RESEARCH PROGRESS REPORT FOR 1985

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Research in 1985 was conducted in the following areas:

a) Potato Clone Spacing and Fertility
b) Preplant Nitrogen
c) Conservation Tillage
d) Sencor Application Timing
e) MH-30 Trial
f) Alar Trial
g) Minituber Size
h) Microplant Starter Fertilizer
i) Microplant Spacing

All plots were located at the San Luis Valley Research Center on a sandy loam soil (pH 8.0-8.3, 1.0-1.2% O.M., 6-7 ppm residual nitrate). Unless otherwise noted, the plots were irrigated with a center pivot sprinkler.

POTATO CLONE SPACING AND FERTILITY

Four advanced selections (WNC567-1, WNC285-18, TC582-1, and AC77652-1) were compared for response to spacing and nitrogen rate with Russet Burbank and Centennial. Three in-row spacings (9, 12 and 15 inches) and three nitrogen rates (80, 120 and 160 lbs N/acre) were used. All plots received 100 lbs P_2O_5/acre. The plot was planted on May 17, 1985, and harvested on September 10, 1985.

TC582-1 produced the highest total yield and yield of U. S. No. 1 potatoes (Table 1). All advanced selections except AC77652-1 produced U. S. No. 1 yields as high as Centennial. All advanced selections produced higher percentage No. 1's than Russet Burbank.

U. S. No. 1 yield and percentage No. 1 yield increased with increasing nitrogen rate in all clones except Centennial and AC77652-1 (Table 1). Russet Burbank was the only clone in which increasing nitrogen rate resulted in an increase in total yield.

The highest U. S. No. 1 yields were produced at the largest in-row spacing (15 inches) in Russet Burbank and TC582-1 (Table 2). The percentage U. S. No. 1's was generally highest at the largest spacing for all clones. Total yield was not affected by in-row spacing, with the exception of Centennial and WNC567-1 where total yield decreased with increased spacing (Table 2).

Table 1. Effect of nitrogen rate on total yield, U. S. No. 1 yield, and percentage No. 1 of 6 potato clones.

N Rate	Russet Burbank	Centennial	WNC567-1	WNC285-18	TC582-1	AC77652-1
	Total Yield (Cwt/Acre)[1]					
80	301.0 b[2]	260.1a	295.6a	253.7a	327.5a	249.4a
120	316.6ab	259.4a	289.7a	269.4a	333.7a	234.1a
160	328.5a	248.7a	306.8a	268.5a	330.5a	235.9a
	U. S. No. 1 Yield (Cwt/Acre)					
80	127.8 c	170.7a	185.5 b	162.9 b	198.8 b	170.1a
120	167.8 b	174.8a	201.5ab	189.0ab	225.4ab	166.1a
160	202.0a	173.8a	221.9a	199.0a	236.0a	160.2a
	% U. S. No. 1					
80	42.2 c	65.6a	62.7 b	64.2 b	60.4 b	68.1a
120	52.7 b	67.3a	69.3a	70.1ab	67.3a	70.7a
160	61.3a	69.6a	72.3a	73.6a	71.2a	67.7a

[1]Values are means of 4 replications averaged over 3 spacings

[2]Column means followed by the same letter are not significantly different (P<.05) by LSD test.

Table 2. Effect of in-row spacing on total yield, U. S. No. 1 yield, and percentage No. 1 of 6 potato clones.

Spacing	Russet Burbank	Centennial	WNC567-1	WNC285-18	TC582-1	AC77652-1
	Total Yield (Cwt/Acre)[1]					
9	308.4a[2]	270.8a	311.4a	273.1a	334.3a	248.3a
12	317.2a	259.9a	296.1ab	261.7a	334.0a	240.7a
15	320.5a	237.6 b	284.7 b	256.8a	323.3a	230.5a
	U. S. No. 1 Yield (Cwt/Acre)					
9	139.6 c	171.0a	212.4a	185.1a	201.0 b	164.0a
12	165.7 b	172.0a	198.6a	179.4a	222.9ab	169.8a
15	192.3a	176.2a	197.8a	186.4a	236.2a	162.6a
	% No. 1 Yield					
9	44.3 c	62.9 b	68.0a	67.6a	59.7 c	66.0a
12	51.9 b	65.5 b	67.1a	68.1a	66.3 b	70.4a
15	60.0a	74.1a	69.2a	72.3a	73.0a	70.1a

[1]Values are means of 4 replications averaged over 3 nitrogen rates.

[2]Column means followed by the same letter are not significantly different (P<.05) by LSD test.

PREPLANT NITROGEN

Russet Burbank, Centennial and Sangre were grown at 5 preplant nitrogen rates (40, 80, 120, 160 and 200 lbs N/acre) to determine the effect on tuber and vine growth, and final yield. Petioles were analyzed for nitrate and phosphate to determine differences between cultivars. The nitrogen treatments were banded in the center of each row along with 100 lbs P_2O_5/acre prior to planting. The plots were planted on May 14, 1985. Each plot consisted of 3 rows, 25 feet long with plants spaced 12 inches apart. Five adjacent plants in one row were harvested on each of 8 dates to determine tuber and vine growth rates. Petiole samples were taken from plants in the adjacent row. One complete row was harvested on September 9, 1985, to determine total and marketable yield.

This two-year study has shown that increasing preplant nitrogen rates from 40 to 200 lbs N/acre delays tuber growth in all cultivars by at least two weeks (Figures 1 to 3). Tuber growth rate in the 40 lb N/acre rate generally decreases after July 22 (Figures 1 and 2). If nitrogen applications through the sprinkler were begun prior to July 22, tuber growth rate should not decrease in the low preplant N plot (dotted line in Figure 4), resulting in a higher final yield. This is the principle behind seasonal applications of nitrogen. Very high applications of nitrogen at planting can delay tuber growth enough to reduce final yield under San Luis Valley conditions. However, there are differences between cultivars in response to nitrogen rate each year. Russet Burbank did not show a decrease in final yield due to high preplant nitrogen in 1985, although it showed the largest decrease in 1984 (Table 1). Centennial Russet has shown the least response to high rates of preplant nitrogen in both years of this study. Figure 5 shows the relationship of nitrogen rate to total and marketable yield for all clones when averaged for 1984 and 1985. Total and marketable yields decrease when nitrogen is banded at planting at rates higher than 160 lbs N/acre.

Nitrogen rate also affects vine growth. Vine growth rate decreases rapidly within 60 days after planting (approximately July 15) when nitrogen rates are below 120 lbs N/acre (Figure 6). This indicates that to obtain adequate early season vine growth with minimum delay in tuber growth, 60 to 100 lbs of nitrogen should be applied at planting. The rest of the nitrogen requirement of the crop can be applied through the sprinkler after tuber initiation. Tuber initiation usually occurs within the first two weeks of July, but will vary with planting date, cultivar grown, cultural practices and environment. Regardless of preplant nitrogen rate, vine weight begins to decrease within 80 days (approximately July 28) after planting (Figure 6). This drop in vine weight is associated with senescence of the plants. Once senescence begins, nutrient uptake from sprinkler applications becomes less efficient. Therefore, applications of nutrients to any of these varieties after the second week of August will probably not have a favorable effect on yield. Excessive application of nitrogen late in the season can delay maturity and decrease quality of the tubers.

Petiole nitrate level increased with increasing preplant nitrogen rate in all cultivars (Table 2). Centennial contained the highest nitrate level in petioles at each nitrogen rate (Figure 7, Table 2). Petiole nitrate levels in Russet Burbank and Sangre dropped below the 15,000 ppm guideline by mid to late July. Nitrate levels in Centennial petioles did not drop below 15,000 ppm until 7 to 14 days later (Table 2). This indicates that the 15,000 ppm nitrate guideline may not as closely predict nitrogen deficiencies in Centennial as it does in Russet Burbank.

Petiole phosphate levels were not as greatly affected by preplant nitrogen rate (Figure 8). Petiole phosphate levels dropped below the 1,000 ppm guideline by early August regardless of preplant nitrogen rate. There were also differences in petiole phosphate levels between cultivars (Figure 9). Sangre contained higher phosphate levels in petioles, especially early in the season. However, the date at which phosphate levels dropped below the 1,000 ppm level was not much later in Sangre than in Centennial and Russet Burbank.

