

Classic Russet and Russet Norkotah Potato Yield and Quality Response to Nitrogen Fertilization

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Introduction: Classic Russet is a newly released variety with higher yield potential and improved pest resistance compared to Russet Norkotah. On the flip side, Classic Russet is susceptible to multiple types of bruising. Experiments were conducted in 2011 and 2012 to compare Classic Russet and Russet Norkotah response to nitrogen fertilizer in Tulelake. Experiments included bruise evaluations for all treatments to determine if nitrogen fertilization influenced bruising. Treatments included 7 rates of split applied nitrogen (0 to 300 lbs N/A) with 50% of the nitrogen applied at planting and 50% from tuber initiation to early bulking. Additional treatments evaluated nitrogen fertilizer application timings including applying all nitrogen at planting and most nitrogen after potato emergence. In 2011, Classic Russet had higher yield, revenue, and nitrogen use efficiency compared to Russet Norkotah across all nitrogen treatments. Classic Russet was very susceptible to shatter bruise, blackspot bruise, and white knot bruise across all fertilizer treatments. The experiment was repeated in 2012 with a few additional treatments. This report outlines 2012 results.

Trial Information

Location: IREC, Tulelake, CA

Soil Type: Tulebasin mucky silty clay loam with 4.2% organic matter

Nitrate and Ammonium at planting: 10 ppm

Planting Date: May 21 and 22, 2012

Vine Kill Date: September 14, 2012

Days to Vine Kill: 113 Days

Harvest Date: October 13, 2012

Days between Vine Kill and Harvest: 29 days

Soil Temperature at Harvest: 55-65 degrees F

Irrigation: Solid-set sprinklers

Plot Size: 2 rows (6 ft) wide by 28.33 ft long

In-Row Spacing: 10.0 inches

Row Spacing: 36 inch spacing

Number of Reps: 5 replications

Trial Information Continued

Nitrogen Fertilizer Treatments: Nitrogen was applied as urea fertilizer. Urea was immediately incorporated after application via tillage or irrigation. Nitrogen was applied before planting (May 20th), tuber initiation (July 6th), and 15 days after tuber initiation (July 19th).

Applied Fertilizer other than Nitrogen: P₂O₅ = 80 lb/A, K₂O = 100 lb/A, S = 93 lb/A, Zn = 10 lb/A (applied and incorporated over the entire plot area before planting on May 20th)

Herbicides: Matrix and metribuzin

Insecticides: Admire Pro

Fungicides: Moncut, Bravo Weather Stick and Manzate

Potato Fresh Market Pack-Out Revenue Assumptions

IREC Grade Size	Market/Packaging	4 yr Price Avg. \$/cwt	Packaging & Handling Cost \$/cwt
4-8 oz tubers	20% to 90 & 100 count	14.13	5.75
	80% to 10 lb. poly bags	9.15	5.75
8-12 oz tubers	70, 80, 90 count	16.45	5.75
>12-20 oz	50 & 60 count	17.33	5.75
<4 oz and culls	Bulk culls	1.15	5.75
No. 2	100 lb burlap sacks	8.60	5.75

Results

Variety Comparison Averaged Across Fertilizer Treatments: Classic Russet produced higher total yield, US #1 yield, average tuber size, and revenue compared to Russet Norkotah (Table 1). Classic Russet was more susceptible to shatter bruise, black spot bruise, and white knot bruise compared to Russet Norkotah (Table 2). The percent incidence of shatter bruise, black spot bruise, and white knot bruise for Classic Russet were more than 3 times greater than Russet Norkotah (Table 2). 2012 results were similar to what was observed in 2011.

Influence of Nitrogen Fertilizer on Potato Yield and Revenue: Classic Russet total yield, US #1 yield, and pack-out revenue plateaued at 50 lbs N/A when nitrogen was split-applied (50% applied at planting and 50% from tuber initiation to early bulking)(Table 3). Russet Norkotah total yield, US #1 yield, and pack-out revenue plateaued at 150 lbs N/A when nitrogen was split-applied (Table 3). Applying nitrogen in split applications resulted in the highest total yield, US #1 yield, and revenue when evaluating nitrogen application timing for both varieties (Table 4). Applying all nitrogen from tuber initiation to early bulking produced similar US # 1 yield and revenue compared to split-applied nitrogen for both varieties (Table 4). At a high nitrogen rate (200 lb N/A), applying all nitrogen pre-plant produced lower yield compared to split-applied nitrogen for both varieties (Table 4).

