RESEARCH PROGRESS REPORT FOR 1997

CULTURAL AND PHYSIOLOGICAL STUDIES

Submitted to the

San Luis Valley Research Center Committee

and the

Colorado Potato Administrative Committee (Area II)

Susie Thompson-Johns

San Luis Valley Research Center

RESEARCH PROGRESS REPORT FOR 1997

Cultural and Physiological Studies

Submitted by

Susie Thompson-Johns

San Luis Valley Research Center

Research was conducted in the following areas in 1997:

a.) Growth Analysis of Cultivars and Advanced Selections
b.) Nitrogen Fertility
c.) Phosphorus Fertility
d.) Precutting
e.) Seed Piece Spacing
f.) Contribution of the Mother Tuber

Other research was directed at improved Alpha production, early blight management, hail recovery, metribuzin tolerance, nitrogen use efficiency, phosphorus forms and application, precision farming, and soil test recommendation comparisons. Results from these projects have been reported elsewhere.

Except for the precutting study, all plots were located at the San Luis Valley Research Center, on a sandy loam soil (8.0 pH , 2.4 % O. M., 41 ppm residual nitrate, 29.3 ppm phosphorus and 433 ppm potassium). The plots were irrigated with a solid set sprinkler.

GROWTH ANALYSIS OF CULTIVARS AND ADVANCED SELECTIONS

Five advanced selections and one cultivar were grown in a replicated experiment to determine how the plant canopy, roots and tubers develop. The 1997 trial was grown at the SLVRC and was planted on May 13 using an assist feed cup planter. Plots were 100 feet long; entries were replicated 3 times. Within-row spacing was 12 inches on 34-inch centers. Liquid fertilizer (40-60-30) was banded at planting. Cultural practices utilized during the production season were typical of the growing area.

Weekly destructive harvests of 5 plants per plot, began on June 11, just at emergence. Plots were evaluated for plant count, height, stem number, vine, root and tuber fresh weight, and tuber number. Evaluation was complete on August 27; A harvest of tubers was conducted on September 10. Results are presented in the following figures.

Figure 1. Plant height (inches) profiles for 5 advanced selections and Yukon Gold, 1997.

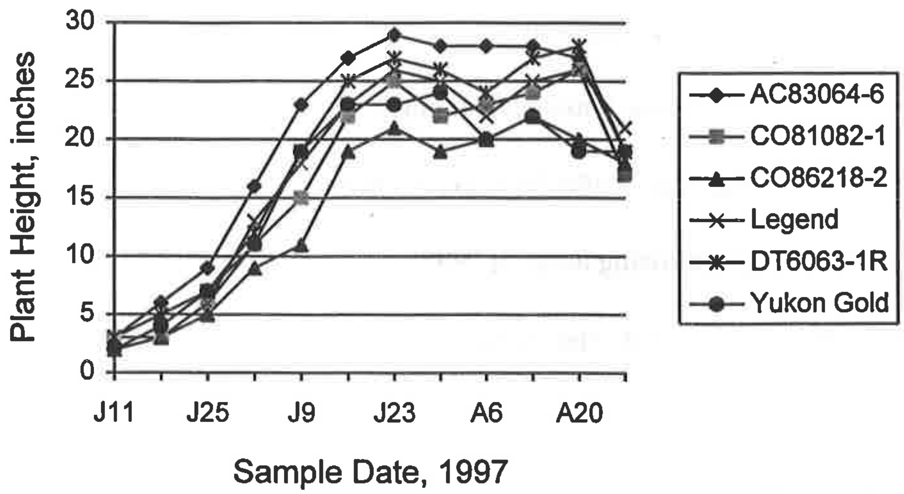


Figure 2. AC83064-6 vine, root, and tuber development, 1997.

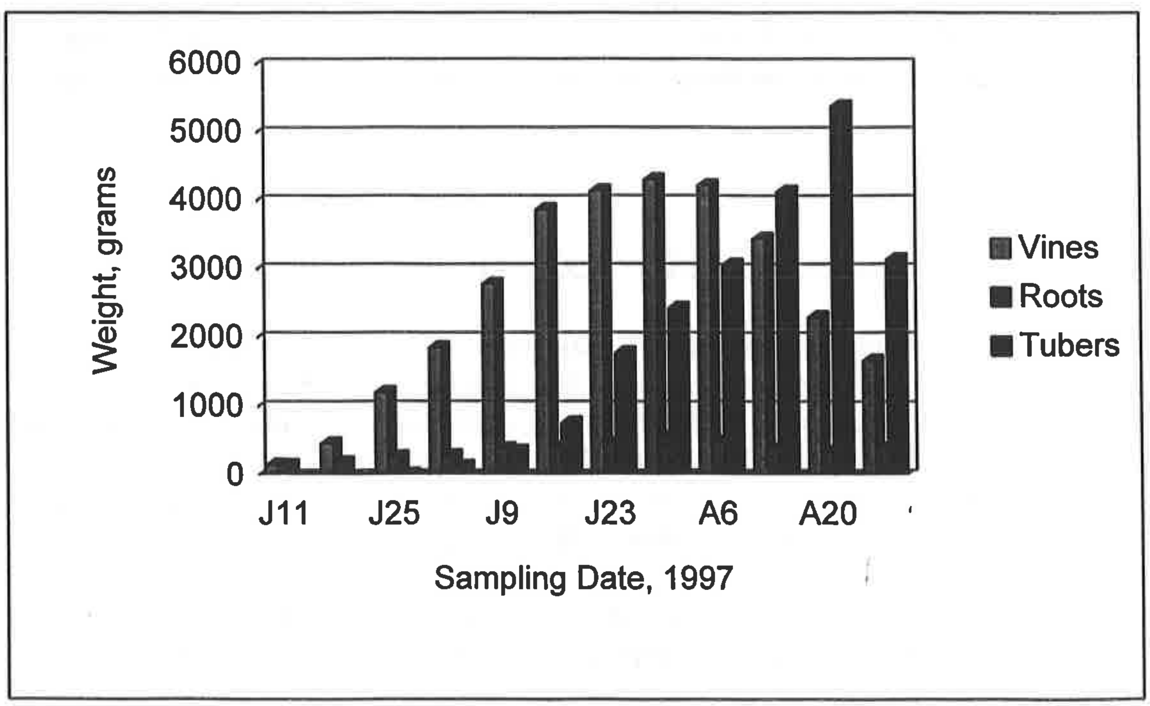


Figure 3. CO81082-1 vine, root, and tuber development, 1997.

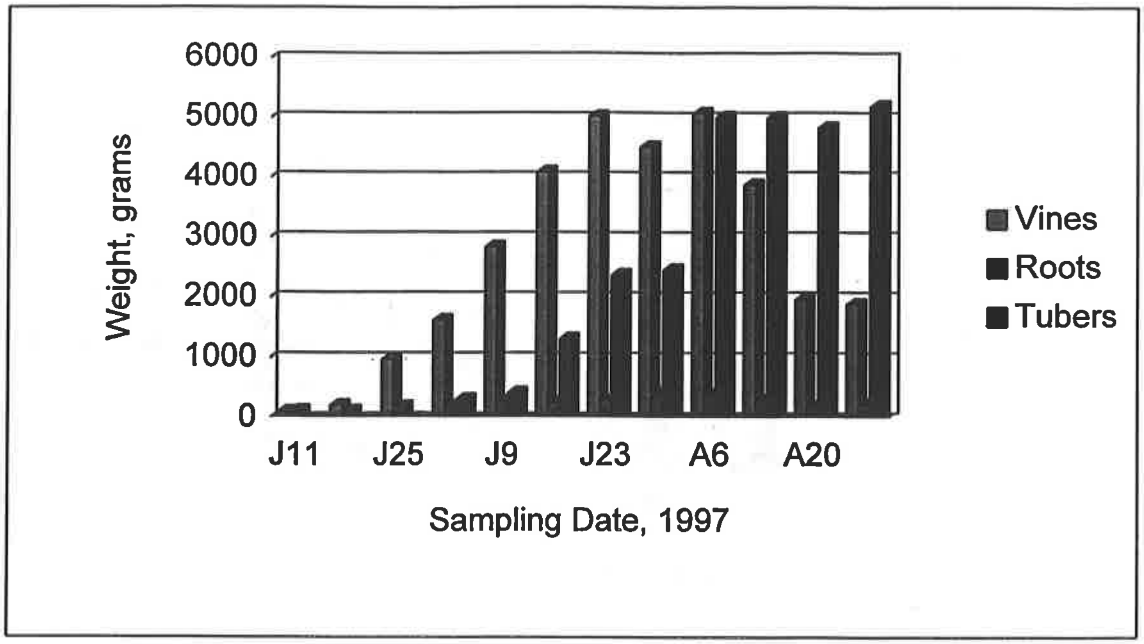


Figure 4. CO86218-2 vine, root, and tuber development, 1997.

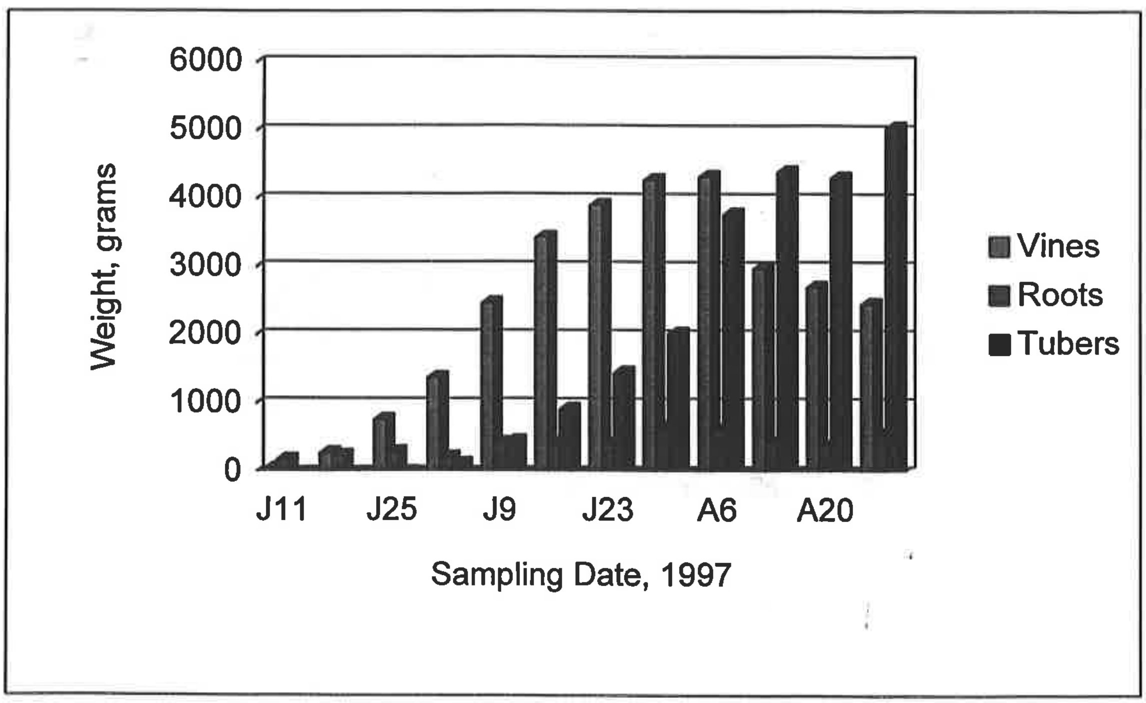


Figure 5. Russet Legend (COO83008-1) vine, root, and tuber development, 1997.

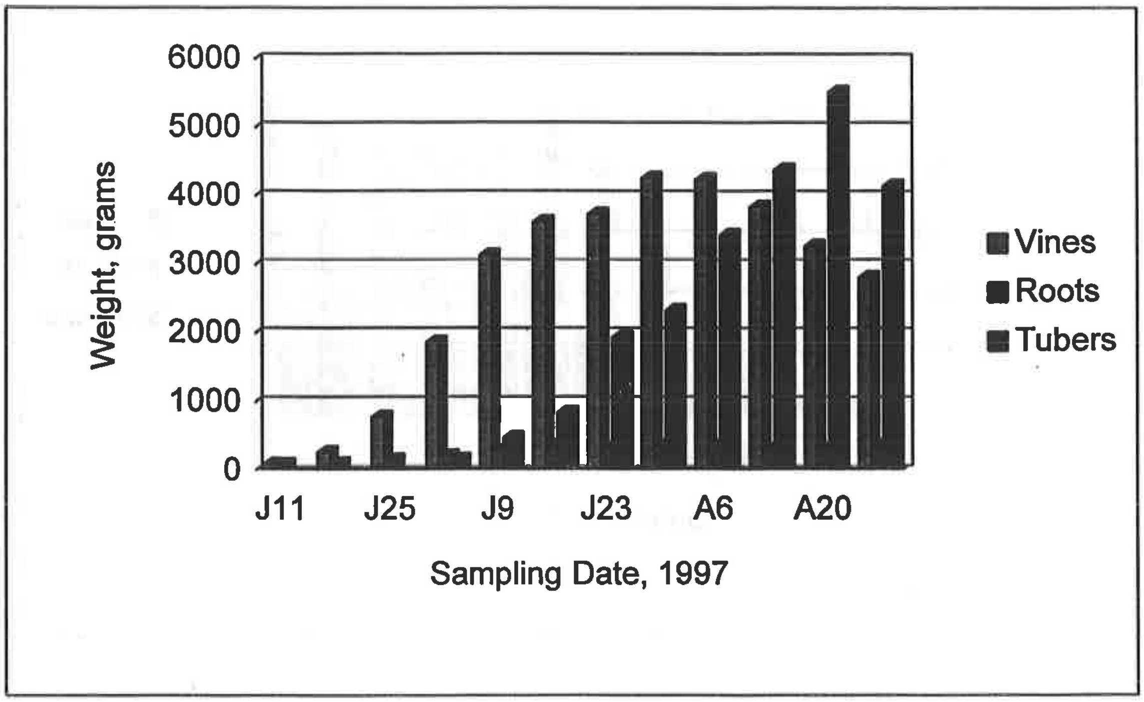


Figure 6. DT6063-1R vine, root, and tuber development, 1997.