Table 1. Effect of preplant nitrogen rate on total yield of Russet Burbank, Centennial and Sangre in 1984 and 1985.

Cultivar	N Rate (lbs/acre)	Total Yield 1984	Total Yield 1985
		Cwt/Acre	
Russet Burbank	40	290.3[1]	216.5
	80	299.8	245.8
	120	386.4	266.2
	160	311.6	278.0
	200	341.0	319.8
Centennial	40	255.2	197.9
	80	284.3	229.6
	120	290.3	209.1
	160	308.4	210.2
	200	319.5	207.1
Sangre	40	312.2	287.9
	80	407.1	318.9
	120	416.6	350.1
	160	389.6	333.7
	200	388.3	331.0
LSD (.01)[2]		54.1	46.4

[1] Values are means of 4 replications.
[2] Values which differ by more than LSD value are significantly different (P>.95).

Table 2. Effect of preplant nitrogen rate on petiole nitrate level of Russet Burbank, Centennial and Sangre on 4 sampling dates.

Cultivar	N Rate (lbs/acre)	Petiole Nitrate (ppm) Sample Date 7/10	7/23	8/7	8/21
Russet Burbank	40	16530[1]	3380	780	350
	80	19880	7320	2850	1090
	120	23160	16160	11300	5020
	160	21880	19870	15020	8720
	200	23310	17490	13560	11200
Centennial	40	24050	9450	2120	1230
	80	24070	15170	10230	6350
	120	22500	19310	15390	11020
	160	21950	19270	18450	13890
	200	21870	19330	16220	13880
Sangre	40	14240	1780	210	130
	80	18740	7140	2920	450
	120	22800	12080	5300	2090
	160	19750	13120	7500	4030
	200	21410	15920	13610	5890

[1] Values are means of 4 replications.

Fig. 1. Comparison of tuber growth at two preplant nitrogen rates in Russet Burbank during 1985. Values are means of 4 replications.

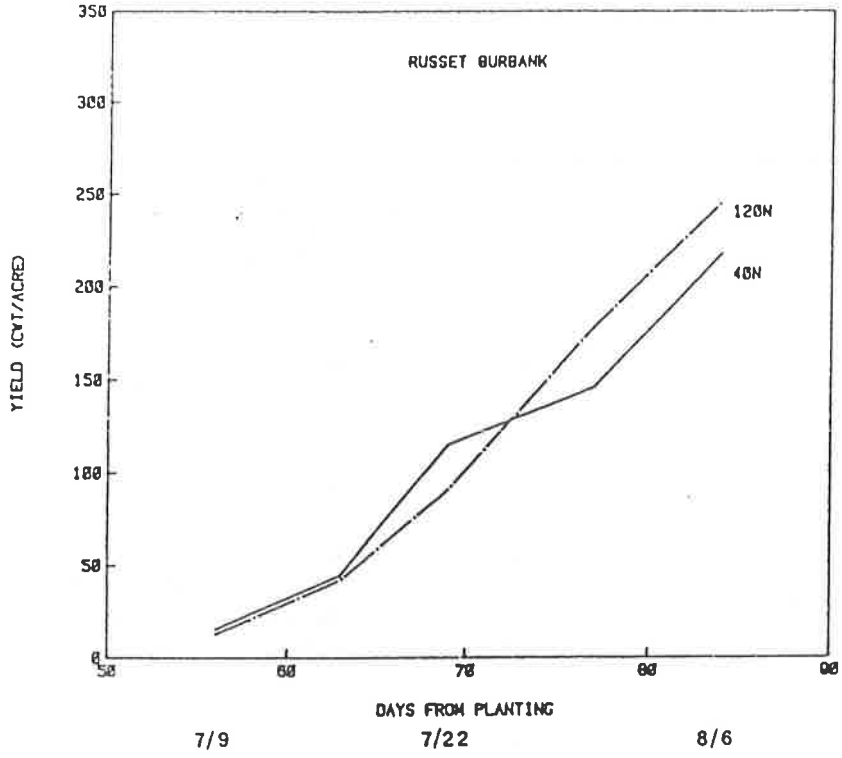


Fig. 2. Comparison of tuber growth rate at two preplant nitrogen rates in Sangre during 1985. Values are means of 4 replications.

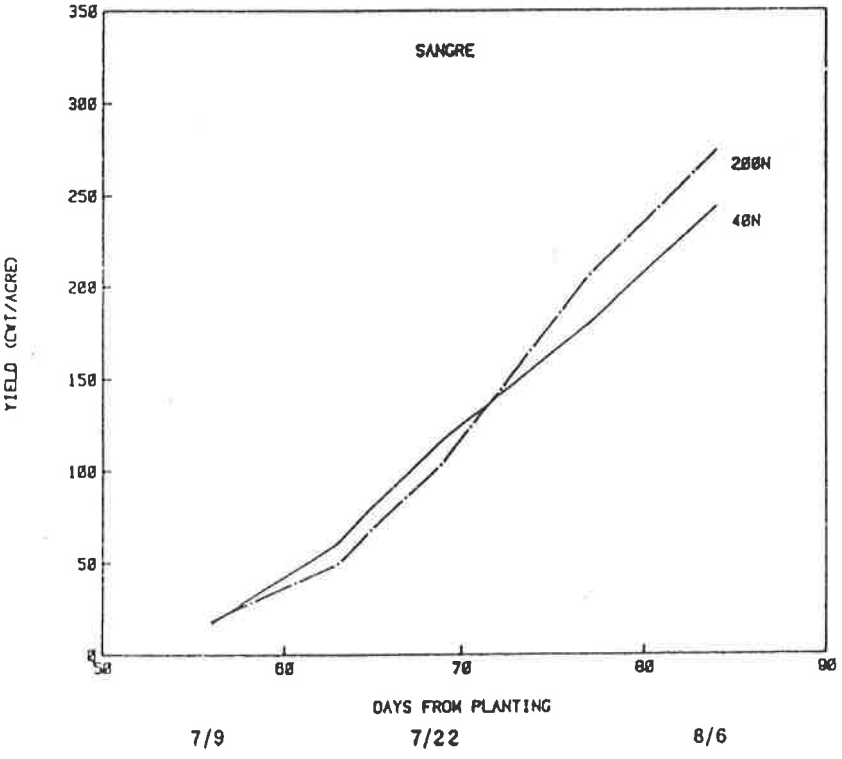


Fig. 3. Comparison of tuber growth at two preplant nitrogen rates in Centennial during 1985. Values are means of 4 replications.

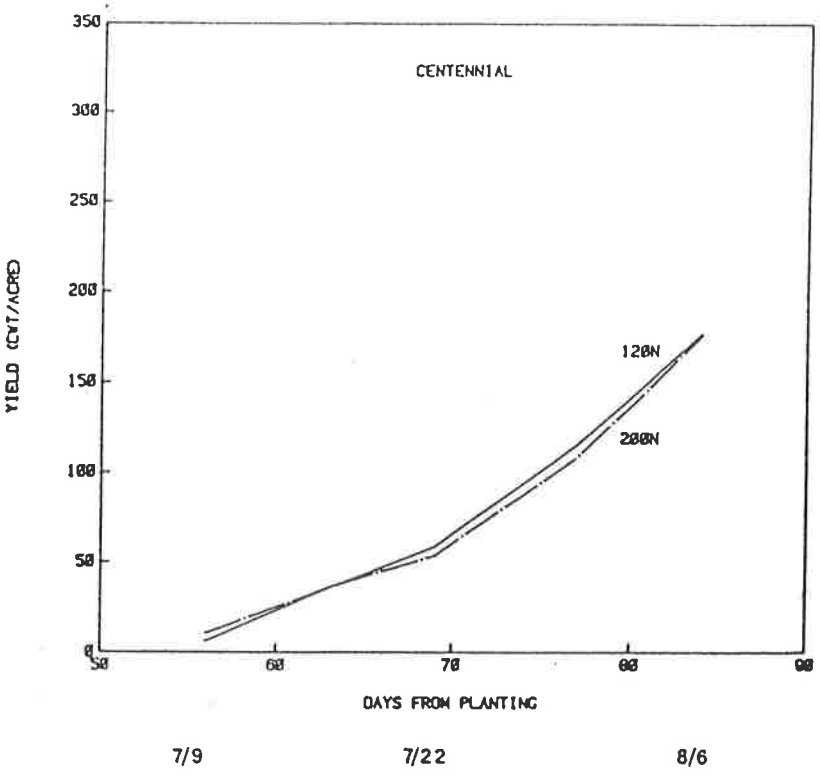


Fig. 4. Comparison of tuber growth at low and high preplant nitrogen rates in Russet Burbank during 1985. Values are means of 4 replications.