Nitrogen rate and application timing influenced tuber set and average tuber size for both varieties (Tables 3 & 4). Increasing pre-plant nitrogen rate produced more tubers per plant for both varieties. Classic Russet tuber set was especially influenced by increasing pre-plant nitrogen as tubers per plant went from 5.6 tubers in unfertilized plots to 8 tubers in plots treated with 150 lbs N/A pre-plant (Table 3). Nitrogen rates up to 100 lbs N/A increased Russet Norkotah tuber size (Table 3). Classic Russet produced large tubers regardless of the

nitrogen rate, but nitrogen had little influence on increasing Classic tuber size (Table 3 & 4). Classic Russet tuber size actually decreased at high nitrogen rates presumably due to the high tuber set and limited growing season in Tulelake (Tables 3 & 4).

Compost applied at 10 tons per acre was included in 2012 at the request of several organic growers. Compost treated plots had higher total and US #1 yield compared to the unfertilized control (Table 5). Compost yields were similar to plots fertilized with 100 lbs/A of nitrogen (Tables 3, 4 & 5). Interestingly, compost had similar petiole nitrate levels compared to the unfertilized control 67 days after planting (Figure 1). This result suggests compost provided limited plant available nitrogen early in the growing season.

Influence of Nitrogen Fertilizer on Potato Bruising and Tuber Defects: Nitrogen fertilizer had no influence on knobs, growth cracks and total culls for both varieties in 2012 (Tables 6 and 7). Excessive nitrogen rates (> 250 lbs N/A) increased Classic Russet skinning (Table 6). All nitrogen fertilizer rates increased black spot bruising at harvest compared to the unfertilized control, but the incidence of black spot bruising did not differ between fertilizer rates (Tables 6 and 7). Nitrogen fertilization decreased hollow heart for both varieties when compared to the unfertilized control (Table 6). White knot bruise and black spot bruise did not differ among nitrogen fertilizer rates and application timings when evaluated 54 days into storage (Tables 6 & 7).

Influence of Nitrogen Fertilizer on Petiole Nitrate Levels: Petiole nitrate levels were measured in four replications for select fertilizer treatments. Petiole nitrate levels at different fertilization rates were similar between varieties (Figure 1). Petiole nitrate 67 days after planting at the 100 lb N/A split-applied nitrogen rate was 16,000 ppm for Classic Russet and 18,000 ppm for Russet Norkotah. For Russet Norkotah, petiole nitrate 67 days after planting was 20,500 ppm for the 200 lb N/A split-applied nitrogen rate. Classic Russet petiole nitrate at the end of the season dropped to 10,000 ppm for the 100 lb N/A split-applied nitrogen fertilizer rate. These results come close to the recommendations outlined in the Tri-state Classic Russet management guidelines.

Estimated Total Nitrogen Use: Lake-bottom soils around Tulelake have high organic matter content (4 to 10%), and a significant amount of nitrogen may be mineralized when growing a potato crop. To estimate mineralization and total nitrogen use, tubers and vines were harvested from a plot area designated solely for destructive harvest. Three treatments replicated three times were evaluated: unfertilized, 100 lbs N/A applied at planting, and 200 lbs N/A applied at planting. Tuber and vine fresh and dry weights were determined for 10 ft of row, and tuber and vine samples were sent to a lab to estimate total nitrogen. Ten 0-12 inch soil samples were collected from each plot at the end of the growing season to estimate residual soil nitrate and ammonium.

Results are presented in Figure 2. Soil organic matter was 5.51%, and pre-plant soil nitrate and ammonium totaled 10 ppm (roughly 40 lbs N/A) in the plot area. In unfertilized plots, approximately 200 lbs N/A was mineralized during the growing season. Tubers contained 155 lbs N/A, vines contained 40 to 46 lbs N/A, and residual soil nitrate and ammonium totaled 9 to 12 ppm (roughly 40 lbs N/A). In fertilized plots, Classic Russet accumulated applied nitrogen in tubers and vines leaving little residual N in the soil. Russet Norkotah accumulated fertilized nitrogen in tubers, but vine nitrogen remained similar across fertilizer rates. Residual nitrogen in the soil increased with fertilizer rate for Russet Norkotah.

In summary, Classic Russet produced higher yield, average tuber size, and more revenue per acre compared to Russet Norkotah. Classic Russet was more susceptible to bruising compared to Russet Norkotah at all fertilizer rates. Fresh market growers must prioritize management activities that minimize bruising. The yield benefits of growing Classic Russet are negated if shatter bruise, white knot bruise, and black spot bruise cannot be effectively managed.