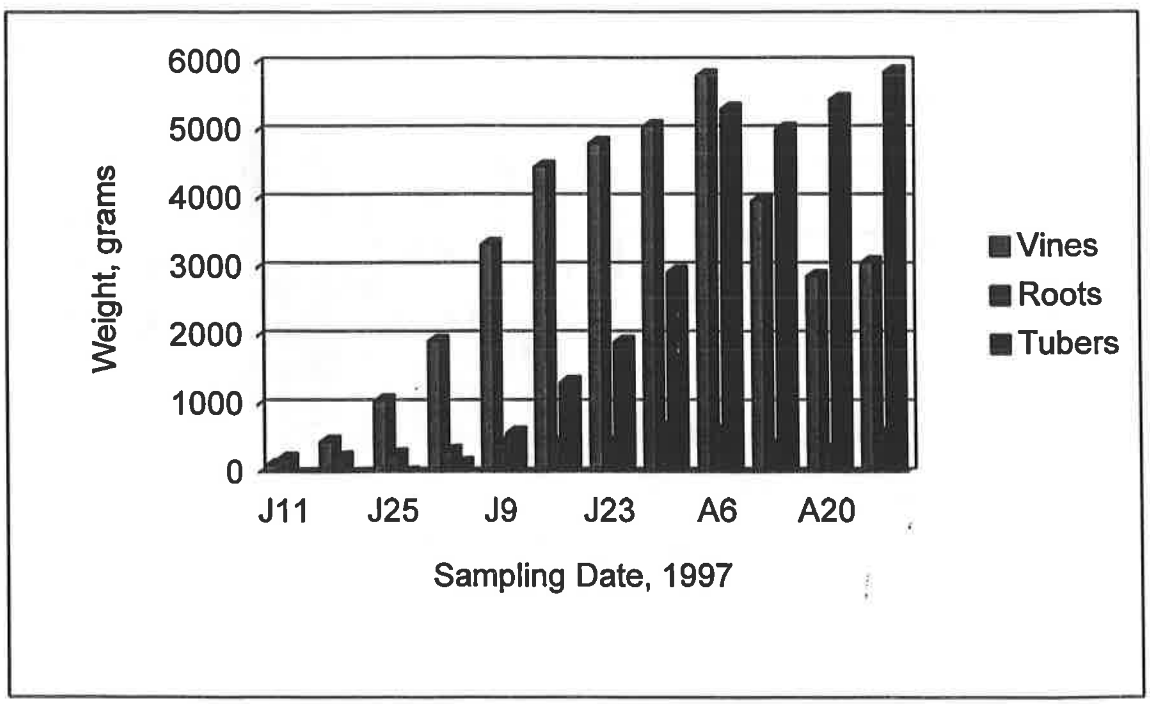
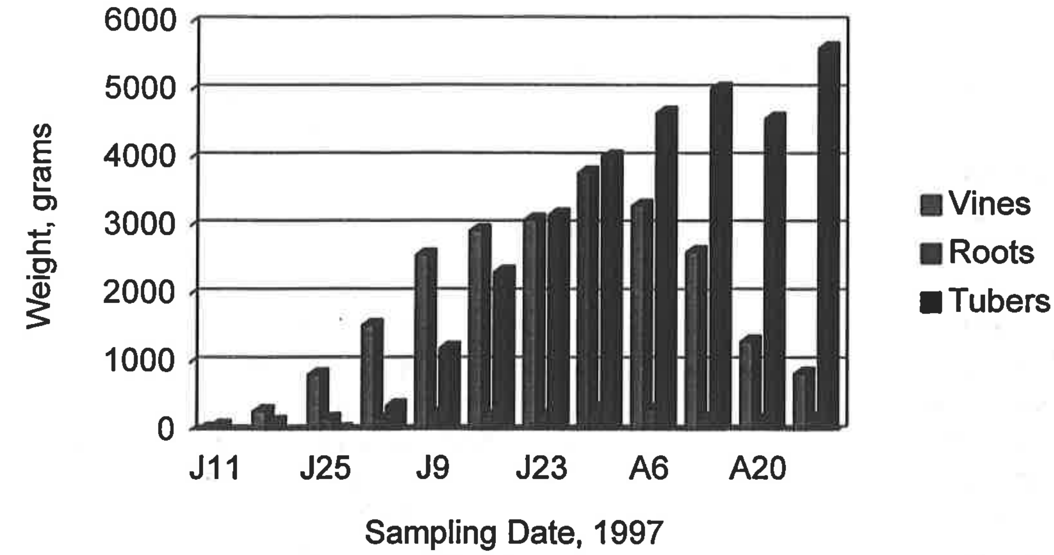


Figure 7. Yukon Gold vine, root, and tuber development, 1997.



Plant height is presented in Figure 1. All 6 clones have similar profile development. AC83064-6 had the largest vine. CO86218-2 had the smallest vine. All entries tended to reach maximum vine growth in late July (23 and 30 harvest dates) and early August (6). Growth analysis of each entry is reported in Figures 2 through 7. DT6063-1R, AC83064-6 and CO86218-2 had similar root masses. These were larger than for the other clones. All entries began with no tubers. Generally, by the third destructive harvest (June 25), tuber development was taking place. DT6063-1R, CO81082-1 and Yukon Gold developed tuber yield faster than the other advanced selections. DT6063-1R, Yukon Gold and Russet Legend had the largest yield.

Individual advanced selections and cultivars, each tend to have their own profile of canopy, root and tuber yield development. This trial demonstrates the differences for 5 advanced selections and Yukon Gold. The information obtained by such analysis provides information regarding time of tuberization, senescence, rate of bulking, and other agronomic traits of interest and importance in developing cultivar specific management profiles for new releases.

NITROGEN FERTILITY REQUIREMENTS FOR ADVANCED SELECTIONS

Cultivars differ in their response to nitrogen fertilizer, each clone having individual needs. A fundamental component to development of cultivar specific management profiles for new cultivars is fertility requirements. Additionally, providing petiole nitrate ranges are important for optimum production. Objectives of this ongoing trial are to determine optimum nitrogen fertilizer rates for advanced selections, and to determine critical petiole nitrate levels for advanced selections to maximize yield, grade and maturity at harvest.

The 1997 trial was grown at the SLV Research Center and included ten advanced selections and two check cultivars, Centennial Russet and Sangre. Entries were grown in 25-foot plots, replicated four times, blocked on nitrogen rates. The trial was planted with an assist-feed cup planter on May 13, 1997. Within-row spacing was 12 inches, with 34 inches between rows. Soil test results from a composite sample taken prior to rowing out in April, indicated organic matter at 2.4%, nitrate at 41 ppm, 29.3 ppm phosphorus, potassium at 433 ppm, adequate levels of micronutrients, and a pH of 8.0. This high level of residual N would be equal to about 145 lbs. of N per acre. Irrigation was by solid set sprinkler throughout the growing season. Liquid fertilizer (0-60-30) was broadcast prior to planting on May 3. Nitrogen rates applied during the season were 0, 50 and 100 lbs./acre. Foliar applications (20-0-0-4.8S) were made on July 10 and then weekly through August 6. The 50 lb./acre treatment plots received 10-0-0-2.4S on July 24. An irrigation followed the foliar applications immediately to minimize foliar burn. Cultural practices typical of the production area were adhered to during the growing season. Petioles were pulled weekly from the beginning of July through vine kill. Vines were desiccated with sulfuric acid on August 28. The trial was harvested mechanically September 17 using a single-row harvester. Agronomic evaluations are reported in Table 1. Yield and grade are summarized in Table 2.

Vine size varied little within a clone for differing nitrogen rates. Vine maturity varied for most clones between treatments. Stems per plant varied little between treatments. In most cases, tubers per plant increased with increased N application. Average tuber weight varied by clone for N rate. Specific gravity decreased with increasing N application, as expected.

Sangre and Russet Norkotah Selection 3 were the highest yielding clones overall treatments. They also had the greatest yield and percentage of US No. 1 tubers. Few No. 2's or culls were produced for any of the N treatments. AC83064-6 performed best at the 50 and 100 lb./acre application rates. The higher rate produced more US No. 1's, although No. 1 yield from the mid rate treatment was not statistically different. Russet Legend (COO83008-1) also achieved best results at the mid and high nitrogen rates. The low (0) application and high application rates produced the greatest yields for Russet Norkotah – S3. US No. 1 production was maximized at the low rate, as were other quality parameters. Russet Norkotah – S8 performed equally across all treatments, although the highest rate had fewer No. 1's (not statistically different) and more culls

Table 1. Agronomic evaluations for twelve clones grown with three rates of nitrogen, 1997.

Clone	N Rate	Vine Size[1]	Vine Maturity[2]	Percent Stand	Stems per plant	Tubers per plant	Avg. Tuber Weight oz.	Specific Gravity[3]
AC83064-6	0	-	2.3	96	4.3	8.3	4.3	1.084
	50	2.3	2.8	99	4.4	7.9	5.1	1.080
	100	2.0	2.8	96	4.4	8.4	5.0	1.075
LSD (∝=0.05)		-	0.3		0.2	0.6	0.3	0.0001
R. Legend	0	1.5	3.8	98	3.9	6.3	5.3	1.092
	50	1.8	3.5	99	4.0	7.0	5.3	1.090
	100	1.8	3.5	98	4.3	7.0	5.1	1.087
LSD (∝=0.05)		0.3	0.4		0.2	0.4	0.3	0.0006
R. Norkotah-S3	0	1.8	3.3	100	3.7	7.6	6.2	1.082
	50	1.6	3.0	95	3.7	8.1	5.4	1.081
	100	1.8	3.0	100	3.6	8.4	5.6	1.077
LSD (∝=0.05)		0.2	0.5		0.2	0.6	0.3	0.0007
R. Norkotah-S8	0	1.0	2.3	99	4.2	7.3	5.1	1.079
	50	1.0	2.0	100	4.0	7.4	5.1	1.077
	100	1.0	2.0	99	4.0	7.5	5.0	1.076
LSD (∝=0.05)		-	0.1		0.2	0.3	0.3	0.0010
Crestone R.	0	1.8	2.8	93	4.3	8.5	4.8	1.077
	50	1.6	3.2	90	4.2	8.9	5.0	1.075
	100	1.8	3.0	97	4.4	8.1	5.0	1.074
LSD (∝=0.05)		0.2	0.2		0.2	0.5	0.2	0.0012
DT6063-1R	0	1.2	2.0	94	4.0	7.4	4.0	1.083
	50	1.5	2.3	97	4.1	9.3	4.6	1.080
	100	1.3	1.5	97	4.1	8.5	4.2	1.078
LSD (∝=0.05)		0.1	0.3		0.2	0.2	0.2	0.0007
BCO894-2	0	1.5	1.8	92	4.1	11.0	3.8	1.083
	50	1.0	1.5	94	3.8	8.9	3.8	1.077
	100	1.0	1.5	94	3.9	11.1	3.5	1.077
LSD (∝=0.05)		0.2	0.3		0.3	0.8	0.2	0.0018
CO86218-2	0	1.0	3.8	98	4.0	10.8	3.2	1.076
	50	1.0	3.0	91	3.7	12.0	3.2	1.074
	100	1.0	4.0	90	3.7	13.2	3.2	1.074
LSD (∝=0.05)		-	0.2		0.2	0.6	0.1	0.0001
CO86142-3	0	2.0	1.0	98	4.1	5.3	-	1.082
	50	1.5	1.3	98	4.1	9.3	3.7	1.079
	100	1.3	1.0	100	4.4	10.0	3.4	1.073
LSD (∝=0.05)		0.2	0.1		-	-	-	-

Table 1. Continued.