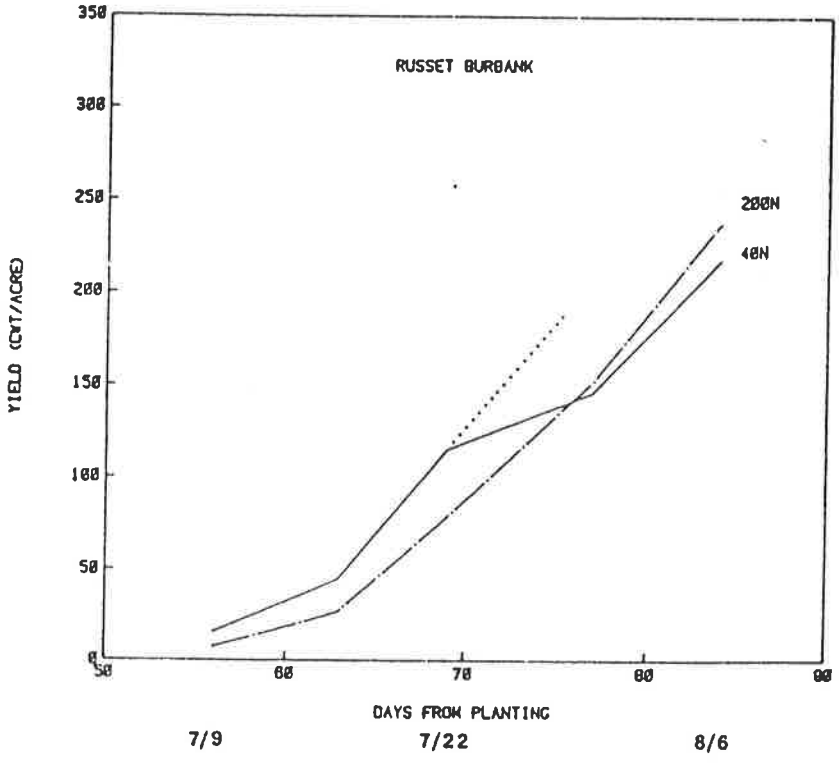


Fig. 5. Relationship between preplant nitrogen and yield. Values are averages for Russet Burbank, Centennial and Sangre cultivars during 1984 and 1985.

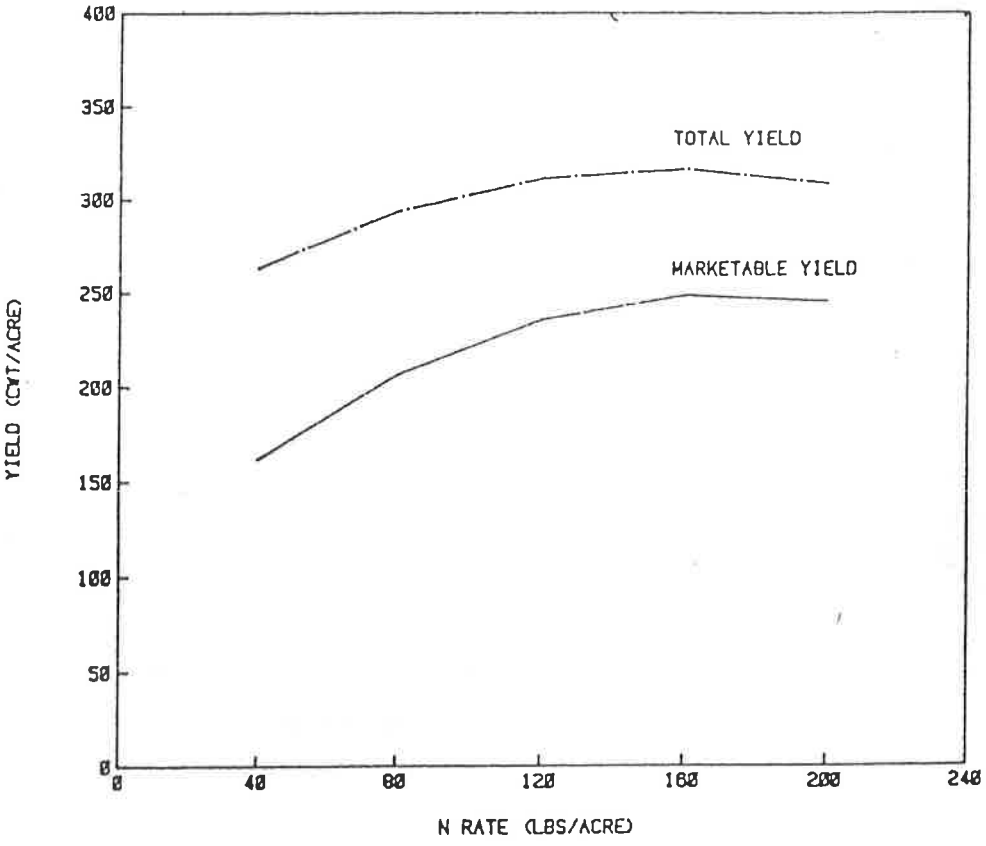


Fig. 6. Comparison of vine growth at three preplant nitrogen rates. Values are averages for Russet Burbank, Centennial and Sangre cultivars during 1984 and 1985.

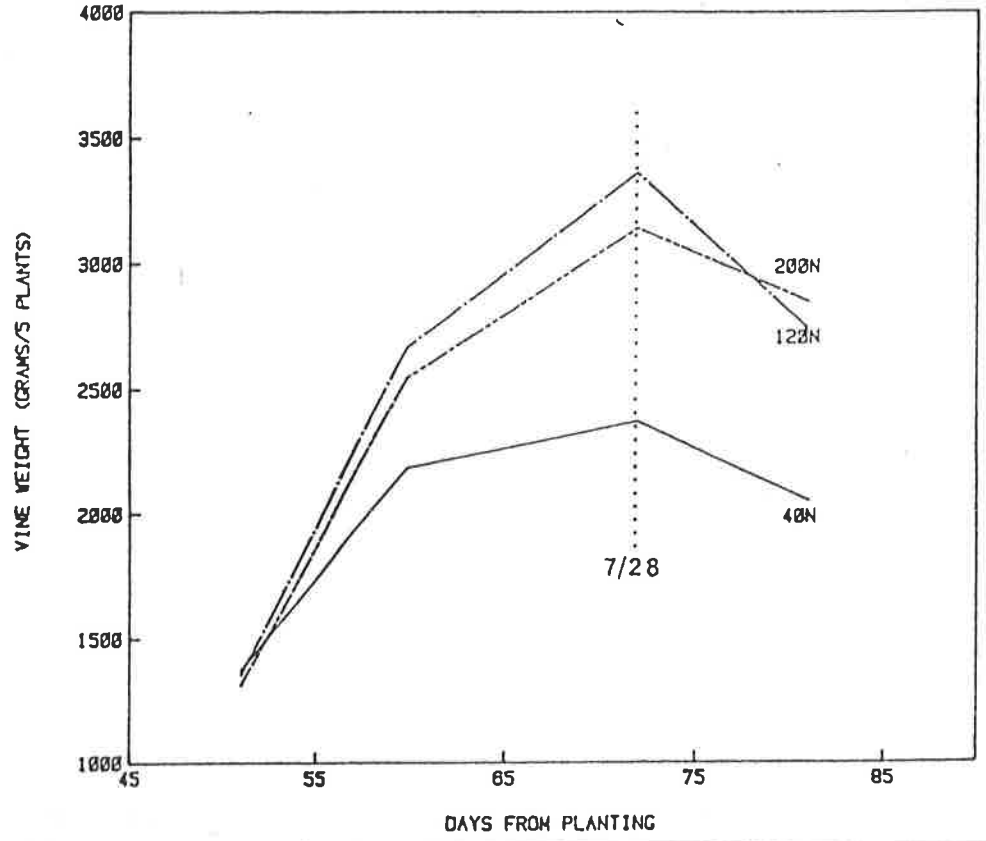


Fig. 7. Comparison of petiole nitrate levels for Russet Burbank, Centennial and Sangre at the 120 lb-N/acre preplant nitrogen level during 1985. Values are means of 4 replications.