Table 1. Classic Russet and Russet Norkotah Tuber Yield, Revenue, and Tuber Defects Averaged Across Nitrogen Fertilization Treatments at IREC in 2012.

Variety	Total U.S. No. 1's (cwt/A)	Total Yield (cwt/A)	Tubers/ Plant	Avg Tuber Size (oz)	Potato Revenue \$/A	Growth				Total Cull % ¹	Hollow Heart % ²
						Knobs % ¹	Cracks % ¹	Rot % ¹	Green % ¹		
Classic Russet	458	535	6.6	9.4	\$3,979	5.1	0.6	0.3	2.8	8.9	9.1
Russet Norkotah	350	443	7.9	5.3	\$1,807	0.8	0.0	0.1	0.5	1.4	17.4
95% confidence Interval	14	13	0.2	0.2	\$170	0.8	0.1	0.1	0.3	1.0	2.5

¹ Percentage of Total Yield

² 10 tubers evaluated from each plot (8-16oz) at harvest

Table 2. Classic Russet and Russet Norkotah Skin Set, Bruising, and Specific Gravity Averaged Across Nitrogen Fertilization Treatments at IREC in 2012.

Variety	Ruptured Lenticel Rating ¹	Shatter Bruise Rating ¹	Skinning Rating ¹	Shatter Bruise % ²	Black Spot Bruising % ³	White Knot Bruising % ⁴	Black Spot Bruising % ⁴	Specific Gravity
	Classic Russet	2.9	2.6	3.2	69.5	12.7	47.5	46.4
Russet Norkotah	4.1	4.3	3.8	15.7	4.7	1.6	10.2	1.068
95% confidence Interval	0.1	0.1	0.1	4.4	2.3	3.4	5.8	NS

¹ Rating Scale of 1-5, 5=no problem; Reglone Application occurred on 9/14/2012; Harvested on 10/13/2012

² 20 tubers evaluated from each plot (8-16oz); 6 inch soil temperature was 45 degrees F at harvest

³ 10 tubers evaluated from each plot (8-16oz) at harvest; cut lengthwise into quarters

⁴ 10 tubers peeled and evaluated from each plot (8-16oz) 54 days after harvest; storage at 40°F with 100% humidity

Table 3. Influence of Split-Applied Nitrogen Fertilizer Rates on Classic Russet & Russet Norkotah Tuber Yield, Revenue, and Residual Soil Nitrate at IREC in 2012.

Season	Tuber Total lbs N/A ¹	Planting lbs N/A ²	Tuber Initiation lbs N/A ³	Early Bulking lbs N/A ⁴	Tuber Yield (cwt/A)										Avg Tuber Size (oz)	Potato Revenue \$/A ⁶	Residual	
					U.S. No. 1's (cwt)												Residual Soil NO ₃ ppm ⁷	+ NH ₄ ppm ⁷
					Total	1's	>16oz	12-16oz	8-12oz	4-8oz	<4oz	2's	Total	Stand ⁵				
Classic																		
0	0	0	0	0	395	112	114	106	63	12	48	456	78	5.2	10.4	\$3,749	6.3	8.5
50	25	12.5	12.5		467	98	134	149	85	18	44	529	80	6.3	9.6	\$4,335	NA	NA
100	50	25	25		474	117	134	139	85	18	50	543	81	6.2	9.9	\$4,353	9.0	12.0
150	75	37.5	37.5		481	111	129	145	96	26	50	556	80	6.9	9.3	\$4,272	NA	NA
200	100	50	50		492	103	126	140	123	26	40	559	82	7.0	8.8	\$4,214	8.3	11.0
250	125	62.5	62.5		446	87	99	146	113	26	62	534	80	7.1	8.7	\$3,593	NA	NA
300	150	75	75		456	81	107	139	130	33	65	554	77	8.0	8.3	\$3,513	9.8	13.0
Norkotah																		
0	0	0	0	0	249	2	15	80	152	78	4	331	96	6.7	4.8	\$1,345	8.8	11.8
50	25	12.5	12.5		322	3	18	74	226	92	5	419	96	7.9	5.1	\$1,543	NA	NA
100	50	25	25		344	8	21	87	228	93	7	444	95	8.3	5.2	\$1,720	12.0	16.3
150	75	37.5	37.5		383	12	34	112	226	84	10	477	94	8.4	5.6	\$2,152	NA	NA
200	100	50	50		371	10	28	103	231	89	11	472	97	8.3	5.4	\$1,907	17.5	23.8
250	125	62.5	62.5		365	8	30	106	221	88	8	461	98	8.0	5.4	\$1,882	NA	NA
300	150	75	75		390	20	33	125	212	85	9	485	95	8.4	5.6	\$2,180	18.3	24.8
95% confidence interval					41	NS	17	23	19	10	11	37	NS	0.5	0.5	\$487	3.1	4.1

¹ Nitrogen fertilizer rates are expressed as lbs of nitrogen per acre. Nitrogen was applied in the form of urea. All treatments included split application at planting, tuber initiation, and early bulking. Urea was incorporated via irrigation or tillage immediately after application. Soil Type= Silty Clay Loam; Preplant Nitrate and Ammonium = 10 ppm.