Clone	N Rate	Vine Size[1]	Vine Maturity[2]	Percent Stand	Stems per plant	Tubers per plant	Avg. Tuber Weight oz.	Specific Gravity[3]
CO85026-4	0	1.3	3.8	98	3.4	8.2	4.3	1.086
	50	1.3	4.0	95	3.6	8.2	4.3	1.080
	100	1.3	4.0	98	3.7	8.0	4.2	1.081
LSD (∝=0.05)		0.2	0.1		0.2	0.5	0.1	0.0010
Centennial R.	0	1.3	4.0	96	3.9	8.9	3.4	1.081
	50	1.8	4.0	97	3.9	8.7	3.8	1.079
	100	1.0	3.8	99	3.5	7.9	3.7	1.077
LSD (∝=0.05)		0.2	0.1		0.1	0.6	0.1	0.0001
Sangre	0	2.0	3.3	97	2.9	9.5	4.6	1.078
	50	2.3	3.5	98	3.3	10.4	5.1	1.075
	100	1.8	3.8	97	3.2	10.1	4.6	1.074
LSD (∝=0.05)		0.2	0.3		0.1	0.4	0.3	0.0007

[1] Vine size – scale 1-5, 1=small, 5=very large.
[2] Vine maturity – scale 1-5, 1=early, 5=late.
[3] Specific gravity determined by weight-in-air, weight-in-water method.

than the 0 rate. Total yield was similar at all rates for Crestone Russet (CO80011-5). The mid rate however, had a higher yield and percentage of US No. 1's. Other grade parameters were also better at this rate. DT6063-1R exhibited erratic performance in this trial in 1997. The best performance was logged for the mid nitrogen application rate. The low nitrogen rates provided the best total yield and grade for BCO894-2. Because this is a chipping selection that exhibits inherently low specific gravity levels, growers may wish to use the lower application rate when producing this selection. CO86218-2 is an attractive fresh market selection with bright red skin. Best performance was at the high rate of N. CO86142-3, another bright red-skinned Colorado selection, attained highest yield and grade at the low N rate. If producers are interested in a higher percentage of undersized tubers of this selection, utilizing more nitrogen may be warranted. CO85026-4 did not have outstanding yield at any of the rates, although the lower two were significantly better. Grade information indicated higher percentages of tubers 6 ounces and smaller than for most other russets evaluated. As in previous years, Centennial Russet did not fair well in this trial. Yield and grade were similar for all treatments, however the mid range provided significantly higher yield and grade. Sangre had superior performance at the mid nitrogen rate, exceeding 500 cwt./acre. Producers interested in the B market, however may choose to decrease nitrogen applications to maximize tuber numbers and minimize size, while still retaining the red color during storage.

Table 2. Yield and grade for twelve clones grown with three rates of nitrogen, 1997.

Clone	N Rate	Total Yield Cwt./a	US No. 1's Cwt./a	US No. 1's %	>12 oz. %	6-12 oz. %	4-6 oz. %	<4 oz. %	No. 2's %	Culls %
AC83064-6	0	333	245	73	1	32	39	26	0	2
	50	380	307	80	1	44	36	19	0	1
	100	379	314	82	2	40	40	16	1	1
LSD (∝=0.05)		34	38							
R. Legend	0	322	262	80	4	41	35	19	0	1
	50	350	282	80	5	41	34	19	0	0
	100	343	278	81	2	44	34	17	0	2
LSD (∝=0.05)		30	30							
R. Norkotah-S3	0	456	393	86	10	45	31	13	0	0
	50	410	334	81	6	41	35	18	0	0
	100	441	364	83	9	43	31	16	0	1
LSD (∝=0.05)		29	24							
R. Norkotah-S8	0	352	270	76	6	38	32	24	0	0
	50	356	272	76	5	38	33	24	0	2
	100	355	260	74	5	40	28	25	0	3
LSD (∝=0.05)		25	29							
Crestone R.	0	367	272	74	3	36	35	23	0	3
	50	379	298	79	2	46	31	19	0	1
	100	372	284	76	1	44	31	22	0	2
LSD (∝=0.05)		24	26							
DT6063-1R	0	267	189	71	2	23	46	26	0	3
	50	403	317	78	3	32	44	20	0	2
	100	328	244	74	2	30	42	24	0	2
LSD (∝=0.05)		22	27							
BCO894-2	0	376	262	69	0	19	51	30	0	0
	50	307	186	59	0	13	46	41	0	0
	100	355	219	62	0	15	47	38	0	0
LSD (∝=0.05)		18	21							
CO86218-2	0	332	210	63	2	19	42	36	0	1
	50	339	221	64	1	21	42	35	0	1
	100	395	261	66	1	21	44	32	1	1
LSD (∝=0.05)		29	23							
CO86142-3	0	348	285	81	9	36	36	19	1	0
	50	318	215	67	1	17	50	31	1	0
	100	318	206	65	1	16	47	35	0	1
LSD (∝=0.05)		20	21							

Table 2. Continued.

Clone	N Rate	Total Yield Cwt./a	US No. 1's Cwt./a	US No. 1's %	>12 oz. %	6-12 oz. %	4-6 oz. %	<4 oz. %	No. 2's %	Culls %
CO85026-4	0	328	233	71	0	19	52	27	0	2
	50	328	226	68	0	28	40	30	0	1
	100	313	208	66	0	25	41	33	1	1
LSD (∝=0.05)		17	16							
Centennial R.	0	273	186	67	0	20	47	32	0	1
	50	309	228	74	0	21	53	26	0	0
	100	279	201	72	0	22	50	28	0	0
LSD (∝=0.05)		20	18							
Sangre	0	416	334	80	3	42	35	20	0	0
	50	502	426	85	4	46	34	15	0	0
	100	435	358	82	5	43	34	18	0	0
LSD (∝=0.05)		25	26							

Results obtained in 1997 continue to demonstrate the need for nitrogen rate investigations for advanced selections and new cultivars of interest to Colorado producers. This information aids directly in development of cultivar specific management profiles, as well.

ESTABLISHING PHOSPHORUS RATES FOR ADVANCED SELECTIONS

Phosphorus (P) is one of the essential elements required by plants, including potatoes. Potato roots absorb P in the form of phosphate from the soil/water solution. Phosphate is mobile, and moves upward and downward within the plant. If deficient, P will be transferred from older to younger, actively growing tissues. Potato plants exhibiting P deficiency will have dark green foliage, stunted vines, and spindly leaves with younger leaflets cupping or curling upward. Often undersides of leaflets will develop a purple color. Cultivars may display an increase in flowering, an internal purpling of tuber flesh, as well as, reduced tuber number, root size and specific gravity levels. Additionally, an abundance of nitrogen availability combined with deficient P levels may result in diminished net on russet cultivars. Phosphorus must be sufficiently available during early vegetative growth through tuber bulking. Uptake increases during tuber initiation, levels off during bulking and ceases with plant maturation. The soils in the San Luis Valley are for the most part inherently high in P, however much of it is not available due to high soil pH, and high calcium levels. Calcium quickly combines with P fertilizer, reducing availability and restricting mobility within the soil. About 7 pounds of phosphorous (~16 lbs. P_2O_5) are removed by each 100 cwt. of potato yield. Vines remove, on average, another 11 lbs. (~25 lbs. P_2O_5) per acre.

Changing research information and recommendations from other growing areas, indicate a need for phosphorous nutrition inquiry for SLV potato production. In response to this need, a research trial was established in 1997 with the objectives of: 1.) Determining optimum phosphorus fertilization rates for advances selections and, 2.) Determining critical petiole P levels for maximum yield, grade and quality. This information will be incorporated into cultivar specific management profiles for advanced selections and new cultivars. The trial will be continued in subsequent years, incorporating advanced selections as they are available from the breeding program of Dr. David Holm, or other regional programs, and graduating or discarding selections as appropriate.

In 1997, the trial was grown at the San Luis Valley Research Center and included four entries grown in 20 foot plots, replicated three times. The trial was planted with an assist-feed cup planter on May 16, using three rates of phosphorus (0, 60 and 120 pounds), applied as a liquid band. Test results from a composite soil sample taken prior to rowing-out in April, indicated organic matter of 2.4%, nitrate at 41 ppm, 29.3 ppm phosphorus, potassium at 433 ppm, adequate to high levels of micronutrients, and a pH of 8.0. Forty pounds of nitrogen and thirty pounds of potassium were applied with the differing rates of phosphorus. With-in row spacing was 12 inches, with 34 inches between rows. Irrigation was by solid set sprinkler. Cultural practices typical of the production area were adhered to during the growing season. Petioles were pulled weekly from the beginning of July through vine kill. Petiole results are not reported here. Vines were desiccated with sulfuric acid on August 28. The trial was harvested on September 12, using a two-row digger and picking plots up by hand. Yield and grade are summarized in Table 1.

Yield and grade data indicate that total yield was near average for the area this growing season. However, tubers tended to be small in this trial with no oversize tubers and a preponderance of undersized tubers. Average percent of undersize tubers was near 50. This is most likely attributable to the sensitivity of two entries to metribuzin. Sencor was applied on June 3, at the rate of 0.25 pounds per acre of active ingredient. While plants were not killed, many plots of CO87009-4 and AC87084-3 had significant foliar damage, which they later out grew. Russet Nugget was least affected by the herbicide and was the highest yielding selection within the trial. Performance was best at the high and low rates of P. The highest percentage of US No. 1 tubers and least undersize tubers was produced with the 120 pounds/acre of applied phosphorus. CO87009-4 is a medium maturing, dual-purpose russet, with long tuber type. This attractive selection exhibited a significant degree of sensitivity to metribuzin in screening trials at the SLVRC and in Idaho in 1997. Highest yields were obtained with no additional P and with the high rate of P. The highest percentage of US No. 1's, lowest percentage of undersized tubers, and maximum internal quality resulted from the application of 120 pounds P. Specific gravity levels have been higher in the past and it is plausible to hypothesize that the tubers were somewhat immature due to the necessary recovery of foliage from the herbicide damage. AC87084-3 is a medium maturing, dual-purpose russet with oblong tuber type. Trial data indicate that it performed best under a low P regime. Total yield, grade and specific gravity were superior when no P was applied in 1997. This advanced selection was very susceptible to metribuzin applications in trials in the San Luis Valley and southeastern Idaho in 1997. AC88042-1 is in the early phases of evaluation by the variety development team at the SLVRC. Performance in this trial was similar under all rates for yield, grade and specific gravity.

This trial will become standard for advanced selections from the Colorado breeding program. First year results demonstrate that cultivars differ in their response to fertility management and cultivar specific profiles are necessary to optimize yield, grade and quality.

Table 1. 1997 Phosphorus Rate Trial – Yield, Grade and Specific Gravity - Center, CO.

Clone	Phos. Rate	Total Yield	US No. 1's Yield	US No. 1's %	>12 oz.	6-12 oz.	4-6 oz.	<4 oz.	Specific Gravity
		Cwt./acre			%				
R. Nugget	0	446	279	63	0	16	47	37	1.0860
	60	287	179	63	0	25	38	36	1.0786
	120	451	329	73	0	27	46	27	1.0856
	Mean	395	262	66	0	23	44	33	1.0834
CO87009-4	0	381	169	44	1	9	34	56	1.0832
	60	306	127	42	0	11	31	58	1.0830
	120	388	199	51	0	14	37	48	1.0948
	Mean	358	165	46	0	11	34	54	1.0870
AC87084-3	0	278	170	61	1	27	34	36	1.0818
	60	186	82	45	0	15	30	55	1.0768
	120	272	125	49	0	20	30	50	1.0777
	Mean	245	126	52	0	20	31	47	1.0788
AC88042-1	0	392	169	43	0	11	32	57	1.0748
	60	350	135	39	0	9	30	60	1.0744
	120	363	169	17	0	18	29	52	1.0732
	Mean	368	157	43	0	13	30	56	1.0741
LSD(∝= 0.05)		43	28						0.0075
Means	0	374	196	53	0	15	37	46	1.0815
	60	283	131	47	0	15	32	52	1.0782
	120	369	205	55	0	20	35	44	1.0828
LSD(∝= 0.05)		37	24						0.0065

EFFECTS OF PRECUTTING ON CULTIVARS AND ADVANCED SELECTIONS

In North America, the potato is predominately vegetatively propagated using cut pieces of whole tubers. These seed pieces are often cut just prior to planting, although occasionally producers will cut within two weeks of planting, to permit suberization of cut surfaces. Potato producers in the SLV are quite skilled at precutting, cutting seed well in advance of planting time, and rarely have problems develop within lots. Local producers will typically start in February, March or April, depending upon individual circumstances. Precutting can permit cut surfaces to heal prior to planting, may even out emergence in cultivars exhibiting erratic emergence due to apical dominance or a high degree of dormancy, favor a degree of physiological aging when an increase in stem numbers or rapid emergence is desired, and may allow producers to use less hectic times in the calendar year to cut. This study was initiated with the objectives of determining if precutting, beginning shortly after harvest, offers a viable option for popular cultivars and advanced selections to growers, determine if physiological age is affected by precutting, if greater disease problems are associated with precutting , and if wound healing is a problem when seed of advanced selections and popular cultivars is precut during the storage season.