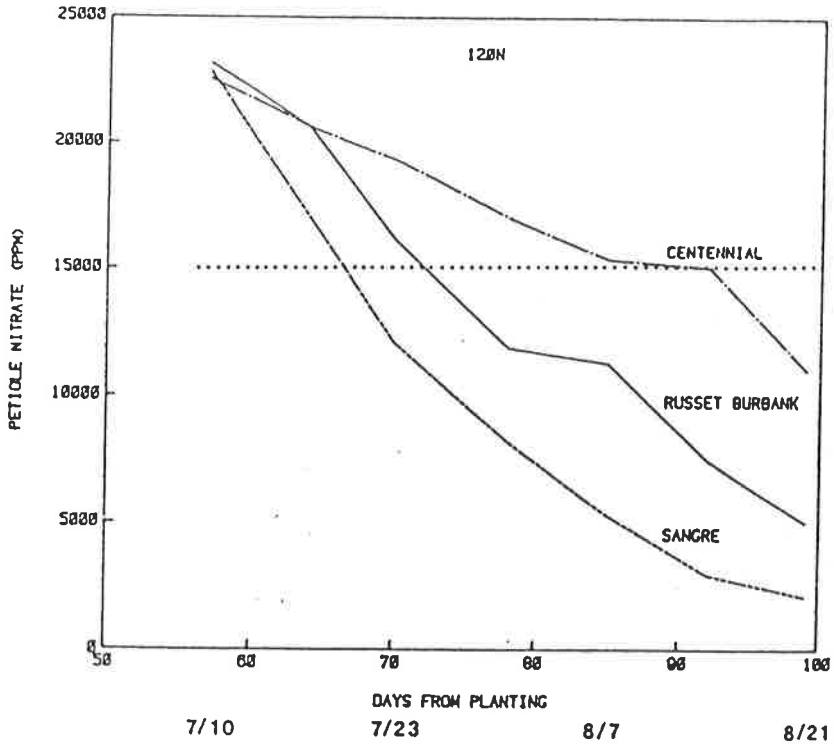


Fig. 8. Comparison of petiole phosphate levels at three preplant nitrogen rates during 1985. Values are averages for Russet Burbank, Centennial and Sangre cultivars.

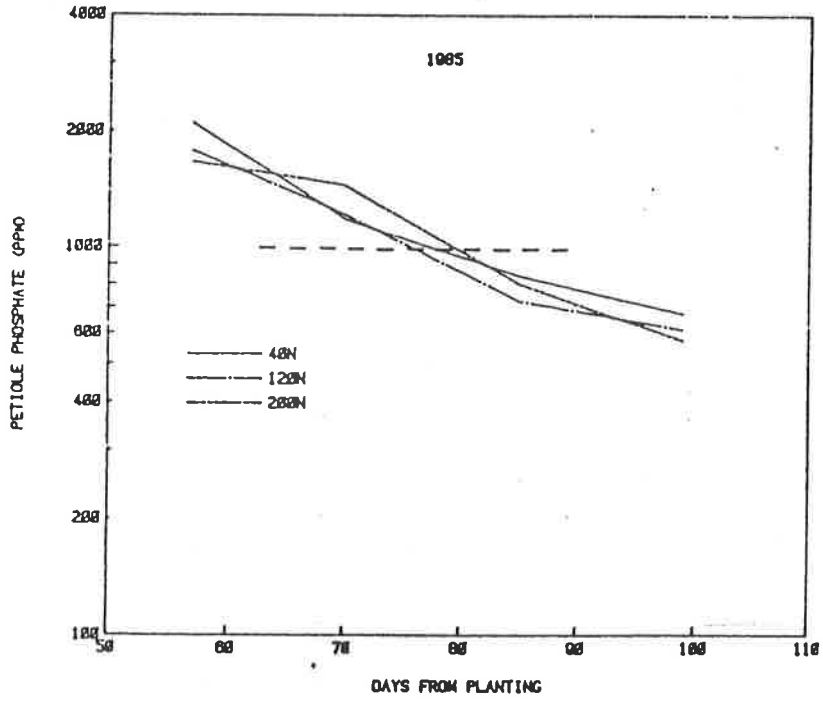
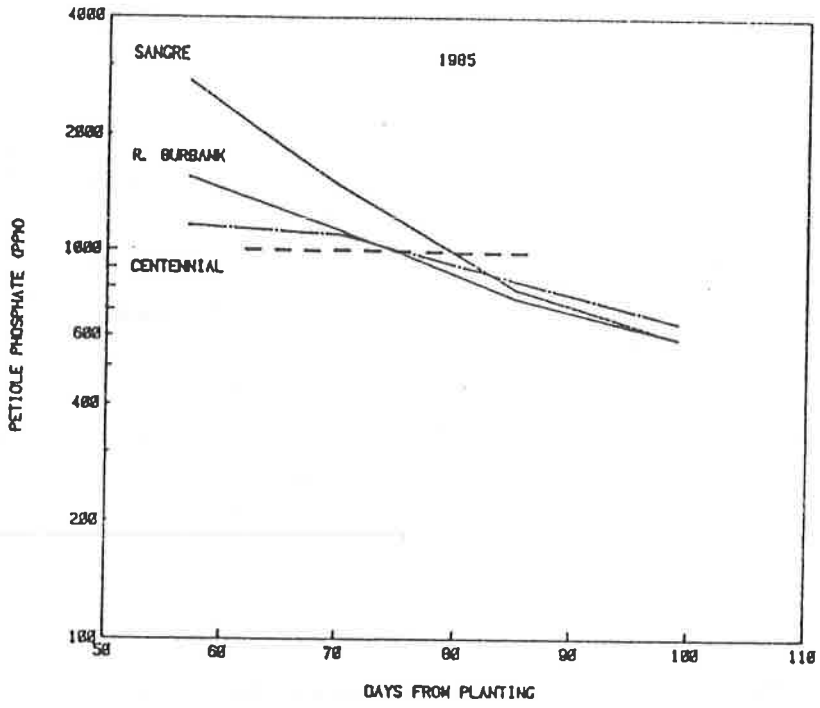


Fig. 9. Comparison of petiole phosphate levels for the Russet Burbank, Centennial and Sangre cultivars during 1985. Values are averages for 5 preplant nitrogen rates.



7/10

8/21

CONSERVATION TILLAGE

The conservation tillage regime for potatoes consisted of a fall disking on October 3, 1984, and primary tillage with a rotary chisel plow on April 12, 1985. The disk and rotary chisel plow left most of the wheat stubble on the surface. The potato rows were marked out on April 24, 1985, and 140 lbs N, 175 lbs P_2O_5 and 52.5 lbs K_2O banded in each row.

The conventional tillage potato ground was tilled with a moldboard plow and the potato rows marked out in the Fall of 1984. Fertilizer was banded in the rows at the same rate as in the conservation tillage plot. Conservation and conventional tillage plots were planted with Centennial Russet potatoes on May 3, 1985, at 12 inch in-row spacing (15,000 plants/Acre). All plots were cultivated and hilled on June 3, 1985. Dual 8E herbicide was applied to approximately half of each plot at a rate of 2 pints per acre by ground rig sprayer on June 4, 1985. Stand, petiole nutrient data, and yields were collected from the section of conservation and conventional tillage plots sprayed with Dual.

The other half of each tillage plot was marked out for a herbicide trial. The plots were cultivated and hilled on June 3 and all herbicides applied pre-emergence to both conservation and conventional tillage areas on June 5. The treatments were applied with an R&D backpack sprayer with two-row boom, LF-3 flat fan nozzles, 40 psi and 2.1 mph walking speed to apply 40 gallons of spray per acre. Herbicide rates are given in Table 1. The herbicides were incorporated with one-half inch of water on June 5, 1985. Total irrigation application for the season was 10.3 inches, with 3.4 additional inches of moisture from rain.

Visual observations of weed control effectiveness were made on July 5 and July 18, 1985. Plots were rated on a 0-5 scale with 0 being no control, 5 being 100% control. Check plots receiving no herbicide applications were established for both conservation and conventional tillage areas to determine major weed species present.

