Chip color<sup>1/</sup> and specific gravity of chipping study entries.

Clone	At Harvest	Color					Specific Gravity
		3 wks @ 70°F	10 wks @ 40°F	10 wks @ 50°F	2 wks/70°F		
					10 wks/40°F	10 wks/50°F	
A70369-2	1.0	1.5	4.5	3.0	3.5	2.0	1.097
BC9953-1	3.5	4.0	5.0	5.0	5.0	4.0	1.086
BC9955-1	2.5	1.5	5.0	3.0	4.5	1.5	1.100
BC9956-2	2.0	1.5	5.0	3.5	4.0	2.5	1.094
BC9988-4	3.0	4.0	5.0	4.5	5.0	3.0	1.094
BR7093-24	1.0	1.5	4.5	2.0	4.0	1.5	1.089
CO7917-10	4.0	4.0	5.0	4.5	5.0	4.0	1.091
TXA17-1	1.5	1.5	4.5	2.5	3.5	1.5	1.081
TXC802-1	2.0	2.5	5.0	3.5	5.0	3.5	1.076
WNC521-12	3.5	2.5	5.0	4.0	4.5	3.0	1.090
WNC672-2	1.5	2.0	5.0	3.0	4.0	3.0	1.083
Atlantic	1.5	1.5	5.0	1.5	3.5	1.0	1.099
Norchip	1.5	1.0	5.0	1.5	3.5	2.0	1.084

<sup>1/</sup> Chip color of 2 or less acceptable.

Table 4. Yield, grade, specific gravity, stand, maturity, tuber shape and skin type, and merit rating for 1983 Western Regional Trial entries grown at the San Luis Valley Research Center, Center, Colorado.

Clone	Total Yield		Yield U.S.No.1		Yield U.S.No.2		Specific Gravity	Stand %	Vine <sup>1/</sup> Maturity		Tuber Shape <sup>2/</sup> Skin Type		Merit <sup>3/</sup> Rating
	Cwt/A	U.S.No.1 Cwt/A	U.S.No.1 >10 oz Cwt/A	U.S.No.1 <4 oz Cwt/A	U.S.No.2 & Culls Cwt/A	%			%	Ob,R	Ob,R		
A69870-10	377	304	80.4	57	54	19	1.084	84	5.0		Ob,R	-	
A72685-2	417	367	88.0	119	47	3	1.098	90	3.3		Ob,R	2	
A74133-1	396	342	86.6	113	46	8	1.086	96	3.3		Ob-L,R	4	
A74212-1	458	380	83.0	67	74	3	1.089	98	3.3		Ob-L,R	1	
A75188-3	455	355	77.8	79	53	48	1.093	100	4.3		Ob,R	-	
BC9289-1	324	248	76.5	57	63	14	1.086	92	3.3		Ob,R	-	
ND534-4	327	301	92.2	86	22	4	1.082	100	1.8		L,R	5	
NDD47-1	409	369	90.2	152	30	10	1.093	98	3.8		L-Ob,W	3	
NDD277-2	335	291	86.8	70	30	14	1.096	99	3.0		R,W	-	
WNC285-18	343	263	76.4	49	53	27	1.088	100	4.0		Ob,R	-	
Centennial Russet	354	299	84.2	67	51	5	1.090	97	3.3		Ob,R	-	
Norchip	376	232	61.5	24	116	28	1.085	100	2.0		R,W	-	
Lemhi Russet	377	269	71.4	50	95	14	1.094	98	2.8		Ob-L,R	-	
Russet Burbank	398	277	69.3	47	75	46	1.089	99	3.3		L,R	-	
Mean	382	307	80.3	74	58	17	1.090	96	3.3		-	-	
LSD (0.05)	37	40	5.7	34	21	12	-	5	0.6		-	-	

<sup>1/</sup> Vine maturity is based on amount of dead foliage on August 31: 1 = Very Early; 2 = Early; 3 = Medium; 4 = Late; 5 = Very Late.

<sup>2/</sup> Tuber Shape: R = Round; OV = Oval; Ob = Oblong; L = Long; Skin Type: R = Russet; W = White

<sup>3/</sup> Merit Rating: 1 = Best

TABLE 5. Summary of grade defects for the 1983 Western Regional Trial Entries grown at the San Luis Valley Research Center, Center, Colorado.