Twelve cultivars and advanced selections were chosen for the experiment. Generation 2 Colorado certified seed was utilized for most entries in the trial. All lots were produced at the SLVRC, with the exception of Yukon Gold obtained from Rockey Farms and Snowden acquired from Worley Seed. Lots received an application of Mertect going into storage at harvest. Seed was collected at harvest, or just post, with an initial cutting date of October 15, 1996. Precutting was also conducted in mid November, December, January, February, March and April. A fresh cut (cut one day and plant the next) was accomplished in May for comparative purposes. Twenty-five seed pieces were cut per sample, with four replications per cutting date. Seed treatment was not used. Samples were placed in mesh bags in count carton box bottoms or tops. Seed was not warmed up prior to cutting, nor was it kept warm to enhance suberization following cutting. Samples were removed from cold storage (about 38F for December through April cutting dates), cut, and returned to storage. This was done because consultation with local producers indicated they did not have the capability to warm the seed, cut it, suberize at 55-65F for two weeks post cutting, then return to cold storage. Fresh weight of each 25 seed piece sample was taken at time of cutting. Evaluations were made monthly for seed piece decay and dormancy for each sample from previous months. Weight of the samples was taken at time of planting to determine loss, if any. Five seed pieces were cut for seed piece decay, predominately by *Fusarium* species and *Erwinia* species.

The trial was planted May 19, 1997 on the farm of Keith and Art Holland, using an assist-feed cup planter. The trial was located on the edge of a Centennial Russet field. A pre-plant soil test indicated nutrients levels of 24 ppm nitrate, 33 ppm phosphorus, 375 ppm potassium and adequate levels of micronutrients. The soil type was a sandy clay loam with pH of 7.3 and organic matter at 0.8%. The experimental design was a randomized complete block, blocked by months, with four replicates within each block. Plots were twenty hills each, on 34-inch centers and within-row spacing of twelve inches. Irrigation was by center pivot and plot maintenance by the grower cooperators was typical of production practices in the SLV. Agronomic evaluations were made during the growing season. Results are reported in Table 1. Vine kill was with sulfuric acid. Plots were harvested October 1 and 2, using a two-row digger and picking up tubers by hand. Evaluations for total yield, grade and specific gravity followed harvest. Findings are presented in Table 2.

All clones responded negatively to cutting in October and December. Stands were significantly impacted by cutting in these months. Tubers per plant also were significantly reduced by this treatment. Total yield was significantly lower for all clones cut in October or December, and grade was inferior. Clones responded differently to cutting in other months.

Crestone Russet (CO80011-5) had similar vine size for all cutting months, except January and December when vine size was significantly reduced. Vine maturity varied by month, with the earliest maturing vines resulting from the January cutting. Latest maturity was for November and May vines. Stands for Crestone were best for the November cutting, with a 100 percent stand; March, February and January followed with 98, 95 and 93 percent, respectively. Stems per plant were lowest for those cut in November, and highest for the April cutting. Tubers per plant were significantly different for the different months. Fewest tubers were produced from the December and October treatments, while most tubers per plant were produced from the March and April cuttings. Average tuber weight was large for all treatments. Specific gravity ranged from 1.053 to 1.059. Total yield varied 500 cwt./acre, with the lowest yield of 135 cwt./acre resulting from the December cut, and the highest of 635 cwt./acre. for March. Percent US No. 1's ranged from 52 to 84 percent. Highest yield of No. 1's was for the April cutting. Other grade parameters closely followed the distribution as for total yield.

Vine size for Ranger Russet varied from 2.8 for the December cutting to 3.7 for October. Maturity ranged from 2.3 to 3.8. Stands were significantly reduced for the October and January cuttings. Tubers per plant ranged from 5.9 for the December treatment to 17.4 for the January cutting. Specific gravity was very low, averaging about 1.065, across all months. Ranger Russet performed most poorly for the December cutting, with total yield at 246 cwt./acre. Cutting in January resulted in the highest total yield of 554 cwt./acre, however US No. 1 yields or percentage were not as high as for other months.

Russet Norkotah vine sizes ranged from 1.0 for those cut in December, to 2.5 for those cut in January. Vine maturity also varied, from 1.0 to 2.0. Stands were significantly reduced for cutting dates in November, January and May. Stem numbers per plant and tuber numbers per plant varied considerably. Average tuber weights were quite large, ranging from 7.1 to 11.7. Specific gravity was low as would be expected for this clone. Total yield ranged from 139 cwt./acre for the December cutting date to 489 in April. The highest yield of US No. 1's was for the January cutting and the highest percentage of US No. 1's was for the November cutting.

Table 1. Agronomic evaluations for 12 cultivars and advanced selections precut October through April and fresh cut in May, 1997.

Clone	Month Cut	Vine Size[1]	Vine Maturity[2]	Stand %	Stems per Plant	Tubers per Plant	Average Tuber Weight	Specific Gravity[3]
Crestone R.	Oct.	3.0	2.7	73	3.3	5.2	11.0	1.0553
	Nov.	3.0	3.3	100	3.0	8.1	12.3	1.0590
	Dec.	2.5	2.8	71	3.2	3.8	6.8	1.0558
	Jan.	2.8	2.5	93	3.6	8.2	10.9	1.0566
	Feb.	3.0	2.8	95	3.7	9.3	10.7	1.0582
	March	3.0	3.0	98	3.4	10.5	10.8	1.0585
	April	3.0	3.0	79	4.6	10.6	9.9	1.0553
	May	3.0	3.3	79	3.8	9.2	11.3	1.0560
Ranger R.	Oct.	3.7	3.3	73	4.6	9.5	-	1.0667
	Nov.	3.3	3.5	93	3.1	10.2	9.9	1.0662
	Dec.	2.8	3.3	96	3.2	5.9	7.8	1.0659
	Jan.	3.5	3.8	59	4.3	17.4	11.5	1.0649
	Feb.	3.0	3.0	89	4.3	11.4	9.5	1.0650
	March	3.0	2.3	90	3.5	11.8	9.0	1.0665
	April	3.0	3.0	89	4.2	12.2	9.0	1.0644
	May	3.0	2.8	96	4.1	11.2	7.7	1.0622
R. Norkotah	Oct.	1.8	1.3	94	4.2	6.7	8.6	1.0599
	Nov.	2.0	2.0	76	3.5	8.2	11.6	1.0834
	Dec.	1.0	1.5	94	3.7	3.6	7.1	1.0630
	Jan.	2.5	2.0	66	4.1	14.5	10.9	1.0612
	Feb.	2.3	1.5	96	3.9	7.9	11.1	1.0584
	March	2.3	1.5	90	3.0	8.0	10.6	1.0615
	April	1.8	1.0	95	3.9	9.1	10.3	1.0639
	May	2.0	1.0	81	4.6	11.7	9.6	1.0640
Sangre	Oct.	3.0	2.8	89	4.0	7.5	8.0	1.0564
	Nov.	3.3	3.8	95	2.7	12.0	9.3	1.0598
	Dec.	2.8	3.5	99	3.7	5.6	5.0	1.0566
	Jan.	3.0	3.0	84	4.1	12.3	10.5	1.0586
	Feb.	3.0	2.8	83	4.2	13.9	9.9	1.0588
	March	2.8	3.3	84	3.9	12.1	8.0	1.0596
	April	2.8	2.8	94	3.6	10.6	10.4	1.0606
	May	2.8	2.8	81	3.9	9.3	9.6	1.0619
Snowden	Oct.	2.8	3.5	85	4.1	6.5	6.9	1.0719
	Nov.	3.5	4.0	99	3.2	3.2	10.7	1.0732
	Dec.	2.8	3.5	84	4.7	4.7	4.4	1.0664
	Jan.	3.5	3.3	85	3.6	10.0	7.3	1.0745
	Feb.	3.3	3.0	90	4.0	10.4	8.6	1.0716
	March	3.0	3.5	79	3.2	9.3	8.2	1.0769
	April	3.0	3.3	76	5.0	11.0	9.4	1.0786
	May	3.3	3.0	93	4.3	11.2	7.4	1.0764

Table 1. Continued.

Clone	Month Cut	Vine Size[1]	Vine Maturity[2]	Stand %	Stems per Plant	Tubers per Plant	Average Tuber Weight	Specific Gravity[3]
Yukon Gold	Oct.	2.0	2.5	26	2.9	8.3	12.4	1.0753
	Nov.	2.5	1.8	59	3.3	5.9	13.9	1.0502
	Dec.	1.5	1.3	66	2.0	3.5	11.1	1.0644
	Jan.	2.8	2.3	69	3.4	7.2	13.8	1.0703
	Feb.	2.0	1.5	80	2.9	6.5	12.9	1.0691
	March	2.0	1.5	74	2.7	7.7	13.7	1.0585
	April	2.3	1.5	86	3.7	8.2	11.3	1.0669
	May	1.8	1.8	89	3.4	6.8	10.2	1.0632
AC83064-6	Oct.	3.0	3.3	80	3.5	7.3	7.9	1.0615
	Nov.	3.3	3.3	90	2.6	8.1	8.6	1.0615
	Dec.	3.5	3.0	95	3.4	4.5	6.8	1.0685
	Jan.	4.0	3.3	75	4.4	9.6	8.5	1.0574
	Feb.	3.3	3.0	94	3.5	8.9	8.2	1.0592
	March	3.5	3.3	86	3.7	10.4	8.3	1.0613
	April	2.8	3.3	74	4.4	9.7	10.0	1.0603
	May	3.5	3.3	84	3.6	7.5	16.7	1.0624
BCO894-2	Oct.	2.5	2.0	81	2.7	10.6	8.5	1.0593
	Nov.	2.8	2.5	88	2.7	8.5	8.5	1.0599
	Dec.	2.3	1.5	83	2.1	6.0	6.8	1.0581
	Jan.	2.3	2.5	93	3.2	9.5	8.8	1.0702
	Feb.	2.5	3.0	86	3.1	10.3	8.3	1.0605
	March	3.0	2.8	84	2.6	12.6	7.0	1.0585
	April	2.3	2.3	86	3.5	10.9	8.6	1.0616
	May	2.5	2.8	88	3.1	9.5	7.4	1.0629
CO81082-1	Oct.	2.5	2.0	90	5.7	8.5	7.6	1.0586
	Nov.	2.3	2.0	86	3.7	10.7	7.4	1.0539
	Dec.	1.3	2.0	70	3.7	3.8	4.4	1.0522
	Jan.	2.8	2.0	84	4.4	7.5	12.1	1.0569
	Feb.	3.3	2.3	85	4.0	9.9	7.5	1.0599
	March	2.3	1.3	96	3.8	7.9	7.8	1.0703
	April	2.3	2.8	85	4.3	7.0	7.4	1.0587
	May	3.0	2.5	88	4.4	7.5	9.2	1.0544
CO82142-4	Oct.	2.8	3.3	90	2.8	6.2	9.8	1.0616
	Nov.	3.5	3.8	90	2.8	7.5	11.8	1.0644
	Dec.	2.5	3.5	79	2.9	4.3	7.2	1.0653
	Jan.	3.3	3.0	61	4.6	7.1	10.6	1.0498
	Feb.	3.0	2.5	98	3.5	6.7	11.4	1.0634
	March	3.5	3.5	94	3.8	7.0	13.0	1.0625
	April	3.0	3.8	80	3.8	7.5	10.0	1.0609
	May	3.3	3.3	83	3.3	9.2	11.2	1.0639

Table 1. Continued.

Clone	Month Cut	Vine Size[1]	Vine Maturity[2]	Stand %	Stems per Plant	Tubers per Plant	Average Tuber Weight	Specific Gravity[3]
R. Legend	Oct.	3.0	3.5	89	3.1	4.3	12.2	1.0698
	Nov.	3.5	3.5	85	3.1	6.7	11.4	1.0698
	Dec.	2.3	3.5	98	2.9	4.0	11.9	1.0742
	Jan.	3.5	2.8	-	3.0	5.0	11.4	1.0695
	Feb.	3.0	3.5	74	4.1	5.8	10.9	1.0700
	March	2.8	3.0	88	3.1	7.3	10.4	1.0734
	April	2.8	3.0	94	3.8	4.8	9.9	1.0701
	May	3.0	2.8	95	3.6	5.8	9.2	1.0695
DT6063-1R	Oct.	3.0	1.5	93	2.8	8.4	8.7	1.0677
	Nov.	2.8	2.3	79	2.6	10.3	9.0	1.0583
	Dec.	2.8	2.3	89	3.1	5.1	7.4	1.0620
	Jan.	2.8	1.5	94	3.4	9.5	8.3	1.0580
	Feb.	3.0	1.8	78	3.9	12.7	10.4	1.0656
	March	2.8	2.0	76	3.6	16.4	7.7	1.0612
	April	3.0	2.3	98	4.5	10.2	9.7	1.0604
	May	3.3	2.3	89	4.1	11.4	10.2	1.0594
LSD(∝=0.05)		0.1	0.1		0.1	0.3	0.4	0.0012

[1] Vine size – scale 1-5, 1=small, 5=very large.
[2] Vine maturity – scale 1-5, 1=early, 5=late.
[3] Specific gravity determined by weight-in-air, weight-in-water method.

Vine size and maturity varied somewhat for Sangre cut in the 8 months. Stands were significantly reduced for cutting months of October, January, February, March and May, particularly. Stems per plant ranged from 2.7 to 4.2. Tubers per plant were quite variable. The smallest tubers resulted from cutting in December. Total yield was very variable for cutting date.