Six 25 foot areas, two rows wide were harvested by hand from each tillage plot on September 9, 1985.

Potato plants emerged in the conservation and conventional tillage plots on June 9, 1985. Plant stand in conservation tillage plots averaged 95 percent, which was not different than conventional tillage.

The population of weeds was higher under conservation tillage. Hairy nightshade, Redroot pigweed and Green foxtail were the major weeds in both tillage plots. Volunteer wheat was not a major weed in the conservation tillage plot due to the late spring tillage with the chisel plow, which killed the germinating wheat. Weed control ratings for the six herbicide treatments are given in Table 1. All herbicide

treatments are given in Table 1. All herbicide treatments except Dual and Dual + Prowl gave good control of Pigweed. Prowl + Lorox, Sencor + Dual, and Prowl + Eptam gave the best control of Nightshade. Dual, Dual + Sencor and Prowl + Eptam gave the best control of Foxtail. In several cases, the level of weed control in the conservation tillage area appeared to be slightly less than in the conventional tillage. Several of the herbicides provided good weed control under either tillage regime. Plants sprayed with Sencor exhibited some phytotoxicity symptoms.

The level of the nutrients in petioles of plants from the two plots were significantly different on several dates (Table 2). Levels of N, P and K were higher in petioles of plants from conservation tillage early in the season (June 27); however, nutrient levels were higher in petioles of potatoes in conventional tillage by the end of the season (August 7). This data does not support the theory that wheat stubble ties up nutrients in conservation tillage potatoes early in the season. The reason for these differences in petiole nutrient levels between tillage plots is unknown.

The conservation tillage plot produced higher total and marketable yields than the conventional tillage plot (Table 3). The conservation tillage plot produced an average of 27 more cwt per acre in total yield. This is in contrast to the 1984 results where conventional tillage plots yielded higher. This change would mostly be attributed to the control of volunteer wheat in the conservation tillage plot in 1985.

Table 1. Weed control ratings of 6 herbicide treatments applied to Centennial Russet potatoes in 1985.

			Hairy Nightshade		Redroot Pigweed		Green Foxtail	
Herbicide	Rate (Product/Ac)	Tillage	7/5	7/18	7/5	7/18	7/5	7/18
Dual 8E +	2.0 pt +	Conservation	2[a]	3	3	3	2	3
Prowl	1.5 pt	Conventional	3	3	4	4	2	3
Prowl +	1.5 pt +	Conservation	4	4	5	5	3	4
Eptam 7E	3.5 pt	Conventional	4	4	5	5	3	4
Prowl +	1.5 pt +	Conservation	5	5	5	5	3	3
Lorox	2.0 lbs	Conventional	5	4	5	5	3	3
Sencor DF	1.0 lbs	Conservation	3	3	5	5	3	3
		Conventional	4	3	5	5	3	4
Dual 8E	2.5 pt	Conservation	3	3	4	3	3	4
		Conventional	4	3	4	4	3	4
Sencor DF +	0.67 lbs+	Conservation	3	5	5	5	3	4
Dual 8E	2.0 pt	Conventional	4	4	5	5	3	4

[a] 0-5 scale: 0 = 0% control; 5 = 100% control.

Table 2. Petiole levels of nitrate, phosphorus, and potassium in conservation and conventional tillage Centennial Russet potatoes in 1985.

Date	Tillage	ppm	% P	% K
6/27	Conventional	19,900[a]	0.09	8.28
	Conservation	23,000*[b]	0.14*	8.72*
7/10	Conventional	21,900	0.10	8.64
	Conservation	22,100	0.14*	9.16
7/23	Conventional	19,500*	0.12	7.92*
	Conservation	17,000	0.12	7.41
8/7	Conventional	17,200*	0.10	5.65*
	Conservation	8,700	0.08	4.86

[a] Values are means of 6 samples.
[b] Means are significantly different (P>.95) by student t-test.

Table 3. Yield of conservation and conventional tillage Centennial Russets harvested 9/9/85.

	Yield (Cwt/Acre)[a]	
Tillage	Total	Marketable
Conservation	263.1*[b]	185.3*
Conventional	236.1	161.4

[a] Values are means of 6 samples.
[b] Means are significantly different (P>.95) by students t-test.

SENCOR APPLICATION TIMING

Fertilizer was banded in the center of each row at the rate of 140lbs N, 175 lbs P_2O_5 and 52.5 lbs K_2O prior to planting. Seedpieces of each clone were planted at a depth of 4-5 inches on May 5, 1985. The plot was arranged in a randomized complete block design with 4 replications. An unsprayed border row was planted between each plot. The plots were cultivated and hilled on June 3, 1985. On June 5, the pre-emergence Sencor applications were made using an R&D backpack sprayer. Rates of application of Sencor 4 for the pre-emergence plots are given in Table 1. The check plots were hand weeded twice during the summer. One-half inch of water was applied by sprinkler within 7 days after the application to incorporate the herbicide. A postemergence application of Sencor 4 was made on June 18 to all clones except Nooksack. The post-emergence application to Nooksack was made on June 27. Rates of application of Sencor 4 for the post-emergence plots are given in Table 2. One inch of water was applied by sprinkler within 13 days after the June 18th application to incorporate the herbicide. Total irrigation application for the season was 10.3 inches, with 3.4 additional inches from rain.

Observations of crop injury due to Sencor 4 were made on July 11, 1985. The vines were beat on September 9 and the plots hand harvested the same day. Data were taken on total and marketable yield.

Pre-emergence application of Sencor 4 at the highest labeled rate (1.0 lb AI/Acre) caused considerable thinning in Centennial (Table 1). A high percentage of Centennial plants also showed severe stunting at this rate. All other clones showed no thinning and less than 10 percent stunting at the one pound rate. At double the labeled rate (2.0 lbs AI/Acre) Sencor 4 caused severe thinning in Centennial, Russet Burbank and WNC567-1 (Table 1). Stunting was above 10 percent in all clones at this rate. Only Nooksack and TC582-1 did not show thinning at the 2 pound rate. Nooksack appeared to be most resistant to crop injury from pre-emergence applications of Sencor 4. Centennial was the most sensitive clone.

Post-emergence application of Sencor 4 at the highest labeled rate (0.5 lbs AI/Acre) caused stunting in Centennial and TC582-1 only (Table 2). Post-emergence application of Sencor 4 at the one-half pound rate did not cause thinning in any clone. At double the labeled rate (1.0 lbs AI/Acre) Sencor 4 caused severe thinning in Centennial (Table 2). Stunting was above 10 percent in Russet Burbank, Centennial and TC582-1 at this rate. Nooksack and WNC567-1 showed slight stunting at the one pound rate. Nooksack and WNC567-1 appeared to be the most resistant to crop injury from post-emergence applications of Sencor 4.
Centennial was most sensitive to Sencor.

Yield reductions associated with Sencor applications were related to crop injury. Pre-emergence applications of Sencor 4 at the 2 pound rate caused significant yield reductions in all clones (Table 3). Pre-emergence applications of Sencor 4 at the labeled rate (1.0 lb AI/Acre) resulted in lower yields than the hand weeded check in Centennial only (Table 3). However, plots treated with Sencor 4 pre-emergence at the 1 pound rate yielded significantly lower than the one-half pound post-emergence rate in all clones except Nooksack and TC582-1. The labeled post-emergence rate (0.5 lb AI/Acre) of Sencor 4 tended to produce the highest yields for all clones except Centennial (Table 3). Post-emergence application of Sencor 4 at twice the labeled rate (1.0 lb AI/Acre) caused significant yield reductions compared to the post-emergence labeled rate (0.5 lb AI/Acre) in Russet Burbank and Centennial. Yields of Nooksack and TC582-1 were least affected by Sencor 4 applications (Table 3). Sencor 4 affected the yield of Centennial most severely.

Visual observations of plant height and ground cover taken on July 11 indicated that all plants treated with Sencor were smaller than the untreated check (data not shown). This delay in growth after Sencor application did not affect yield in most post-emergence plots. Only when this stunting was combined with chlorosis or plant death was yield significantly affected.

Table 1. Effect of pre-emergence application of Sencor 4 on crop injury of 5 potato clones. Sencor applied 6/5/85; injury evaluations made 7/11/85.