Clone	External Defects <sup>1/</sup>	Type External Defect(s) Observed <sup>2/</sup>	Hollow Heart <sup>3/</sup>	Internal Discoloration <sup>3/</sup>
	%		%	%
A69870-10	5.2	GC*, MS	5.8	0.8
A72685-2	0.8	MS*, SB	2.6	0.8
A74133-1	2.1	GC, MS*, SB	0.3	-
A74212-1	0.7	MS*	-	-
A75188-3	10.5	GC*, MS, SB	-	17.3
BC9289-1	4.2	GC*, MS, AH	2.5	0.5
ND534-4	1.2	MS*	2.0	-
NDD47-1	2.5	MS, GR*	1.2	3.9
NDD277-2	4.3	GC, SG, MS*	-	1.6
WNC285-18	7.9	MS, AH*	-	-
Centennial Russet	1.3	CG*, MS*, AH	3.3	-
Norchip	7.5	GC*, SG, MS*, GR	0.6	-
Lemhi Russet	3.7	GC, MS*	2.9	-
Russet Burbank	11.6	GC, SG*, MS	0.8	3.3

<sup>1/</sup> Percent external defects based on proportion of the total sample weight with significant defects.

<sup>2/</sup> GC = Growth Crack; SG = Second Growth; SB = Shatter Bruise; MS = Misshapen; AH = Alligator Hide; GR = Green. Most prevalent defects for each clone are asterisked.

<sup>3/</sup> Percent hollow heart and internal discoloration calculated as follows: (Weight of tubers >10 ounces with defect/total sample weight) x 100.

TABLE 6. Tuber yield, percent U.S. No. 1 potatoes, and specific gravity of Russet Burbank potatoes receiving two Cytex treatments.

Treatment	Yield			Specific Gravity
	Total	U.S.No.1	U.S.No.1	
	Cwt/A		%	
Control	349	173	49.6	1.088
Cytex - 7/4 <sup>1/</sup>	333	166	50.0	1.086
Cytex - 8/3 <sup>2/</sup>	328	174	53.1	1.086
Mean	337	171	50.9	1.087
LSD (0.05)	NS	NS	NS	NS

<sup>1/</sup> Applied at tuber initiation.

<sup>2/</sup> Applied five weeks before vine kill.

#### CYTOZYME

Cytozyme Dry Seed+, another commercially available product, has been reported to increase potato yield.

Dry Seed+ was applied at the rates of one or two pounds of product per 1800 pounds of Russet Burbank seed. Data was collected on total yield, yield of U.S. No. 1 potatoes, and specific gravity. Table 7 presents the results of this study.

TABLE 7. Tuber yield, percent U.S. No. 1 potatoes, and specific gravity of Russet Burbank potatoes receiving Cytozyme Dry Seed+ treatments.

Treatment	Yield			Specific Gravity
	Total	U.S.No.1	U.S.No.1	
	Cwt/A		%	
Control	344	201	58.3	1.090
1 pound <sup>1/</sup>	347	200	57.8	1.091
2 pound <sup>1/</sup>	330	174	53.0	1.088
Mean	340	192	56.4	1.089
LSD (0.05)	NS	NS	NS	NS

<sup>1/</sup> One or two pounds of Cytozyme Dry Seed+ applied per 1800 pounds of seed potatoes before planting.

Cytozyme Dry Seed+ application did not affect yield, grade, or specific gravity of the crop.



## WATER STRESS X TUBERIZATION

This is a second-year study designed to evaluate the effect of water stress at tuber initiation on tuber set, yield, and grade of Russet Burbank and Centennial Russet.

In 1982, total yield and U.S. No. 1 yield were reduced by water stress during tuber initiation. Also, Centennial Russet tended to be less sensitive to stress. Again in 1983, Centennial was less sensitive to stress (Table 8). Percent and yield of U.S. No. 1 potatoes for both cultivars was not significantly affected by stress in 1983. Also, average tuber weight for both cultivars was not significantly affected by stress. Under stress conditions, tuber number per plant decreased for Russet Burbank and increased for Centennial Russet.

Results for both years indicate that there is no benefit from stressing potatoes at tuber initiation.

### BINDING STUDIES

This work is being conducted jointly with Rob Davidson.

Studies conducted indicate that there are differences in the binding ability between Erwinia carotovora var. carotovora and Erwinia carotovora var. atroseptica and among Erwinia carotovora strains to potato tuber tissue.

Techniques are presently being developed to see if a testing scheme can be developed to determine the susceptibility of potato clones to blackleg. Results are preliminary at this time and hence will be reported on in the future.

TABLE 8. Influence of water stress at the time of tuber initiation on yield, grade and tuber characteristics.

Cultivar	Water Regime	
	Nonstressed	Stressed
	Yield (Cwt/A)	
Centennial Russet	267	291
Russet Burbank	345	317
	Yield U.S.No.1 (%)	
Centennial Russet	204 (76.0)	216 (74.1)
Russet Burbank	205 (59.2)	202 (63.7)
	Average Tuber Wt. (oz)	
Centennial Russet	4.7	4.7
Russet Burbank	4.3	4.9
	Tuber Number/Plant	
Centennial Russet	5.9	6.5
Russet Burbank	8.3	6.9