Vine maturity for Snowden was earliest for the cutting dates in February and March. The latest maturing vines were for the November cut. Percent stand varied from 76 in April to 99 for November. Tubers per plant were significantly reduced for cutting dates in October and December. Tuber size was also much reduced for these months, however tuber size for chip processing tends to be smaller than for other uses to prevent breakage. Specific gravity ranged from 1.0664 to 1.0786, very low for this chipper. Total yield was extremely low for the December cutting. Yield was also low for October. The highest total yield and yield of US No. 1's was for the November cutting date. Few oversized tubers resulted for any of the cutting months. Other grade parameters closely followed the distribution for total yield.

Table 2. Yield and grade for 12 cultivars and advanced selections precut October through April and fresh cut in May, 1997.

Clone	Month Cut	Total Yield Cwt./A	US No. 1's Cwt./A	US No. 1's %	>12 oz. %	6-12 oz. %	4-6 oz. %	<4 oz. %	No. 2's %	Culls %
Crestone R.	Oct.	299	221	73	12	39	21	25	0	2
	Nov.	539	452	84	21	42	20	16	0	0
	Dec.	135	65	52	0	22	30	41	0	6
	Jan.	480	349	72	19	37	16	22	0	5
	Feb.	539	395	73	17	35	21	21	1	5
	March	635	514	80	18	37	25	14	0	6
	April	473	324	67	11	39	18	27	0	5
	May	472	353	74	22	38	14	19	0	7
Ranger R.	Oct.	544	355	65	11	39	16	30	0	4
	Nov.	520	389	75	7	42	26	23	0	1
	Dec.	246	137	55	4	31	21	43	0	1
	Jan.	554	361	65	14	31	20	31	1	3
	Feb.	521	359	68	11	33	24	29	0	2
	March	506	369	73	8	36	29	25	0	2
	April	530	345	64	8	36	20	34	0	2
	May	457	301	65	7	36	22	32	1	1
R. Norkotah	Oct.	290	176	62	3	35	23	37	0	1
	Nov.	397	335	84	17	44	23	11	0	5
	Dec.	139	86	57	2	30	25	42	0	1
	Jan.	475	366	76	15	42	19	21	0	2
	Feb.	470	345	73	15	40	18	23	0	3
	March	421	328	78	16	39	23	19	0	3
	April	489	348	70	16	39	15	26	1	3
	May	449	319	71	12	37	22	25	1	3
Sangre	Oct.	281	187	66	10	32	24	33	0	1
	Nov.	576	432	75	11	34	30	24	0	1
	Dec.	153	69	43	0	7	36	56	0	1
	Jan.	584	421	72	16	36	21	26	1	1
	Feb.	618	504	81	12	41	28	19	0	0
	March	440	292	65	11	32	22	34	0	1
	April	580	427	72	11	45	17	26	1	1
	May	397	309	78	14	35	28	21	0	0
Snowden	Oct.	214	98	47	2	19	27	53	0	0
	Nov.	464	303	65	4	23	39	35	0	0
	Dec.	82	22	25	0	6	19	75	0	0
	Jan.	350	191	56	4	28	25	42	0	1
	Feb.	430	303	71	3	29	40	28	0	0
	March	336	242	72	6	30	36	27	0	0
	April	423	264	60	5	32	24	40	0	0
	May	437	289	66	1	29	35	34	0	0

Table 2. Continued.

Clone	Month Cut	Total Yield Cwt./A	US No. 1's Cwt./A	US No. 1's %	>12 oz. %	6-12 oz. %	4-6 oz. %	<4 oz. %	No. 2's %	Culls %
Yukon Gold	Oct.	89	77	89	26	53	10	7	0	4
	Nov.	226	202	87	27	43	18	10	1	0
	Dec.	153	123	73	17	36	20	25	0	3
	Jan.	376	308	81	30	41	10	13	2	4
	Feb.	365	314	86	26	43	16	11	1	3
	March	425	371	87	33	38	16	10	2	1
	April	449	352	78	17	40	21	20	0	2
	May	377	299	79	21	31	27	18	0	3
AC83064-6	Oct.	243	156	63	3	32	28	36	1	1
	Nov.	344	262	75	2	34	38	123	0	1
	Dec.	162	83	50	0	19	31	49	0	1
	Jan.	344	253	74	3	41	29	24	1	1
	Feb.	374	270	71	2	34	35	27	0	2
	March	420	307	74	7	37	30	24	0	2
	April	409	286	68	9	41	19	29	1	2
	May	495	408	78	9	34	35	22	0	0
BCO894-2	Oct.	395	267	68	0	34	33	32	0	0
	Nov.	337	260	77	1	32	44	23	0	0
	Dec.	194	105	53	0	17	36	46	0	1
	Jan.	423	294	71	1	38	31	29	0	0
	Feb.	388	269	69	4	30	36	31	0	0
	March	377	238	62	0	19	43	38	0	0
	April	449	288	63	1	31	31	36	0	1
	May	336	225	66	0	26	40	34	0	0
CO81082-1	Oct.	308	168	54	5	28	21	45	0	1
	Nov.	369	245	66	4	28	34	33	0	0
	Dec.	79	28	29	0	11	18	71	0	0
	Jan.	379	249	67	10	36	20	33	0	1
	Feb.	346	229	67	7	35	25	31	0	1
	March	328	189	57	2	32	23	43	0	0
	April	247	141	57	4	30	22	42	0	1
	May	329	243	74	7	42	25	26	0	0
CO82142-4	Oct.	321	237	69	7	46	16	30	0	1
	Nov.	440	384	88	17	46	24	11	1	1
	Dec.	146	92	54	3	17	34	45	0	0
	Jan.	244	205	80	14	40	26	20	0	0
	Feb.	415	342	82	16	40	27	16	1	2
	March	453	373	82	18	40	23	17	0	1
	April	345	254	72	11	43	18	25	0	0
	May	442	358	81	18	43	20	17	1	1

Table 2. Continued.

Clone	Month Cut	Total Yield Cwt./A	US No. 1's Cwt./A	US No. 1's %	>12 oz. %	6-12 oz. %	4-6 oz. %	<4 oz. %	No. 2's %	Culls %
R. Legend	Oct.	269	217	80	28	40	12	19	0	1
	Nov.	350	287	82	17	42	23	15	1	3
	Dec.	256	195	76	12	43	21	20	0	4
	Jan.	317	258	82	20	41	21	9	0	9
	Feb.	239	169	67	12	36	20	32	0	1
	March	341	260	76	11	43	22	22	0	1
	April	252	178	72	9	34	28	25	0	4
	May	274	206	74	15	35	24	23	0	2
DT6063-1R	Oct.	370	266	70	4	40	26	28	1	1
	Nov.	395	304	77	8	37	32	19	2	3
	Dec.	204	107	41	0	22	19	54	0	4
	Jan.	405	296	70	6	46	18	27	1	1
	Feb.	559	472	85	8	49	28	13	1	1
	March	469	346	73	8	43	21	23	1	3
	April	537	364	68	7	39	21	29	0	3
	May	549	429	78	12	37	28	19	0	3
LSD(∝=0.05)		14	12							

Vine size and maturity varied somewhat for cutting date for Yukon Gold. Percent stand was poor for all dates, ranging from 26 in October to 89 in May. Total yield was much reduced for cutting dates just after harvest. Best yields were obtained for the cutting dates in March and April. US No. 1 yield was also higher for these months.

AC83064-6 had much reduced vine size for the April cutting date. The January cutting date had the largest vine. Vine maturity was quite consistent, compared to other selections and cultivars in the study. Stands ranged from 74% for April, to 95 for December. Stems per plant varied significantly for the cutting months. Tubers per plant were much reduced for the December cutting date, however they tended to stay small and not bulk up. Specific gravity levels for this dual-purpose russet were quite low, ranging from 1.0574 to 1.0685. Yields were significantly reduced for October and December cutting dates, particularly, as was US No. 1 yield. The highest yield and yield of US No. 1 tubers was obtained from the fresh cut in May. Undersized tubers were very prevalent for October and December cutting dates.

Vine size varied from 2.3 to 3.0 for BCO894-2, a chipping selection from the Colorado program. December vines matured very early, while February's were the latest with a score of 3.0. Percent stands were all in the 80's, with the exception of the January date. Stems per plant ranged from 2.1 to 3.1. Tuber number per plant varied considerably, from 6.0 for December to 12.6 for the March date. Specific gravity levels were very low for this chipping selection, with a range of 1.0581 to 1.0702. Total yield for December was extremely low. Highest yield was obtained from the April cutting. Grade distribution was very good for all months, since this is a chipper. Most undersized tubers were produced from the December cutting date.

CO81082-1 is being dropped from evaluation by the breeding program. In the 1997 trial, vine size ranged from 1.3 to 3.3. Vine maturity also varied somewhat. Best stands were obtained from cutting dates in March and October. Tubers per plant were lowest when cut in December, and highest for the November cut. Tuber size was very significantly reduced for December . Specific gravity ranged from 1.0522 to 1.0703. December yields were very much reduced at 79 cwt./acre. Seventy-one percent of this yield was undersized. Best yields were obtained from cutting in January and November. A criticism of this selection has been its low yield. The highest percent of US No. 1's was produced from the fresh cut seed.

Largest and latest vines were produced by cutting in November for CO82142-4. Percent stand was best for the February cutting date and lowest for January and December. Stems per plant varied significantly for the different months. Tubers per plant were very low for December at 4.3 and high for May, at 9.2. Average tuber weight was large for all, however tubers from the December cut were smallest, averaging 7.2 ounces. Specific gravity ranged from 1.0498 to 1.0644. Lowest yields were for December and January cutting dates. Highest yields were produced from March, May and November. US No. 1 yield and percent were best for November. Undersized tubers were prevalent for the October and December dates. CO82142-4 has been dropped from evaluation by the breeding program.

Russet Legend (COO83008-1) had vine sizes ranging from 2.3 to 3.5. Vine maturity was medium for all months. Stand was most reduced for the February cut. Tuber size was large for this attractive, dual-purpose russet. Specific gravity was lower than is typically, however, higher than many entries in the trial. Total yield was reduced for all months. Performance was best for the November and March dates. November, January and March had the highest yields of US No. 1 tubers.

Vine size and maturity varied for cutting dates for DT6063-1R. Stands were superior for October, January and April. Stems per plant were greatest for cutting dates closest to planting. Tubers per plant varied significantly from 5.1 in December to 16.4 for March. Specific gravity was lower for this attractive red than is typical. Total yield was most reduced for December, October and November cutting dates. February, May and April cutting dates had outstanding yields in excess of 530 cwt./acre. The lowest percentage of US No. 1's were for December. This date also produced the highest percentage of undersized tubers, often the grade where red producers receive a premium price.

Cultivars and advanced selections vary in their response to precutting in different months. Precutting does offer a viable alternative for producers if adequate facilities exist for healing the cut seed. Precutting may provide an advantage to producers who can cut judiciously to optimize specific market sizes, affect maturity appropriately and or permit timely use of workers. Additional work is warranted as new cultivars and selections are developed. Future work may include investigation of suberization rates at cold temperatures for cultivars and advanced selections.

OPTIMUM SEED PIECE SPACING FOR ADVANCED SELECTIONS

The 1997 seed-piece spacing trial was planted on May 14, at the San Luis Valley Research Center. Twelve advanced selections were grown at two spacings, 9 and 12 inches, replicated three times. Plot size was 20 feet, with 34 inches between rows. Rows were opened by machine, without covering disks, plots were hand planted and rows closed without shoes. Liquid fertilizer (40-60-30) was banded during row closing. Cultural practices through the growing season were typical of production in the SLV. Standard agronomic evaluations were made during the growing season; results are reported in Table 1. Vines were killed with sulfuric acid on August 28. Plots were harvested on September 17 with a single-row potato harvester. Yield, grade and specific gravity were determined and results are presented in Table 2.

Average tuber size was small overall the trial. Growth cracks were not a problem for most entries, although DT6063-1R, Legend and AC88357-3 had a few at the closer spacing. AC83064-6 and CO86142-3 had growth cracks at both within-row spacings, with the most prevalent for CO86142-3 at the 12-inch spacing. Second growth (knobs) was minimal in the trial, however presence was noted for CO86142-3 and CO86218-2.

Vine size and maturity were the same for the two within-row spacings for Crestone Russet. Shape was significantly different, with the wider spacing permitting tubers to lengthen out. Stems per plant did not vary significantly, however tubers per plant did, with the wider spacing having more tubers per plant. Average tuber weight was significantly different, with the closer spacing having larger tubers, most likely due to the reduced number. Specific gravity was not statistically different for the two spacings. Total and US No. 1 yield were statistically different, with the closer spacing providing the superior yields. Few oversize tubers, US 2's or culls were produced.

Larger vine size was obtained with the closer spacing for DT6063-1R. Vine maturity was not different. Again, the wider spacing permitted tubers to lengthen out. Stems per plant were not significantly different. Tubers per plant were statistically different, with the wider spacing having about 4 tubers more per plant. Again, tuber size was smaller for the wider spacing. Specific gravity varied considerably, and was high. DT6063-1R was the highest yielding entry in the trial. Total and US No. 1 yield were not significantly different. Yield distribution was nearly identical.