Variety	Untreated Check % Thinning[1]	Untreated Check % Stunting[2]	Sencor 1.0 lb AI/A % Thinning	Sencor 1.0 lb AI/A % Stunting	Sencor 2.0 lb AI/A % Thinning	Sencor 2.0 lb AI/A % Stunting
Russet Burbank	0	0	0	7	22	74
Centennial	0	0	13	21	62	33
Nooksack	0	0	0	0	0	12
WNC567-1	0	0	0	8	12	13
TC582-1	0	0	0	7	0	22

[1]Thinning determined as percentage plants dead after herbicide application.
[2]Stunting determined as percentage of plants not dead which were stunted and chlorotic after herbicide application.

Table 2. Effect of postemergence application of Sencor 4 on crop injury of 5 potato clones. Sencor applied 6/18/85 to all clones except Nooksack. Applications to Nooksack made 6/27/85. Injury evaluations made 7/11/85.

Variety	Untreated Check % Thinning[1]	Untreated Check % Stunting[2]	Sencor 1.0 lb AI/A % Thinning	Sencor 1.0 lb AI/A % Stunting	Sencor 2.0 lb AI/A % Thinning	Sencor 2.0 lb AI/A % Stunting
Russet Burbank	0	0	0	0	0	15
Centennial	0	0	0	14	25	22
Nooksack	0	0	0	0	0	3
WNC567-1	0	0	0	0	0	3
TC582-1	0	0	0	10	0	12

[1]Thinning determined as percentage dead plants after herbicide application.
[2]Stunting determined as percentage of plants not dead which were stunted and chlorotic after herbicide application.

Table 3. Effect of Sencor application rate and timing on yield of 5 potato clones.

Clone	Growth Stage	Application Rate (AI/Acre)	Total Yield	Marketable Yield
			------ Cwt/A[1] --------	
Russet Burbank	Pre-emergence	1 lb.	240.0 b[2]	154.0 b
		2 lb.	161.0 c	105.5 c
	Postemergence	1/2 lb.	291.9a	217.4a
		1 lb.	218.9 b	150.2 b
	Check	-	260.2ab	176.1 b
Centennial	Pre-emergence	1 lb.	98.8 b	76.8 b
		2 lb.	3.2 d	2.6 c
	Postemergence	1/2 lb.	180.4a	143.0a
		1 lb.	53.9 c	41.2 bc
	Check	-	198.8a	150.7a
Nooksack	Pre-emergence	1 lb.	201.7ab	180.9ab
		2 lb.	166.5 b	145.5 b
	Postemergence	1/2 lb.	226.4a	209.8a
		1 lb.	201.6ab	182.6ab
	Check	-	204.8ab	187.8a
WNC567-1	Pre-emergence	1 lb.	220.6 b	182.1 b
		2 lb.	143.7 c	112.1 c
	Post-emergence	1/2 lb.	262.9a	221.8a
		1 lb.	227.3ab	190.8ab
	Check	-	254.9ab	208.1ab
TC582-1	Pre-emergence	1 lb.	261.1a	225.8a
		2 lb.	165.8 b	126.5 b
	Postemergence	1/2 lb.	262.8a	225.4a
		1 lb.	238.6a	212.3a
	Check	-	242.5a	199.5a

[1] Values are means of 3 replications.

[2] Column means within clones followed by the same letter are not significantly different ($P<.05$) by LSD test.

MH-30 Trial

Fertilizer was banded in the hill at a rate of 140 lbs N, 175 lbs P_2O_5, and 53 lbs K_2O per acre prior to planting. Cut seed of TC582-1 was planted at 12 inch spacing on May 2, 1985. The treatments were arranged in a randomized complete block design with 4 replications. Royal MH-30SG was applied to the plots on August 6, 1985, at a rate of 5 lbs in 40 gallons of water per acre. X-77 adjuvant was added to the spray at a rate of 1 qt. in 100 gal. The sprayer was an R&D CO_2 sprayer with two-row boom, LF-3 flat fan nozzles, 40 psi and 2.1 MPH walking speed. At the time of application the potatoes were approximately 40 inches tall, with at least 8 tubers in the hill over 2 inches in diameter. The plots were sprayed with Dinitro 5B on August 26. Plots were harvested by hand on September 12.

Royal MH-30SG produced no visible effects on the foliage or tubers of TC582-1. Yield comparisons of Royal MH-30SG treated plots versus the untreated check are given in Table 1. Royal MH-30SG had no significant effect on total yield or size distribution.

The timing of the spray application may not have been optimum for modification of tuber size distribution in this potato clone. Also, TC582-1 exhibits a very tall, lush growth habit which makes thorough coverage of the foliage by ground application difficult.

Table 1. Effect of Royal MH-30SG on total yield and size distribution of TC582-1. Values are means of 4 replications.

Treatment	<4 oz.	>10 oz.	Total	% No. 1
	----------	Cwt/Acre	---------	
Royal MH-30SG	48.8	45.2	322.0	83.3
Untreated Check	43.4	47.3	317.2	84.1

Alar Trial

Fertilizer was banded in the hill at a rate of 60 lbs N, 75 lbs P_2O_5, and 22.5 lbs K_2O per acre prior to planting. Russet Burbank tubers produced in the greenhouse by micro-propagated potatoes (minitubers) were planted at 12 inch spacing on May 22, 1985. The treatments were arranged in a randomized complete block design with 4 replications. Alar 85 was applied at a rate of 1.8 lbs in 40 gallons of water per acre. The treatments included were:

1. Alar 85 at tuber initiation (7/8/85)
2. Alar 85 7 days after tuber initiation (7/15/85)
3. Alar 85 14 days after tuber initiation (7/22/85)
4. Untreated Check

The Alar was applied with an R&D CO_2 sprayer with two-row boom, LF-3 flat fan nozzles, 40 psi and 2.1 walking speed. Plots were sprayed early in the morning to allow maximum uptake by the plant. The plots were sprayed with Dinitro 5B on August 28. Plots were harvested by hand on September 12.

Alar 85 did not cause phytotoxicity but treated plants were noticeably shorter than the check within one week after application. Plants treated with Alar 85 produced higher total yields and yields of 4 to 10 oz. tubers (Table 1). The yield of less than 4 oz and over 10 oz tubers was not affected by Alar. Plants treated with Alar 7 days after tuber initiation produced the highest total yield.

Plants treated with Alar did not produce more tubers per plant than the check (Table 2). Plants treated with Alar 7 days after tuber initiation tended to produce the most tubers per plant.

Alar also affected tuber shape and eye number (Table 3). Plants treated with Alar produced tubers with a higher length to width ratio and more eyes on each tuber than the untreated check. Plants sprayed with Alar 7 days after tuber initiation had the most eyes per tuber and the highest length to width ratio.

It has been reported that Alar applied as a foliar spray to potatoes can increase tuber set in some potato cultivars. An increase in tuber production would be very desirable in production of nuclear seed stocks. Application of Alar to Russet Burbank minitubers resulted in an increase in yield of 4 to 10 oz tubers and total yield, but did not significantly increase the number of tubers produced per plant.

Table 1. Effect of Alar 85 on yield of Russet Burbank plants grown from minitubers.

Application Timing	<4 oz	4-10 oz	>10 oz	Total
	Cwt/A			
1. Tuber initiation	66.1[a]	95.7	3.5	165.3
2. Tuber initiation + 7 days	73.0	106.6	6.6	186.2
3. Tuber initiation + 14 days	67.4	99.7	8.0	175.1
4. Check	64.8	85.0	8.5	158.4
LSD(.05)[b]	(11.6)	(11.2)	(7.3)	(17.3)

[a] Values are means of 4 replications.
[b] Means differing by more than LSD value are significantly different (P>.95).

Table 2. Effect of Alar 85 on tuber production of Russet Burbank plants grown from minitubers.

Application Timing	<4 oz	4-10 oz	>10 oz	Total
	Tuber no/plant			
1. Tuber initiation	3.5[a]	2.0	0.0	5.5
2. Tuber initiation + 7 days	4.1	2.3	0.1	6.4
3. Tuber initiation + 14 days	3.8	2.0	0.1	5.9
4. Check	3.9	1.8	0.1	5.9

[a] Values are means of 4 replications.