² At planting treatments were applied on May 21st.

³ Tuber initiation treatments were applied on July 6th.

⁴ Early bulking treatments were applied on July 19th.

⁵ Seed spacing was 10 inches with 68 seed pieces per plot for both varieties.

⁶ Revenue per Acre = Gross Revenue using the 4 year average for Columbia Basin Carton and Bag Prices - \$5.75/CWT Packing and Handling Charges - Fertilizer Cost at \$0.90 per lb of N)

⁷ Residual soil nitrate and ammonium (0-12 inch depth) was measured shortly after harvest on Oct. 13th for select treatments. n/a = treatments not sampled for residual nitrate and ammonium.

Table 4. Influence of Nitrogen Application Timing (N at planting versus N split-application) on Classic Russet & Russet Norkotah Tuber Yield, Revenue, and Residual Soil Nitrate at IREC in 2012.

Season	Total lbs N/A ¹	Planting lbs N/A ²	Tuber Initiation lbs N/A ³	Early Bulking lbs N/A ⁴	Tuber Yield (cwt/A)								Culls + 2's	Total	Percent Stand ⁵	Tubers/ Plant	Avg Tuber Size (oz)	Potato Revenue \$/A ⁶	Residual Soil NO ₃ ppm ⁷	Residual Soil NO ₃ + NH ₄ ppm ⁷
					U.S. No. 1's (cwt)															
					Total 1's	>16oz	12-16oz	8-12oz	4-8oz	<4oz										
Classic																				
100	0	75	25	454	167	119	97	70	16	60	518	80	5.6	10.7	\$4,301	NA	NA			
100	50	25	25	474	117	134	139	85	18	50	543	81	6.2	9.9	\$4,353	9.0	12.0			
100	100	0	0	481	115	118	149	98	30	52	562	81	6.9	9.2	\$4,263	7.5	10.0			
200	0	150	50	481	193	100	114	75	19	73	572	83	5.9	10.8	\$4,335	NA	NA			
200	100	50	50	492	103	126	140	123	26	40	559	82	7.0	8.8	\$4,214	8.3	11.0			
200	150	25	25	459	86	122	140	111	28	55	542	75	7.7	8.8	\$3,833	NA	NA			
200	200	0	0	425	77	99	135	114	32	52	509	79	7.2	8.3	\$3,419	5.8	8.0			
Norkotah																				
100	0	75	25	361	9	37	108	207	72	10	443	96	7.4	5.7	\$2,134	NA	NA			
100	50	25	25	344	8	21	87	228	93	7	444	95	8.3	5.2	\$1,720	12.0	16.3			
100	100	0	0	344	4	21	92	226	91	6	440	96	8.1	5.2	\$1,744	13.5	18.3			
200	0	150	50	374	13	40	112	209	75	6	455	94	7.8	5.7	\$2,171	NA	NA			
200	100	50	50	371	10	28	103	231	89	11	472	97	8.3	5.4	\$1,907	17.5	23.8			
200	150	25	25	366	13	25	103	225	89	8	461	99	8.1	5.3	\$1,913	NA	NA			
200	200	0	0	337	11	20	106	200	77	9	423	95	7.6	5.5	\$1,794	18.3	24.8			
95% confidence interval				32	22	NS	19	16	9	11	26	NS	0.4	0.5	\$405	3.1	4.1			

¹ Nitrogen fertilizer rates are expressed as lbs of nitrogen per acre. Nitrogen was applied in the form of urea. All treatments included split application at planting, tuber initiation, and early bulking. Urea was incorporated via irrigation or tillage immediately after application. Soil Type= Silty Clay Loam; Preplant Nitrate and Ammonium = 10 ppm.

² At planting treatments were applied on May 21st.

³ Tuber initiation treatments were applied on July 6th.

⁴ Early bulking treatments were applied on July 19th.

⁵ Seed spacing was 10 inches with 68 seed pieces per plot for both varieties.