The wider spacing had smaller vine size than the close for Russet Legend (COO83008-1). Vine maturity also varied, with the wider spacing being slightly later. Shape was identical for the two treatments. Stems per plant were not significantly different, however tubers per plant were. About two tubers more were produced with the 12-inch spacing. Average tuber size was not different. Specific gravity was high, and significantly different for the two treatments. Total yield and US No. 1 yield did not differ statistically. Grade was similar for the two spacings.

As with the previous advanced selections, AC83064-6 varied slightly for vine size, while vine maturity was the same. Shape also did not vary. Stems per plant were identical, while the wider spacing produced more tubers per plant. Average tuber size was slightly larger for the 9-inch spacing, most likely because of fewer tubers produced for the same stem number. Specific gravity was not significantly different. Total yield and US No. 1 yield did not vary for the two spacings.

Vine size was the same for the two treatments for the bright red selection CO86142-3. Vine maturity was later for the wider spacing. The 12-inch spacing permitted tubers to lengthen out. Stems per plant were significantly more for the wider spacing, as were tubers per plant. Average tuber size and specific gravity did not vary. Total yield nearly differed significant, and grade was nearly identical, although tubers were slightly larger for the wider spacing.

Vine size and maturity for CO86218-2 were the same at the two spacings. Shape was slightly longer for the 9-inch spacing. Stems per plant were the same for the treatments. Tubers per plant increased with increasing within-row spacing. Average tuber size did not differ; nor did specific gravity. Total and US No. 1 yield were not significantly different and the grade distribution was nearly identical.

Vine size and maturity were significantly smaller and earlier for the narrower spacing for the chipping selection BCO894-2. Shape was longer for the 9-inch spacing. Stems per plant were significantly different, with more stems at the wider space. Tubers per plant were significantly more at the wider spacing. Average tuber weight, however, did not differ. Specific gravity, also was not different. Total and US No. 1 yield were not different. Grade distribution varied slightly with more tubers in the 6-12 oz. category at the wider spacing.

AC88357-3 varied for vine size and maturity. Vine size was smaller at the closer spacing, and maturity earlier for the wider spacing. Shape was longer for the 12 inch spacing. Stems per plant was not different. There were more tubers at the wider spacing. However, average tuber size did not vary; nor did specific gravity. Yield and grade were nearly identical for this selection.

CO85026-4 exhibited a small percentage of metribuzin damage, as a result of a pre-emergent application. Vine size was not different for the treatments. Vine maturity was later at the 9-inch spacing. Shape was elongated at the 12-inch spacing. Stems per plant were not statistically different, nor was average tuber size and specific gravity. Tubers per plant were greater at the 12-inch spacing. Total and US No. 1 yield did not differ significantly. Grade distribution was slightly better at the wider spacing.

Vine size, maturity and shape were identical at the two spacings for AC87084-3. Stems per plant were significantly different, with more stems at the wider spacing. Tubers per plant were also significantly greater at the 12-inch space, as was average tuber size. Specific gravity was significantly different for the two treatments and was much higher for the wider spacing. This selection did exhibit metribuzin damage and yields may have been impacted by this sensitivity. Total yield was significantly less for the 9-inch spacing. Tubers also were smaller at the narrower spacing.

CO87009-4 had smaller vine size and later maturity at the tighter spacing. Tuber shape did not differ. Stems per plant were greater for the wider spacing, as were tuber numbers per plant. Average tuber weight and specific gravity did not differ. Total yield was not statistically different, and US No. 1 yield was nearly significant. Grade distribution was slightly better at the wider spacing.

Vine size was smaller at the 12-inch spacing for AC88165-3. Vine maturity, tuber shape and stems per plant were not significantly different for the two treatments. Tubers per plant were greater for the 12-inch spacing, however average tuber weight did not differ. Specific gravity for the 9-inch treatment was very low and was significantly different from the level for the 12-inch spacing. Total and US No. 1 yield were not different, however grade distribution was slightly better at the wider spacing.

For most advanced selections quality parameters increased with an increase in within-row spacing. In most cases total yield did not differ, however specific grade categories varied with average tuber size and number. The findings reported here will be utilized in development of cultivar specific management strategies for promising advanced selections.

Table 1. Summary of agronomic information for twelve advanced selections grown at 9 or 12-inch within-row spacing, 1997.

Clone	Spacing Inches	Vine Size[1]	Vine Maturity[2]	Shape[3]	Stems per plant	Tubers per plant	Average tuber weight oz.	Specific Gravity[4]
Crestone R.	9	2.3	3.0	3.3	3.8	10.4	4.7	1.0647
	12	2.3	3.0	4.0	4.1	12.9	4.0	1.0700
DT6063-1R	9	3.0	3.0	2.7	3.9	11.3	4.4	1.1000
	12	2.7	3.0	3.0	4.4	15.6	4.0	1.0854
R. Legend	9	3.0	3.0	3.3	3.8	8.1	4.7	1.1008
	12	2.7	3.3	3.3	4.3	10.4	4.8	1.0889
AC83064-6	9	3.0	3.0	3.3	4.4	10.7	4.1	1.0789
	12	2.7	3.0	3.3	4.4	13.7	3.9	1.0803
CO86142-3	9	2.0	2.0	1.7	3.6	11.2	3.8	1.0733
	12	2.0	2.3	2.0	4.4	13.7	3.7	1.0749
CO86218-2	9	2.0	3.0	2.3	3.5	11.9	3.4	1.0730
	12	2.0	3.0	2.0	3.5	13.3	3.4	1.0752
BCO894-2	9	1.7	2.7	2.7	3.4	9.5	4.7	1.0826
	12	2.0	3.0	2.0	4.6	11.3	4.6	1.0786
AC88357-3	9	1.7	3.0	1.3	4.3	10.1	3.2	1.0852
	12	2.3	2.3	1.7	4.4	12.0	3.5	1.0848
CO85026-4	9	2.3	3.7	3.3	3.9	9.2	4.3	1.0764
	12	2.3	3.3	3.7	4.3	10.7	4.2	1.0777
AC87084-3	9	3.0	4.0	3.7	5.4	7.8	3.3	1.0788
	12	3.0	4.0	3.7	6.2	11.3	3.9	1.0892
CO87009-4	9	2.3	3.3	3.0	6.6	12.0	3.6	1.0862
	12	2.0	3.0	3.0	7.6	14.9	3.5	1.0892
AC88165-3	9	3.0	3.0	4.0	3.8	12.3	4.0	1.0578
	12	2.7	3.0	4.0	3.9	13.0	4.2	1.0819
LSD (α=0.05)		0.2	0.2	0.3	0.5	0.8	0.3	0.0073

[1] Vine size – scale 1-5, 1=small, 5=very large.
[2] Vine maturity – scale 1-5, 1=early, 5=late.
[3] Shape – scale 1-5, 1=round, 5=very long.
[4] Specific gravity determined by weight-in-air, weight-in-water method.

Table 2. Yield and grade information for twelve advanced selections grown at 9 or 12-inch within-row spacing, 1997.

Clone	Spacing In.	Total Yield Cwt./acre	US. No. 1 Yield Cwt./acre	US No. 1 %	>12 oz. %	6-12 oz. %	4-6 oz. %	<4 oz. %	No. 2's %	Culls %
Crestone R.	9	552	450	81	4	37	40	17	0	2
	12	496	394	79	2	31	46	19	0	2
DT6063-1R	9	585	455	78	3	34	40	19	0	3
	12	569	446	78	3	35	41	18	1	3
R. Legend	9	460	388	84	5	39	41	14	0	1
	12	477	409	86	6	41	38	14	0	1
AC83064-6	9	506	391	77	1	34	42	21	0	1
	12	511	381	75	1	28	45	24	0	1
CO86142-3	9	493	363	74	0	15	59	22	0	3
	12	469	341	73	0	19	53	23	1	3
CO86218-2	9	455	311	68	1	29	39	29	0	2
	12	430	289	67	1	29	38	31	1	1
BCO894-2	9	512	432	84	2	33	50	15	0	0
	12	511	440	86	0	39	47	14	0	0
AC88357-3	9	369	260	70	0	20	53	20	0	1
	12	386	276	72	0	24	48	27	0	1
CO85026-4	9	422	323	76	1	24	52	22	0	2
	12	433	347	80	1	33	46	19	0	1
AC87084-3	9	307	108	64	0	23	41	35	0	1
	12	424	120	75	1	33	40	25	0	1
CO87009-4	9	495	300	61	0	11	50	33	5	0
	12	496	332	67	0	17	50	31	2	1
AC88165-3	9	540	396	73	1	30	42	26	0	1
	12	547	416	76	2	32	42	22	0	1
LSD ($\propto$=0.05)		28	37							

CONTRIBUTION OF THE MOTHER TUBER

The effect of loss of the mother tuber at three points during the growing season was examined for Russet Burbank and Russet Norkotah in 1997. Seed piece loss at various points during the growing season may impact yield and quality in distinct ways. Five replications of ten hill plots were planted on May 5. Within-row spacing was 12 inches, on 34-inch centers. Liquid fertilizer was banded at the rate of 40-60-30 at planting. Irrigation was by solid set sprinkler and cultural practices were typical of those used in the growing area. Treatments consisted of a control, disturb at emergence, sever at emergence, disturb at eight inches, sever at eight inches, disturb at bloom, and sever at bloom. Treatments at emergence were performed on June 5, eight inches on June 18, and bloom July 8. Vines were desiccated on August 28 with sulfuric acid. Harvest was conducted on September 22 using a two-row potato digger, with plots picked up by hand. Plots were graded and samples taken for post-harvest evaluation.

Total yield and yield of US No. 1's were significantly affected by treatment for both cultivars (Table 1, Figures 1 and 2). For Russet Burbank, the highest yield was in the control plots. This yield was not significantly different for the disturb at bloom treatment. Yield of US No. 1's did not statistically differ for the control, treatments at emergence, or the disturb at 8-inches treatment. The greatest yields of oversized tubers were for the treatments at emergence and the disturb at 8-inches treatment. Lowest yields for desirable grade categories were produced by the sever at bloom treatment. A large amount of culls resulted from this treatment. Undersize tuber yields did not differ statistically for treatments.

Russet Norkotah produced the highest total yield in the control and the disturb treatments. Lowest yield was produced by the sever at bloom treatment, as for Russet Burbank. Treatments had similar yields of US No. 1's for Russet Norkotah, except for the sever at 8-inch and sever at bloom scenarios. Production of undersize tubers, No. 2's, and culls were not different for treatments for Russet Norkotah .

Mean tubers per plant was 11.9 for Russet Burbank, and 6.9 for Russet Norkotah. Treatment effects on tubers per plant are reported in Figure 3. There were no statistical differences for Russet Burbank, however, Russet Norkotah did differ statistically for treatments. Severing treatments produced fewer tubers per plant than the control or disturbing. Stems per plant averaged 3.8 for Russet Burbank and 3.4 for Russet Norkotah. Effects of the various treatments are presented in Figure 3. Russet Burbank was significantly impacted by the treatments, with the more severe treatments having more stems. Stems per plant were not significantly different for Russet Norkotah.

Effect of seed piece loss on vine size is presented in Figure 4. Both cultivars were significantly impacted by the treatments, although somewhat differently. The latest treatments resulted in smaller vine size for Russet Burbank. A different profile emerged for Russet Norkotah, where the sever treatment at 8 inches resulted in the smallest vine size. Vine maturity was not significantly different for treatments of either cultivar (data

Table 1. Effect of loss of mother tuber on yield and grade, 1997.

Cultivar	Treatment[1]	Total Yield	US No. 1 Yield	>12 oz.	6-12 oz.	4-6 oz.	<4 oz.	No. 2's	Culls
		CWT./Acre							
R. Burbank	Control	498	382	15	219	147	104	4	9
	Disturb E.	463	321	27	169	124	115	9	19
	Sever E.	407	300	26	168	106	99	1	7
	Disturb 8	433	319	25	171	123	96	2	15
	Sever 8	372	247	10	133	104	104	9	12
	Disturb B.	376	207	13	104	90	116	22	31
	Sever B.	301	129	9	74	47	119	4	49
LSD (∝=0.05)		64	74	21	52	34	33	7	31
R. Norkotah	Control	361	291	18	171	103	68	0	2
	Disturb E.	362	300	21	168	110	61	0	1
	Sever E.	288	233	24	137	72	49	2	5
	Disturb 8	331	267	20	166	82	58	1	5
	Sever 8	232	179	30	95	54	52	0	1
	Disturb B.	330	241	16	161	65	75	10	4
	Sever B.	169	91	2	52	38	52	19	5
LSD (∝=0.05)		77	69	19	62	32	33	20	8
Combined	Control	430	337	17	195	125	86	2	6
	Disturb E.	413	310	24	169	117	88	4	10
	Sever E.	347	267	25	152	89	74	1	6
	Disturb 8	382	293	22	169	102	77	1	10
	Sever 8	302	213	20	114	79	78	4	7
	Disturb B.	353	224	14	132	77	96	16	18
	Sever B.	234	110	5	63	42	86	12	27
LSD (∝=0.05)		48	48	14	39	22	23	10	16

[1] E = emergence, 8 = eight inches, and B = bloom.

not presented here). Samples were tested for susceptibility to shatter and blackspot bruise. Shatter bruise scores were not statistically different for the treatments within cultivars. Blackspot bruise susceptibility was significantly different. For Russet Burbank and Russet Norkotah the best blackspot scores were for the sever at bloom treatment. It is surmised that this is related to tuber maturity. Specific gravity of the sever at bloom treatments for both cultivars tended to be the lowest as well. Specific gravity levels were significantly different for treatments. The best gravities for Russet Burbank were for the control and early season treatments. Samples were fried from 45 F storage about 3 months after harvest. Fry color was not statistically different for Russet Norkotah for the various treatments. The color was also not acceptable by fry color standards. For Russet Burbank, two treatments produced acceptable color. The disturb at 8-inches and sever at bloom treatments produced light colored fries. Other treatments were significantly

Figure 1. Effect of seed piece loss on yield and grade for Russet Burbank, 1997.