Table 3. Effect of Alar 85 on tuber shape and eye number.

Application Timing	Length:Width Ratio	Eye # per Tuber
1. Tuber initiation	2.04[a]	17.6
2. Tuber initiation + 7 days	2.05	18.4
3. Tuber initiation + 14 days	2.00	18.2
4. Check	1.95	17.4
LSD(.05)[b]	(0.05)	(0.7)

[a] Values are means of 4 replications, with 25 observations per replication.

[b] Means differing by more than LSD value are significantly different (P>.95).

EFFECT OF MINITUBER SIZE AND DORMANCY ON THE YIELD OF RUSSET BURBANK, NORCHIP AND MONONA POTATOES

Fertilizer was banded in the center of each row at a rate of 60 lbs N, 75 lbs P_2O_5 and 22.5 lbs K_2O per acre prior to planting. Minitubers and cut seedpieces were planted at a depth of 3-4 inches on May 22, 1985. The plots were irrigated by solid set sprinkler. Minituber sizes, greenhouse harvest dates and Bromoethane treatments for each cultivar are given in Table 1. The 21 treatments were arranged in a randomized complete block design with 4 replications. Each plot consisted of one row, 25 feet long, with plants spaced 12 inches apart. The plots were cultivated and hilled on June 5. A single application of Dual 8E herbicide was applied at a rate of 2.5 pints per acre according to label directions on June 5.

Plots were observed for emergence and the date at which at least 80% of the plants had emerged was recorded. Data on stand and stem number was taken on August 8. All plots were sprayed with Dinitro 5B, a vine killer, at a rate of 2 pints per acre on August 28. The plots were harvested by hand on September 12 and graded into three size categories. The number of tubers in each size category was also determined.

Minitubers emerged 2 to 30 days later than seedpieces in Norchip and Monona (Table 1). There was no significant difference in emergence dates of Russet Burbank minitubers and seedpieces. Minitubers tended to emerge later as minituber size decreased. Physiologically young minitubers (late harvested) were the slowest emerging (Table 1). Emergence of plants from dormant minitubers was also very uneven.

All the minitubers and seedpieces, except the late harvested Russet Burbank minitubers, produced good stands (Table 2). Russet Burbank minitubers harvested from the greenhouse on March 30, 1985 (Treatments 7 and 8) produced very low stand counts, regardless of Bromoethane treatment. Seedpieces produced significantly more stems per plant than minitubers (Table 2). Stem number increased with increasing minituber size. Physiologically young minitubers produced the fewest stems per plant.

Plants from seedpieces generally produced higher total yields, and yields of <4 oz and 4 to 10 oz tubers than minitubers, although medium sized Russet Burbank minitubers produced as high yields as seedpieces (Table 3). Total yield and yield of 4 to 10 oz tubers increased with increasing minituber size. Yield of >10 oz tubers was not affected by any of the treatments. Minitubers harvested from the greenhouse early produced the highest yields (Table 3). Russet Burbank minitubers harvested on March 30, 1985, (Trt. 7 and 8) produced very low yields regardless of Bromoethane treatment.

Seedpieces generally produced more tubers per plant than minitubers, although medium sized Russet Burbank minitubers produced as many tubers as seedpieces (Table 4). The number of <4 oz tubers, 4 to 10 oz tubers and total tuber number per plant also increased with increasing minituber size. Minituber physiological age had no effect on <4 oz or total tuber number per plant; however, the yield of 4-10 oz tubers was significantly higher from earlier harvested minitubers (Table 4). Russet Burbank minitubers harvested on March 30, 1985 (Trt. 7 and 8) produced the fewest tubers per plant.

Differences measured in yield and tuber production between minituber sizes in 1985 were consistent with 1984 results. These differences could probably be attributed to reductions in stem number and early growth with decreasing minituber size. Minituber physiological condition greatly influenced emergence, stem number and yield, but effect on tuber production was variable. The few stems produced by late harvested minitubers (1.4 per plant) is typical of physiologically young seed. Bromoethane was more effective in breaking dormancy of Monona minitubers than Russet Burbank minitubers harvested from the greenhouse on March 30, 1985.

Table 1. Effect of minituber size, greenhouse harvest date and Bromoethane treatment on emergence date of three cultivars.

Trt. No.	Cultivar	Minituber Size	Greenhouse Harvest Date	Bromo-ethane Trt.	Average[a] Emergence Date
1	Russet Burbank	0.10-0.25oz(Pw)	10-11-84	-	6-17-85
2		0.25-0.50oz(Sm)	10-11-84	-	6-16-85
3		0.50-1.00oz(Me)	10-11-84	-	6-15-85
4		0.10-0.25oz(Pw)	11-16-84	-	6-17-85
5		0.25-0.50oz(Sm)	11-16-84	-	6-17-85
6		0.50-1.00oz(Me)	11-16-84	-	6-16-85
7		0.10-0.25oz(Pw)	3-30-85	0.2 ml/L	-[b]
8		0.10-0.25oz(Pw)	3-30-85	-	-
9		Seedpiece	-	-	6-17-85
10	Norchip	0.10-0.25oz(Pw)	1-30-85	-	6-21-85
11		0.25-0.50oz(Sm)	1-30-85	-	6-21-85
12		0.50-1.00oz(Me)	1-30-85	-	6-20-85
13		0.10-0.25oz(Pw)	2-15-85	-	7-02-85
14		0.25-0.50oz(Sm)	2-15-85	-	6-28-85
15		Seedpiece	-	-	6-15-85
16	Monona	0.10-0.25oz(Pw)	1-30-85	-	6-20-85
17		0.25-0.50oz(Sm)	1-30-85	-	6-18-85
18		0.50-1.00oz(Me)	1-30-85	-	6-18-85
19		0.10-0.24oz(Pw)	3-30-85	0.2 ml/L	7-17-85
20		0.25-0.50oz(Sm)	3-30-85	0.2 ml/L	7-04-85
21		Seedpiece	-	-	6-16-85

[a] Emergence date determined as 80% or more of plants in the plot emerged.
[b] Less than 20% of the plants emerged by August 8.

Table 2. Effect of minituber size, greenhouse harvest date and Bromoethane treatment on stand and stem number per plant.

Treatment	Average[a] Stand	Stem No. per plant
Russet Burbank		
1. Oct. 11, Pw	24.0[c]	1.5
2. Oct. 11, Sm	24.3	1.8
3. Oct. 11, Me	24.3	3.0
4. Nov. 16, Pw	24.0	1.3
5. Nov. 16, Sm	24.0	1.7
6. Nov. 16, Me	24.5	2.0
7. Mar. 30, Pw+Be	2.8	1.2
8. Mar. 30, Pw-Be	1.3	1.1
9. Seedpiece	24.8	3.3
Norchip		
10. Jan. 30, Pw	24.0	1.3
11. Jan. 30, Sm	24.0	1.4
12. Jan. 30, Me	24.8	1.7
13. Feb. 15, Pw	23.5	1.0
14. Feb. 15, Sm	23.5	1.1
15. Seedpiece	22.3	3.8
Monona		
16. Jan. 30, Pw	23.5	1.0
17. Jan. 30, Sm	24.8	1.1
18. Jan. 30, Me	23.8	1.3
19. Mar. 30, Pw+Be	22.8	1.0
20. Mar. 30, Sm+Be	24.0	1.0
21. Seedpiece	24.8	2.9
LSD(.05)[d]	1.6	0.3
Main Effects		
Seedpiece (Trt. 9,15,21)		3.3**[b]
Minituber (Trt. 1-6, 10-14, 16-20)		1.2
Early Harvest (Trt. 1-3, 10, 11)		1.8**
Late Harvest (Trt. 4-6, 13, 14)		1.4

[a] Number of plants in 25 feet.
[b] Differences are significant at 0.01 level (**) by linear contrast.
[c] All values are means of 4 replications.
[d] Means differing by more than LSD value are significantly different (P>.95).

Table 3. Effect of minituber size, greenhouse harvest date and Bromoethane treatment on yield of three cultivars.