⁶ Revenue per Acre = Gross Revenue using the 4 year average for Columbia Basin Carton and Bag Prices - \$5.75/CWT Packing and Handling Charges - Fertilizer Cost at \$0.90 per lb of N)

⁷ Residual soil nitrate and ammonium (0-12 inch depth) was measured shortly after harvest on Oct. 17th for select treatments. n/a = treatments not sampled for residual nitrate and ammonium.

Table 5. Influence of Split-Applied Nitrogen Fertilizer Rates and Compost on Classic Russet & Russet Norkotah Tuber Yield, Revenue, and Residual Soil Nitrate at IREC in 2012.

Season Total lbs N/A ¹	Planting lbs N/A ²	Tuber Initiation lbs N/A ³	Early Bulk lbs N/A ⁴	Tuber Yield (cwt/A)								Culls + 2's	Percent Stand ⁵	Tubers/ Plant	Avg Tuber Size (oz)	Potato Revenue \$/A ⁶	Residual Soil NO ₃ ppm ⁷	Residual Soil NO ₃ + NH ₄ ppm ⁷
				U.S. No. 1's (cwt)						Total	Total							
				Total 1's	>16oz	12-16oz	8-12oz	4-8oz	<4oz									
Classic																		
0	0	0	0	395	112	114	106	63	12	48	456	78	5.2	10.4	\$3,749	6.3	8.5	
150	75	37.5	37.5	481	111	129	145	96	26	50	556	80	6.9	9.3	\$4,272	NA	NA	
Compost @ 10Tons/A	0	0	0	461	116	134	140	71	17	49	527	78	6.0	10.2	\$3,675	5.5	7.5	
Norkotah																		
0	0	0	0	249	2	15	80	152	78	4	331	96	6.7	4.8	\$1,345	8.8	11.8	
150	75	37.5	37.5	383	12	34	112	226	84	10	477	94	8.4	5.6	\$2,152	NA	NA	
Compost @ 10Tons/A	0	0	0	351	8	19	89	235	89	10	448	95	8.3	5.2	\$1,131	10.5	13.8	
95% confidence interval				43	NS	19	21	22	9	NS	40	NS	0.5	0.5	\$527	3.1	4.1	

¹ Nitrogen fertilizer rates are expressed as lbs of nitrogen per acre. Nitrogen was applied in the form of urea. All treatments included split application at planting, tuber initiation, and early bulking. Urea was incorporated via irrigation or tillage immediately after application. Soil Type= Silty Clay Loam; Preplant Nitrate and Ammonium = 10 ppm.

² At planting treatments were applied on May 21st.

³ Tuber initiation treatments were applied on July 6th.

⁴ Early bulking treatments were applied on July 19th.

⁵ Seed spacing was 10 inches with 68 seed pieces per plot for both varieties.

⁶ Revenue per Acre = Gross Revenue using the 4 year average for Columbia Basin Carton and Bag Prices - \$5.75/CWT Packing and Handling Charges - Fertilizer Cost at \$0.90 per lb of N (Compost \$72.50/Ton)

⁷ Residual soil nitrate and ammonium (0-12 inch depth) was measured shortly after harvest on Oct. 13th for select treatments. n/a = treatments not sampled for residual nitrate and ammonium.

Table 6. Influence of Split-Applied Nitrogen Fertilizer Rates on Classic Russet & Russet Norkotah Vine Vigor, Disease Rating, Tuber Defects, Bruising, Specific Gravity, and Storage at IREC in 2012.