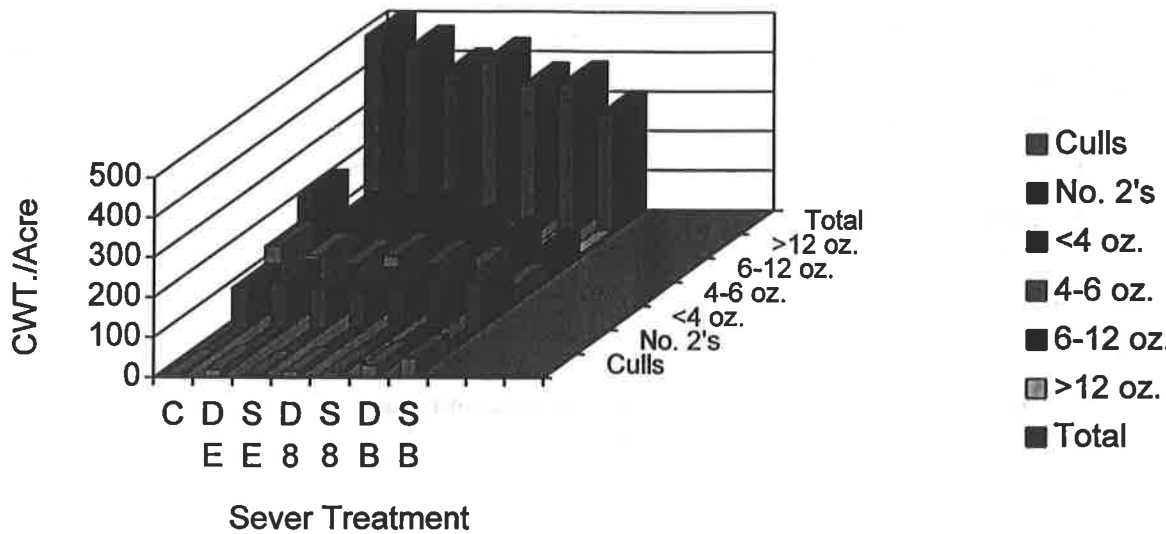


Figure 2. Effect of seed piece loss on yield and grade for Russet Norkotah, 1997.

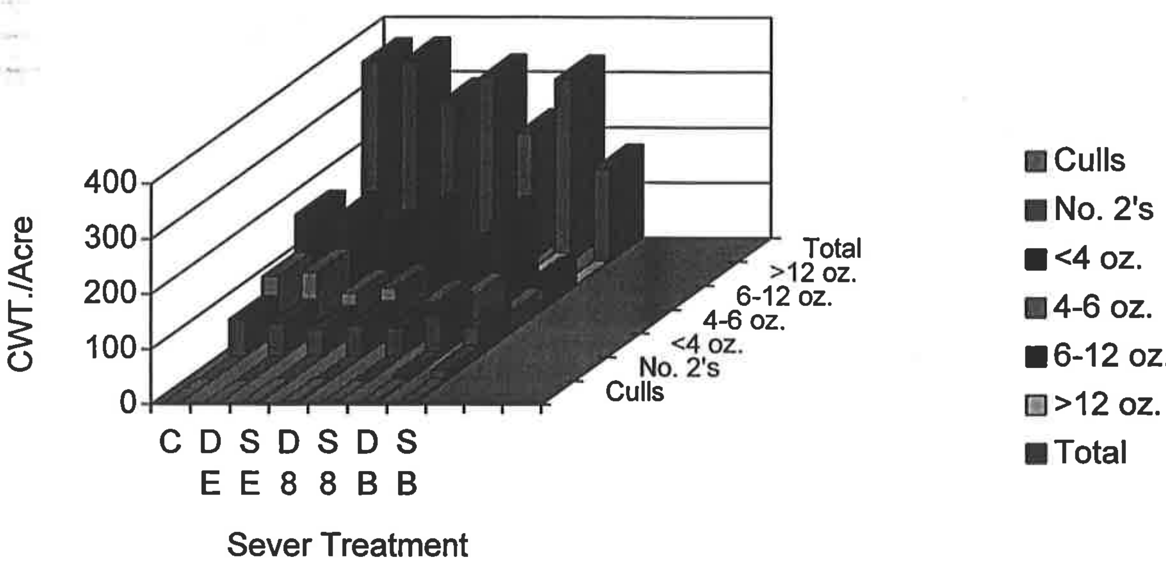
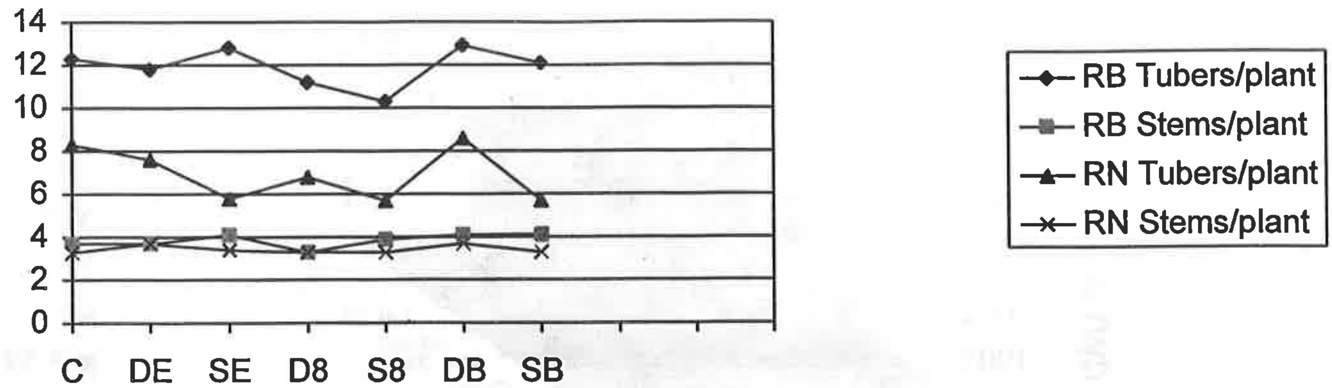
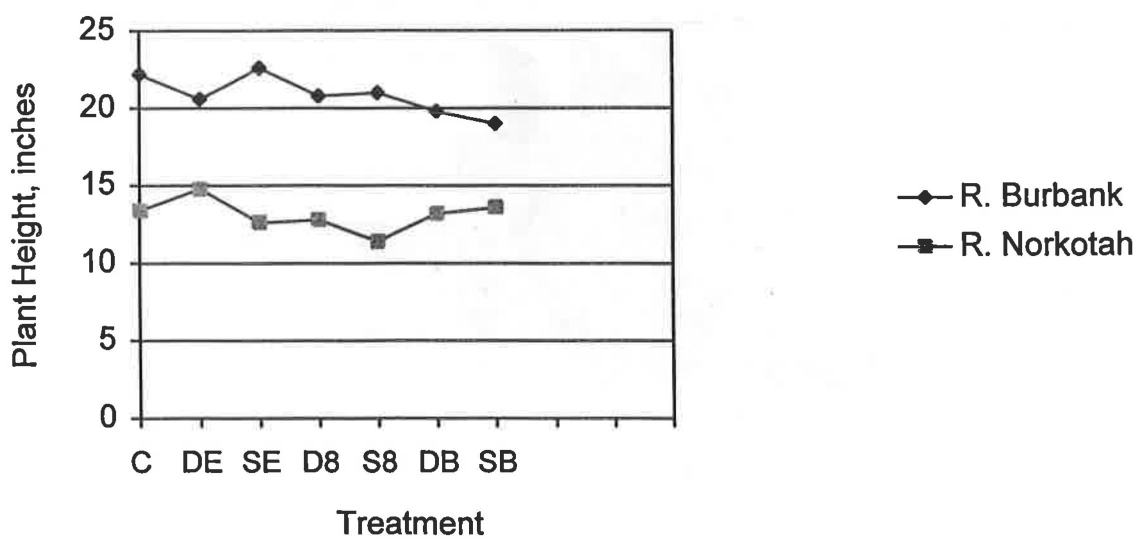


Figure 3. Effect of loss of mother tuber on tubers and stems per plant, 1997.



Least significant differences at ∝ = 0.05 - Russet Burbank tubers/plant = 3.5, stems/plant = 0.7. Russet Norkotah tubers/plant = 2.3, stems/plant = 0.6.

Figure 4. Effect of loss of the seed tuber on plant height profiles for Russet Norkotah and Russet Burbank, 1997.

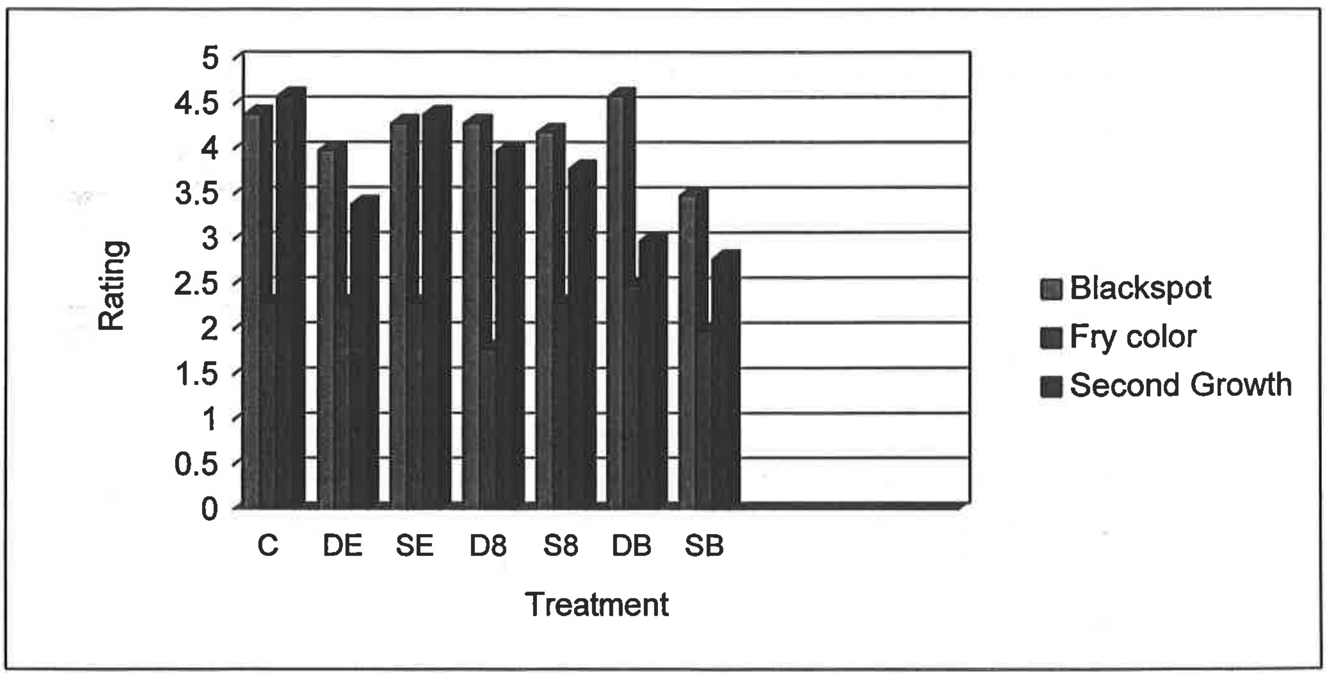


LSD (∝ = 0.05) for Russet Burbank = 3.5 inches, and for Russet Norkotah = 2.6 inches.

different and non-acceptable. There were no significant differences for percent sugar ends or presence of growth cracks (data not presented here). Second growth (knobs), however, were statistically different for the treatments. The sever at bloom treatment tended to make tubers more rough for both cultivars.