Treatment	<4 oz	4-10 oz	>10 oz	Total
	Cwt/A			
Russet Burbank				
1. Oct 11, Pw	68.0[b]	114.8	6.3	189.1
2. Oct 11, Sm	52.1	172.8	19.4	244.3
3. Oct 11, Me	125.0	129.0	3.2	257.2
4. Nov 16, Pw	55.4	122.7	17.1	195.1
5. Nov 16, Sm	84.1	132.2	5.4	221.7
6. Nov 16, Me	126.4	123.8	3.5	253.7
7. Mar 30, Pw+Be	3.7	4.5	0.0	8.2
8. Mar 30, Pw-Be	0.0	0.0	0.0	0.0
9. Seedpiece	121.0	109.5	3.9	234.3
Norchip				
10. Jan 30, Pw	48.4	85.5	0.9	134.8
11. Jan 30, Sm	57.7	121.9	0.9	180.5
12. Jan 30, Me	97.0	114.9	1.1	212.9
13. Feb 15, Pw	40.9	46.6	0.0	87.5
14. Feb 15, Sm	51.1	58.1	0.0	109.2
15. Seedpiece	108.2	137.9	6.5	252.6
Monona				
16. Jan 30, Pw	33.8	93.8	0.0	127.6
17. Jan 30, Sm	25.7	172.7	12.6	210.9
18. Jan 30, Me	46.3	202.8	8.3	257.3
19. Mar 30, Pw+Be	35.4	12.3	0.0	47.7
20. Mar 30, Sm+Be	59.3	31.7	0.0	91.0
21. Seedpiece	84.3	218.6	10.0	312.9
LSD(.05)[c]	23.6	29.6	8.8	27.8
Main Effects				
Seedpiece (Trt 9,15,21)	104.5**[a]	155.3**	6.8[NS]	266.5**
Minituber (Trt 1-6,10-14, 16-20)	65.1	120.8	5.6	191.6
Early Harvest (Trt 1-3,10,11)	70.2[NS]	124.8**	6.1[NS]	201.2**
Late Harvest (Trt 4-6,13,14)	71.6	96.7	5.2	173.4

[a]Differences are significant at 0.01 level (**) or not significant (NS) by linear contrast.

[b]All values are means of 4 replications.

[c]Means differing by more than LSD value are significantly different.

Table 4. Effect of minituber size, greenhouse harvest date and Bromoethane treatment on tuber production of three cultivars.

Treatment	<4 oz	4-10 oz	>10 oz	Total
	Tuber No/Plant			
Russet Burbank				
1. Oct 11, Pw	3.2[b]	2.3	0.1	5.5
2. Oct. 11, Sm	2.5	3.0	0.2	5.8
3. Oct 11, Me	5.4	2.8	0.0	8.1
4. Nov 16, Pw	2.7	2.3	0.2	5.1
5. Nov 16, Sm	3.7	2.5	0.1	6.2
6. Nov 16, Me	5.9	2.5	0.0	8.4
7. Mar 30, Pw+Be	1.6	1.4	0.0	2.9
8. Mar 30, Pw-Be	0.0	0.0	0.0	0.0
9. Seedpiece	5.2	2.2	0.0	7.3
Norchip				
10. Jan 30, Pw	2.3	1.9	0.0	4.2
11. Jan 30, Sm	2.7	2.7	0.0	5.4
12. Jan 30, Me	4.2	2.5	0.0	6.7
13. Feb 15, Pw	2.4	1.1	0.0	3.5
14. Feb 15, Sm	2.8	1.7	0.0	4.5
15. Seedpiece	5.8	3.2	0.1	9.0
Monona				
16. Jan. 30, Pw	1.7	2.0	0.0	4.2
17. Jan 30, Sm	1.2	3.2	0.1	4.5
18. Jan 30, Me	2.3	4.0	0.1	6.3
19. Mar 30, Pw+Be	2.5	0.4	0.0	2.8
20. Mar 30, Sm+Be	3.8	0.8	0.0	4.5
21. Seedpiece	3.9	4.5	0.1	8.6
LSD(.05)[c]	1.3	0.8		1.6
Main Effects				
Seedpiece (Trt 9,15,21)	4.9**[a]	3.3**	0.1[NS]	8.3**
Minituber (Trt 1-6,10-14,16-20)	3.1	2.5	0.1	5.6
Early Harvest (Trt 1-3,10,11)	3.2[NS]	2.5**	0.1[NS]	5.8[NS]
Late Harvest (Trt 4-6,13,14)	3.5	2.0	0.1	5.5

[a]Differences are significant at 0.01 level (**) or not significant (NS) by linear contrast.

[b]All values are means of 4 replications.

[c]Means differing by more than LSD value are significantly different (P>.95).

MICROPLANT STARTER FERTILIZER

Virus-free Russet Burbank microplants were transferred from culture jars to Speedling transplant trays and placed under a water mist system in the greenhouse. After three weeks in the greenhouse, the microplants were hardened outdoors for one week prior to transplanting. The plots were planted by hand and one cup of starter fertilizer applied to each microplant on June 12, 1985. Each treatment was replicated four times in plots consisting of 25 plants, spaced 12 inches apart. Prior to planting, 350 lbs/acre of 16-20-6 fertilizer was banded in each row. Dual 8E herbicide was applied at a rate of 2.5 pints/acre prior to planting to control weeds. A solid set sprinkler was used to irrigate the plots. The plots were sprayed with Dinitro 5B to desiccate vines on August 28. The plots were dug with a two-row harvester on September 6.

Three Peters soluble fertilizers were used to make up starter fertilizers with various P concentrations. Fertilizer formulation, P concentration and N:P ratio are given in Table 1.

Microplant survival was 100% in all plots. Total yield and yield of <4 oz tubers tended to increase with increasing starter fertilizer P concentration (Table 1), although differences were not significant. Starter fertilizer P concentration did not have a consistent effect on yield of 4-10 oz tubers or total tuber number per plant (Table 1).

Table 1. Effect of fertilizer P concentration on yield and tuber production of Russet Burbank microplants.

Fertilizer	Phosphate Concentration	N:P Ratio	<4 oz	4-10 oz	Total	Total Tuber No./Plant
	ppm		cwt/acre			
Check	0	-	61.0[1]	1.9	62.9	8.8
20:20:20	500	1:1	68.6	2.0	70.6	10.7
15:30:15	1000	1:2	72.7	1.5	74.3	9.9
15:45:5	1500	1:3	78.6	2.5	81.0	12.1
LSD (.05)[2]			30.1	4.2	31.4	4.3

[1] Values are means of 4 replications.
[2] Values differing by more than LSD value are significantly different (P>.95).

MICROPLANT SPACING

Virus-free Russet Burbank microplants were transplanted directly from culture jars into Speedling transplant trays. The microplants were watered by an overhead mist system. After three weeks in the greenhouse, the microplants were hardened outdoors for one week prior to transplanting. The microplants were transplanted at 4 in-row spacings: 4, 8, 12 inches and 12 inches with 3 plants per hill. Each treatment was replicated four times in plots consisting of 25 plants spaced 12 inches apart. All treatments were planted by hand on June 12, 1985. Peters 20:20:20 starter fertilizer was applied to each microplant. Prior to planting, 350 lbs/acre of 16:20:6 fertilizer was banded in each row. Dual 8E herbicide was applied at a rate of 2.5 pints/acre prior to planting to control weeds. A solid set sprinkler was used to irrigate the plots. All plots were sprayed with Dinitro 5B to desiccate vines on August 28. The plots were dug with a two-row harvester on September 6.

Microplant survival was above 99%. Yields were significantly affected by in-row spacing (Table 1). Total yield and yield of <4 oz tubers increased with decreasing spacing. Yield of 4-10 oz tubers was not affected by spacing. Plants spaced 12 inches apart, with 3 plants per hill, did not yield as well as the same number of plants spaced 4 inches apart (Table 1).

Tuber production per plant and yield per plant increased with increasing in-row spacing. If land area for planting is not limiting, then microplants should be placed at large in-row spacing to optimize tuber production on a per plant basis.

Table 1. Yield and tuber production of Russet Burbank microplants at 4 in-row spacings.

Spacing	<4 oz.	4-10 oz.	Total	Yield/Plant	Tubers/Plant
(Inches)	----------	cwt/acre	----------		
4	126.2[1]	1.3	127.5	1.7	6.8
8	102.4	4.3	106.7	2.9	9.7
12	69.4	2.6	72.0	2.9	9.3
12(3)	88.5	2.6	91.2	1.2	4.8

[1] Values are means of 4 replications.