Season Total lbs N/A ¹	Plantin g lbs N/A	Tuber		Vigor Rating 7/24/12 ²	Vigor Rating 9/7/12 ³	Vert Wilt Rating 8/21/12 ⁴	Knobs % ⁵	Growth Cracks % ⁵	Green % ⁵	Total Cull % ⁶	Skinning Rating ⁶	Shatter Bruise % ⁷	Black Spot Bruising % ⁸	Hollow Heart % ⁹	Specific Gravity	Shrink in Storage % ⁹	Rot in Storage % ⁹	White Knot Bruising % ⁹	Black Spot Bruising % ⁹
		Initiati on lbs N/A	Early Bulking lbs N/A																
Classic																			
0	0	0	0	6.8	5.6	3.4	6.4	0.6	1.0	8.5	3.4	63	4	22	1.087	4.9	0.0	40.0	37.5
50	25	12.5	12.5	7.8	6.2	2.6	4.7	0.7	2.2	7.8	3.2	75	14	4	1.090	4.4	0.0	57.5	55.0
100	50	25	25	8.6	6.8	2.4	5.2	0.8	2.5	9.0	3.4	65	20	12	1.087	4.2	0.3	55.0	50.0
150	75	37.5	37.5	9.2	6.6	2.6	3.9	0.5	3.1	7.8	3.2	68	14	4	1.088	4.1	0.6	57.5	50.0
200	100	50	50	9.2	7.2	2.0	3.7	0.3	2.8	7.1	3.2	78	12	8	1.089	4.0	0.0	42.5	57.5
250	125	62.5	62.5	9.4	7.6	2.2	5.6	0.6	4.1	10.6	2.9	75	20	8	1.087	4.0	0.4	50.0	47.5
300	150	75	75	9.0	7.8	2.0	5.5	0.5	4.6	10.9	3.0	63	14	8	1.088	4.4	0.0	32.5	45.0
Norkotah																			
0	0	0	0	6.2	1.4	8.8	0.6	0.0	0.1	1.0	3.8	8	0	32	1.079	4.4	0.2	5.0	0.0
50	25	12.5	12.5	7.0	1.2	8.8	0.8	0.0	0.4	1.3	4.0	11	0	28	1.078	4.1	0.0	0.0	5.0
100	50	25	25	7.6	1.0	9.0	0.8	0.0	0.3	1.1	3.9	24	8	12	1.079	3.9	0.0	2.5	5.0
150	75	37.5	37.5	7.8	1.0	8.8	0.9	0.0	0.7	1.6	3.6	7	6	14	1.077	3.4	0.0	0.0	10.0
200	100	50	50	8.2	1.0	8.4	1.0	0.0	0.9	1.8	3.6	14	10	10	1.074	4.3	0.2	2.5	5.0
250	125	62.5	62.5	8.4	1.2	8.4	0.8	0.0	0.6	1.4	3.8	22	8	12	1.077	3.7	0.0	0.0	17.5
300	150	75	75	8.6	1.2	8.4	0.9	0.0	0.8	1.6	3.5	17	0	12	1.074	3.2	0.0	2.5	5.0
95% confidence interval				0.4	0.4	0.4	NS	NS	0.9	NS	0.3	NS	8	10	NS	0.6	NS	NS	NS

¹ Nitrogen fertilizer rates are expressed as lbs of nitrogen per acre. Nitrogen was applied in the form of urea. All treatments included split application at planting, tuber initiation, and early bulking. Urea was incorporated via irrigation or tillage immediately after application.

² Vine Vigor Rating 0-10 Scale, 10= highest vigor

³ Late Season Vine Vigor Rating 0-10 Scale, 10= highest vigor

⁴ Verticillium Wilt Rating 0-9 scale, 0= 0 Symptoms, 1= Trace, 2= 1-5% of plants show symptoms of disease, 3= 5-10%, 4= 10-20%, 5= 20-40%, 6= 40-60%, 7= 60-75%, 8= 75-90%, 9= 90-

⁵ Percentage of Total Yield

⁶ Skinning Rating (20 tubers/plot) 0-5 Scale, 5= no skinning; Reglone Application occurred on 9/14/2012; Harvested on 10/13/2012

⁷ 20 tubers evaluated from each plot (8-16oz tubers); 6 inch soil temperature was 45 degrees F at harvest

⁸ 10 tubers evaluated from each plot (8-16oz tubers) at harvest; cut lengthwise into quarters

⁹ 10 tubers peeled and evaluated from each plot (8-16oz) 54 days after harvest; storage at 40°F with 100% humidity

Table 7. Influence of Nitrogen Application Timing (N at planting versus N split-application) on Classic Russet & Russet Norkotah Vine Vigor, Disease Rating, Tuber Defects, Bruising, Specific Gravity, and Storage at IREC in 2012.