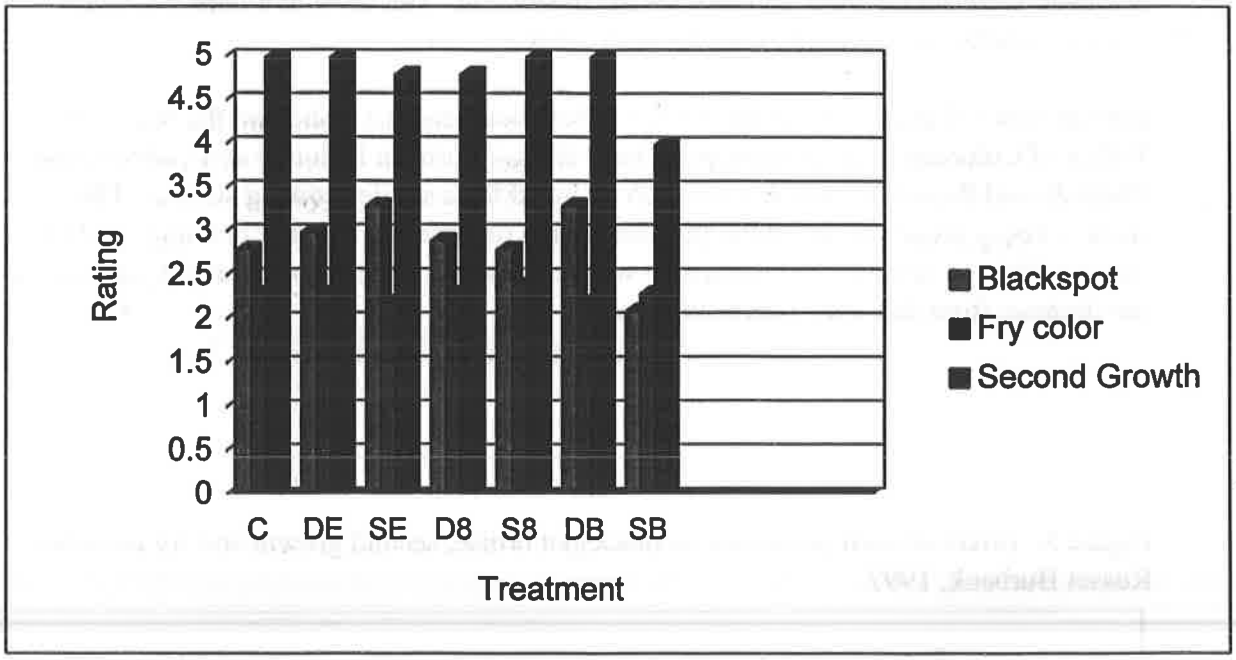
Several years of data have been gathered in both southeastern Idaho and the San Luis Valley of Colorado. All location years have Russet Burbank included as a cultivar, and Shepody and Russet Norkotah were each included for a single growing season. This work is being presented at the Potato Association of America meeting in Fargo, ND in July of 1998. A refereed journal article will be in the works shortly thereafter, presenting the findings from this very interesting study.

Figure 5. Effect of seed piece loss on blackspot bruise, second growth and fry color for Russet Burbank, 1997.



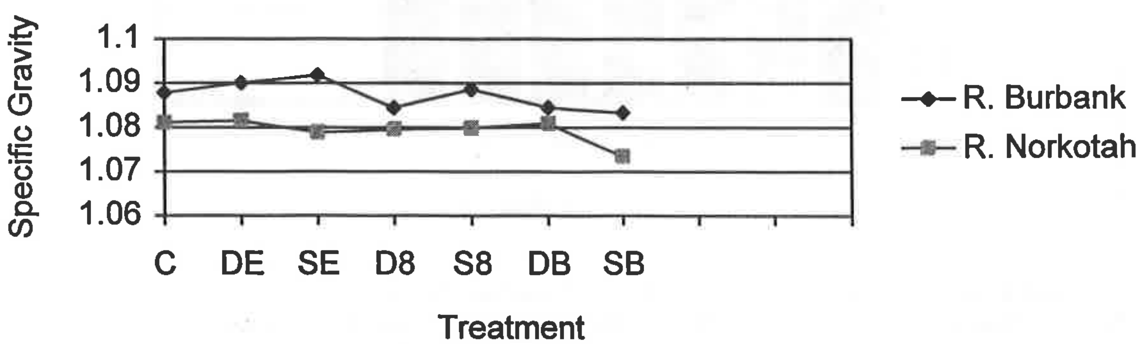
Blackspot bruise rating scale 1-5, 1=resistant, 5=very susceptible. LSD = 0.5.
Fry score from 45 F storage. Scale of 00-4, with 00=very white, 4=black. LSD=0.4.
Second growth rating scale 1-5, 1=all with knobs, 5=no knobs. LSD=1.0.

Figure 6. Effect of seed piece loss on blackspot bruise, second growth and fry color for Russet Norkotah, 1997.



Blackspot bruise rating scale 1-5, 1=resistant, 5=very susceptible. LSD = 0.6.
Fry score from 45 F storage. Scale of 00-4, with 00=very white, 4=black.
Second growth rating scale 1-5, 1=all with knobs, 5=no knobs. LSD=0.6.

Figure 7. Effect of seed piece loss on specific gravity for Russet Burbank and Russet Norkotah, 1997.



R. Burbank - LSD=0.0067, R. Norkotah - LSD=0.004.

CULTIVAR SPECIFIC MANAGEMENT

All factors making up a potato production management program must be done correctly to make a high-yielding, high-quality crop a reality. Growers should aim to achieve a maximum economic yield while being environmentally responsible. Cultivar specific management permits producers to put goals and actions on paper (PLAN!), gain a better understanding of individual situations, and aid in minimizing the seriousness of production emergencies because difficulties may be anticipated. Thus, growers may utilize management options which fit specific cultivars, avoiding or at least diminishing the risks and associated consequences.

The cultivar specific management worksheet introduced in early 1996 provides a mechanism to anticipate and plan for all aspects of the cropping season. The ideal situation is for the producer to view each cultivar individually, as if it were the only one being grown on the farm. Then, mesh all cultivars together in a way to provide for meeting the best management guidelines of individual cultivars. This may include planting cultivars with similar water or fertility requirements in the same circle, or designing vine kill and harvest to coincide with unique skin set requirements, etc.

Advantages of utilizing cultivar specific management in a producers operation include the opportunity to fine-tune and deal with cultivars on an individual, unique basis. Secondly, to identify and anticipate potential problems during the growing and storage seasons. Managing cultivars for optimum yield and quality based upon the response of the cultivar itself, and not on a general compromise across the operation is a third advantage. Additionally, it becomes easier to fit a new cultivar into the operation, to interpret research results dealing with new potato cultivars, and reduce problems which may have plagued the operation in the past because of poor management options.

A major objective of this research program is identifying the unique characteristics of advanced selections and new cultivars. These characteristics and associated production requirements are then combined to form a cultivar specific management profile. Several guidelines were available prior to re-establishment of this research program in 1995, however, the diversity of cultivars continues to evolve. In 1997 the cultivar specific management profile for DT6063-1R, an attractive bright-red skinned selection from the Colorado potato breeding program of Dr. David Holm, was disseminated. Due to interest in this advanced selection from many areas of North America, the management schematic has been widely distributed within the potato industry. It is our hope, as potato research and extension faculty, to include these newly developed profiles in the San Luis Valley potato production manual. The cultivar specific management guidelines for Russet Legend (COO83008-1), an attractive dual-purpose russet cultivar selected in Oregon from seedlings crossed and produced by Dr. David Holm, follow. It is the aim of this program to develop several more management schemes in 1998 for advanced selections and new cultivars of interest to producers in the San Luis Valley and Colorado.

CULTIVAR SPECIFIC MANAGEMENT WORKSHEET

Prepared by Susie Thompson-Johns and Robert D. Davidson, Colorado State University

1. **Cultivar** - ______________________________

2. **Market Niche/End Use** - ______________________________

3. **Yield Goal** - ______________________________

4. **Growth Habit** - ______________________________
   Indeterminate ______ or Determinate ______
   Maturity - Early ____, Medium ____, or Late ____

5. **Seed Supply**
   Classes Available - ______________________________
   Concerns - ______________________________
   Cut ___, Whole ____, or Combination ___
   Size - ______________________________
   Preparations for Planting - ______________________________

6. **Planting**
   Date - ______________________________
   Soil Temperature - ______________________________
   Seed Spacing - ______________________________

7. **Fertility**
   Required to Meet Yield Goal - ______________________________
   Pre-plant Soil Test - ______________________________
   Seasonal Water Nutrient Credit - ______________________________
   Total to Apply - ______________________________
   Amount to Apply Preplant - ______________________________
   Amount to Sidedress or Fertigate - ______________________________
   # of Applications & Amount per Application - ______________________________
   Date of Last Application - ______________________________

8. **Irrigation**
   Rooting Depth & Size - ______________________________
   Total to Apply - ______________________________
   Post-plant/Pre-emergence Interval & Amount - ______________________________
   Monitoring Tool(s) - ______________________________
   Interval at Maximum ET - ______________________________

9. **Weed Control**

Previous Crop - ____________________

Target Weeds - ____________________

Cultivation - ____________________

Chemical Control - ____________________

Cultivar Sensitivity - ____________________

Chemicals Used/Rate/Date - ____________________

10. **Insect/Disease Control**

Insect Problems - ____________________

Treatment/Rate/Date - ____________________

Disease Problems - ____________________

Treatment/Rate/Date - ____________________

11. **Vine Kill**

Bulking Rate & Time - ____________________

Predicted Date - ____________________

Desired Size Range - ____________________

Natural ______ or Chemical ______

Chemical Used/Rate/Date - ____________________

Kill - Rapid ______ or Slow ____

Disease & Quality Concerns - ____________________

12. **Harvest**

Time to Skin Set/Chemical Maturity - ____________________

Storage Preparation - ____________________

Rapid Cool Down - Yes _____ or No ______

Pre-harvest Irrigation - ____________________

Disease/Bruise Susceptibility - ____________________

Bruise Free Preparation - ____________________

Sort/Sizing into Storage - ____________________

Chemical Treatment/Rate - ____________________

13. **Storage**

Size/Location of Bins - ____________________

Length of Curing/Rapid Cool - ____________________

Temperature/RH - ____________________

Length of Storage - ____________________

Problems/Steps to Handle - ____________________

14. **Results** - ____________________

____

____

____

Russet Legend

Susie Thompson-Johns and Rob Davidson, Colorado State University

Russet Legend (COO83008-1) is an attractive, medium maturing potato cultivar with heavy russet skin. It has not been officially released by the Oregon Agricultural Experiment Station and Western Regional cooperators, but release is currently being pursued. Legend is a dual-purpose selection suitable for use in the fresh market and for processing as high quality French fries. This selection emerges rapidly and has a medium vine with white flowers. Legend has a determinate growth habit and a moderate root system. Tubers are oblong to long, with white flesh. Eyes are shallow and fairly well distributed. Specific gravity is medium to high (1.087+). Yield potential may exceed 450 cwt./acre, with US No. 1 production in excess of 90%.

GROWING SEASON MANAGEMENT

Pre-planting considerations: Tubers have medium dormancy. Single drop or cut seed is acceptable. When using cut seed, utilize practices which enhance suberization and prevent decay by pathogens. For seed, within-row spacing should be 6-8 inches. For commercial production space at about 12 inches. Plant seed about 4 inches deep with a good cover.

Fertility: Total fertilizer applied during the growing season should be in the following range, based upon soil analysis: N(160-180), P(100-200), K(0-60). Pre-plant incorporated N should be from 70 to 90#. Early season N applications do not seem to adversely affect the timing of tuberization. Sprinkler applied N should be in the 70 to 90# range, with applications ending within one month of harvest to promote adequate vine maturity and tuber skin set.

Irrigation: Interval at the maximum ET is about 3 days. Drought tolerance is moderate. Water usage will decline as vines mature, so monitor fields to prevent over watering late in the season and potential decay by pathogens such as *Pythium* or *Phytophthora*.

Pest control:

Weeds: Competition against weeds is good. Legend is resistant to metrubuzin. Adverse reactions to other commonly utilized herbicides for potato production have not been noted in grower experiences.

Insects/Diseases: Standard insect control measures generally are effective. Control of foliar early blight usually requires 4-5 applications of fungicide.

Tuber development: Russet Legend consistently sets 7-9 tubers per plant. Tubers are set somewhat shallow in the hill, so greening may be a factor. Tuberization occurs early and tubers bulk at a very rapid rate. Legend will occasionally develop growth cracks and second growth. Internal quality is good. Tubers have a moderate response to shatter and blackspot bruise.

Vine kill: Average days from planting to vine kill are 105 to 110. Vine killing is usually required and is easy to accomplish. Adequate skin set occurs at about 21 days. Oversize tubers may be a problem, so carefully monitor the crop beginning in mid-August.

STORAGE MANAGEMENT

Legend is a long-term storage potato with few problems, and sprouting is minimal. Legend may be stored slightly cooler than Russet Burbank if intended for processing.

DISEASE REACTION

Overall disease problems are minimal. Bacterial ring rot foliar symptom expression is adequate and occurs within 95 days after planting. Potato leafroll virus symptoms are also sufficient. Bacterial soft rot, caused by *Erwinia*, may be a problem in storage, and in the field as seed piece decay.

Field	
Foliar early blight	MS
Verticillium wilt	MR
Blackleg	S
Seedpiece decay	MS
Leafroll virus	MS
Leafroll net necrosis	MR
PVY	S
PVX	S
Common scab	
Bacterial ring rot	S
Storage	
Tuber early blight	MS
Bacterial soft rot	MS
Fusarium dry rot	MS
Leak (*Pythium*)	
Pink rot (*Phytophthora*)	
Silver scurf	
Rhizoctonia scurf	

Disease reaction ratings = susceptible, moderately susceptible, moderate, moderately resistant and resistant.