Season	Tuber			Vigor Rating	Vigor Rating	Vert Wilt Rating	Growth			Total Cull % ⁶	Skinning Rating ⁶	Shatter Bruise % ⁷	Black Spot Bruising % ⁸	Hollow Heart % ⁹	Specific Gravity	Shrink in Storage % ⁹	Rot in Storage % ⁹	White Knot Bruising % ⁹	Black Spot Bruising % ⁹
	Total lbs N/A ¹	Planting lbs N/A	Early Initiation lbs N/A				7/24/12 ²	9/7/12 ³	8/21/12 ⁴										
Classic																			
100	0	75	25	7.8	6.4	2.4	6.0	0.2	1.8	8.3	3.2	67	14	16	1.088	3.9	0.0	40.0	47.5
100	50	25	25	8.6	6.8	2.4	5.2	0.8	2.5	9.0	3.4	65	20	12	1.087	4.2	0.3	55.0	50.0
100	100	0	0	8.8	6.6	2.4	3.9	0.6	2.7	7.8	3.3	69	12	8	1.088	4.2	0.0	50.0	40.0
200	0	150	50	8.2	7.4	2.4	6.9	0.9	2.8	10.7	2.9	56	12	12	1.088	4.1	0.0	47.5	32.5
200	100	50	50	9.2	7.2	2.0	3.7	0.3	2.8	7.1	3.2	78	12	8	1.089	4.0	0.0	42.5	57.5
200	150	25	25	9.4	7.4	2.6	4.7	0.5	3.3	9.0	3.0	81	12	2	1.090	4.2	0.4	47.5	55.0
200	200	0	0	8.8	7.0	2.4	4.3	0.8	3.9	9.4	3.0	76	10	2	1.088	4.0	0.0	45.0	37.5
Norkotah																			
100	0	75	25	7.0	1.2	8.4	1.0	0.0	0.6	1.6	3.9	18	4	32	1.076	4.0	0.0	0.0	15.0
100	50	25	25	7.6	1.0	9.0	0.8	0.0	0.3	1.1	3.9	24	8	12	1.079	3.9	0.0	2.5	5.0
100	100	0	0	7.8	1.0	9.0	0.6	0.0	0.4	1.0	3.8	13	0	16	1.079	3.9	0.0	0.0	15.0
200	0	150	50	7.6	1.4	8.4	1.0	0.0	0.4	1.1	4.0	15	6	34	1.075	3.8	0.0	2.5	20.0
200	100	50	50	8.2	1.0	8.4	1.0	0.0	0.9	1.8	3.6	14	10	10	1.074	4.3	0.2	2.5	5.0
200	150	25	25	8.2	1.0	8.8	0.6	0.0	0.9	1.5	3.7	17	10	10	1.077	3.8	0.3	0.0	10.0
200	200	0	0	8.2	1.0	8.6	1.0	0.0	0.5	1.6	4.1	15	6	6	1.076	3.6	0.3	2.5	10.0
95% confidence interval				0.5	0.4	NS	NS	NS	NS	NS	NS	NS	NS	11	NS	NS	NS	NS	NS

¹ Nitrogen fertilizer rates are expressed as lbs of nitrogen per acre. Nitrogen was applied in the form of urea. All treatments included split application at planting, tuber initiation, and early bulking. Urea was incorporated via irrigation or tillage immediately after application.

² Vine Vigor Rating 0-10 Scale, 10= highest vigor

³ Late Season Vine Vigor Rating 0-10 Scale, 10= highest vigor

⁴ Verticillium Wilt Rating 0-9 scale, 0= 0 Symptoms, 1= Trace, 2= 1-5% of plants show symptoms of disease, 3= 5-10%, 4= 10-20%, 5= 20-40%, 6= 40-60%, 7= 60-75%, 8= 75-90%, 9= 90-100%

⁵ Percentage of Total Yield

⁶ Skinning Rating (20 tubers/plot) 0-5 Scale, 5= no skinning; Reglone Application occurred on 9/14/2012; Harvested on 10/13/2012

⁷ 20 tubers evaluated from each plot (8-16oz tubers); 6 inch soil temperature was 45 degrees F at harvest

⁸ 10 tubers evaluated from each plot (8-16oz tubers) at harvest; cut lengthwise into quarters

⁹ 10 tubers peeled and evaluated from each plot (8-16oz) 54 days after harvest; storage at 40°F with 100% humidity

Table 8. Influence of Split-Applied Nitrogen Fertilizer Rates and Compost on Classic Russet & Russet Norkotah Vine Vigor, Disease Rating, Tuber Defects, Bruising, Specific Gravity, and Storage at IREC in 2012.

Season Total lbs N/A ¹	Planting lbs N/A	Tuber Initiation lbs N/A	Early Bulking lbs N/A	Vigor	Vigor	Vert Wilt	Growth			Total Cull	Skinning	Shatter	Black Spot	Hallow	Vascular	Specific Gravity	Shrink in	Rot in	White	Black
				Rating 7/24/12 ²	Rating 9/7/12 ³	Rating 8/21/12 ⁴	Knobs % ⁵	Cracks % ⁵	Green % ⁵	% ⁶	Rating ⁶	Bruise % ⁷	% ⁸	Heart % ⁹	Discolora tion % ⁹		Storage % ⁹	Storage % ⁹	Bruising % ⁹	Bruising % ⁹
Classic																				
0	0	0	0	6.8	5.6	3.4	6.4	0.6	1.0	8.5	3.4	63	4	22	16	1.087	4.9	0.0	40.0	37.5
150	75	37.5	37.5	9.2	6.6	2.6	3.9	0.5	3.1	7.8	3.2	68	14	4	8	1.088	4.1	0.6	57.5	50.0
Compost @ 10 Tons/A	0	0	0	7.4	5.6	3.4	5.2	0.7	1.8	8.0	3.3	66	6	18	30	1.087	4.2	0.0	42.5	37.5
Norkotah																				
0	0	0	0	6.2	1.4	8.8	0.6	0.0	0.1	1.0	3.8	8	0	32	4	1.079	4.4	0.2	5.0	0.0
150	75	37.5	37.5	7.8	1.0	8.8	0.9	0.0	0.7	1.6	3.6	7	6	14	8	1.077	3.4	0.0	0.0	10.0
Compost @ 10 Tons/A	0	0	0	6.8	1.6	9.0	0.6	0.1	0.3	1.0	4.0	13	4	14	2	1.078	3.6	0.3	2.5	7.5
95% confidence interval				0.5	0.5	NS	NS	NS	0.8	NS	NS	NS	7	8	7	NS	0.6	NS	NS	NS

¹ Nitrogen fertilizer rates are expressed as lbs of nitrogen per acre. Nitrogen was applied in the form of urea. All treatments included split application at planting, tuber initiation, and early bulking. Urea was incorporated via irrigation or tillage immediately after application.

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⁸ 10 tubers evaluated from each plot (8-16oz tubers) at harvest; cut lengthwise into quarters

⁹ 10 tubers peeled and evaluated from each plot (8-16oz) 54 days after harvest; storage at 40°F with 100% humidity

Figure 1. Petiole Nitrate Levels- 4th Petiole from Growing Tip at Early Bulking (67 DAP)

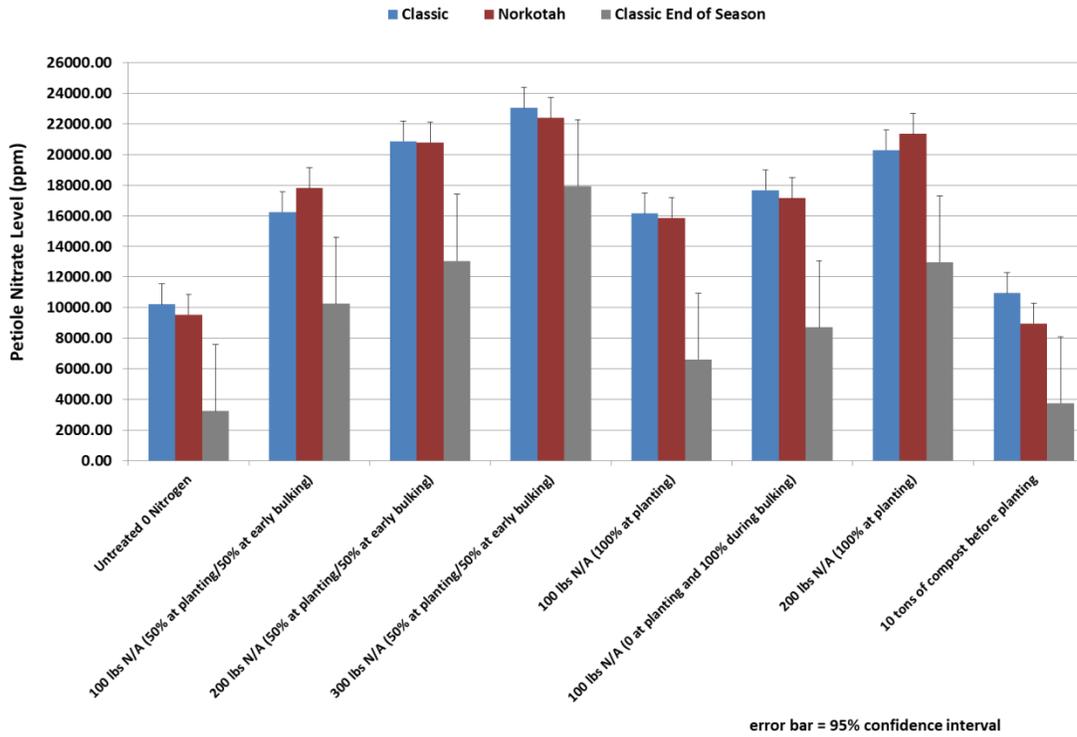


Figure 2. Estimated Total Nitrogen in Vines, Tubers, and Soil at Vine Kill
(roughly 40 lbs of N/A were available at planting as estimated from at planting soil tests)

