

34 Inch Rows: Should They Stay, or Should They Go?

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Justification: Literature that explains why Columbia Basin growers plant potatoes into 34 inch rows is elusive if not nonexistent.

Purpose: Identify the row width that maximizes grower revenue by optimizing land use efficiency, yield, and tuber size profile for certain varieties.

Background: Alturas, Russet Burbank, and Umatilla Russet were all planted into 30-, 32-, 34-, and 36-inch wide rows in 2011-13. Ranger Russet, Russet Norkotah and Chieftain were added during 2012-13. In 2014, The 36 inch row width was dropped because it returned low gross return all three years and a 28 inch row width treatment was added. We also added two new varieties, Teton Russet and Yukon Nugget. Typical in-season data and post-harvest data were captured. Varieties were allowed to grow for the full season and harvested after 150 DAP.

Results: In 2014, the 34 inch row width returned the highest gross return (Table 1). The results did not match those from 2011-13 (Table 2). In 2011-13, with the exceptions of R. Burbank and Ranger R. (Table 2), total yield and economic revenue increased as row width was reduced from 36 inches to 30 inches. Ranger produced the highest economic return at 32 inch row width in 2011-13, but in 2014, the highest was at 34 inch row width (Tables 1 & 2). Numerically, Alturas produced higher gross return in 2014 at the 28 inch row width and Teton at 30 inches. Neither of these was statistically significant, so more research is likely needed to smooth out the seasonal growth differences.

One might expect to see a decrease in average tuber size (weight/length) as rows are planted closer together – we have yet to see it. The plants appear to adjust tuber number per plant as the row width is altered. Similar to in-row spacing changes, as plants become closer together, they produce fewer tubers per plant. When they do this, the tubers benefit by getting more photosynthetic assimilates than if there were more tubers – hence the average tuber size per plant stays somewhat similar to that of wider spaced rows (Tables 1 & 2).

One theory on why the closer row widths didn't produce higher yields or gross than the wider row widths in 2014 was that there was reduced tuber bulking in late July, all of August, and early Sept due to excessive heat. Across all of our research trials in Othello, tuber bulking was slow to non-existent later in the summer due to high ambient temperatures. Perhaps the more closely spaced rows were relatively immature compared to the wider rows when the heat intensified. This is suspected because the closer spaced rows must grow more vine and foliage to compete (data not shown) for light. In the previous years, the extended growing season typical of the Columbia Basin allowed tubers of the immature plants to bulk adequately prior to harvest.

Recommendations:

The 2014 season humbled us. We found that an unpredictable environment can have profound effects on this type of research. However, the reason we didn't stop this research after 3 years of positive results is because we wanted to make sure we could provide a sound recommendation that would hold true >90% of the time. At this time, growers should stay at the row width that has been working for them (likely 34 inches in the Columbia Basin) over the years. We will continue the small plot research until we feel there is no more to learn.

Table 1. Total yield, average tuber weight and number per plant, process yield, specific gravity and seed-cost adjusted gross revenue for 2014. Seed cost adjusted gross value is shown as the difference (%) in return from the standard row width (34 inches).

2014 WSU Row Width X Variety Trial														
ENTRY	Row* Width inches	TOTAL YIELD (CWT/A)	US # 1's* US # 2's* Culls*				(Final Harvest) AVERAGE TUBER		PROCESS YIELD US 1's and 2's		PROCESS YIELD US 1's and 2's		Specific Gravity	Seed-Cost Adjusted Process Value** Gross \$/A % diff from 34 inch
			> 4 oz	> 4 oz	& < 4 oz	% of Total Yield	WEIGHT	NUMBER	> 6 oz	≥ 12 oz	> 6 oz	≥ 12 oz		
							oz	Tubers/Plant	% of Total Yield		CWT/A			
Alturas	28	605	543	78	4	18	7.5	5.8	69	24	417	143	1.080	9
	30	661	531	68	5	27	7.7	6.7	60	19	397	125	1.081	0
	32	588	493	70	4	26	7.1	6.8	60	20	353	120	1.076	-17
	34	720	611	72	4	24	7.2	8.9	59	13	425	96	1.072	0
	p-Value	ns	ns	ns	ns	ns	ns	0.0009	ns	ns	ns	ns	0.0463	ns
	LSD							1.0					0.0063	
Ranger R.	28	676	661	83	6	11	7.7	6.3	76	20	514	133	1.085	-13
	30	741	734	89	5	6	8.5	6.7	81	32	600	240	1.083	0
	32	696	676	85	4	11	8.2	6.9	76	30	529	206	1.079	-15
	34	796	782	84	6	10	8.4	8.4	77	39	613	309	1.080	0
	p-Value	ns	ns	0.0462	0.0582	ns	ns	0.0118	ns	ns	ns	ns	0.0056	0.0029
	LSD			4.0	4.0			1.2						
R. Burbank	28	633	604	82	6	12	8.3	5.4	73	34	462	216	1.081	-15
	30	670	612	76	7	17	8.4	6.1	70	35	469	233	1.079	-15
	32	721	663	76	10	14	9.4	6.3	78	41	562	297	1.081	-4
	34	778	730	79	7	14	8.8	7.8	75	40	584	308	1.078	0
	p-Value	ns	ns	ns	ns	ns	ns	0.0231	ns	ns	ns	ns	ns	ns
	LSD							1.4						
R. Norkotah	28	686	668	89	4	7	9.1	5.4	76	34	521	230	1.070	-16
	30	742	730	90	4	6	9.3	6.2	78	39	579	293	1.070	-9
	32	772	757	87	7	6	9.8	6.5	80	46	618	354	1.068	-12
	34	839	821	89	4	7	9.3	7.9	76	42	638	354	1.073	0
	p-Value	ns	ns	ns	ns	ns	ns	0.0135	ns	ns	ns	ns	ns	ns
	LSD							1.3						
Teton R.	28	594	546	86	1	13	8.7	4.9	76	31	451	186	1.075	-6
	30	674	624	84	3	13	8.7	5.9	78	36	526	245	1.072	8
	32	649	649	83	4	13	9.3	5.7	80	42	519	273	1.070	1
	34	668	668	86	1	13	8.7	6.7	76	38	508	257	1.073	0
	p-Value	ns	ns	ns	ns	ns	ns	0.0024	ns	ns	ns	ns	ns	ns
	LSD							0.7						
Umatilla R.	28	586	569	72	8	20	6.1	6.9	54	15	316	88	1.084	-21
	30	645	637	76	2	22	5.5	9.0	51	7	329	48	1.082	-16
	32	600	591	81	2	17	6.3	8.0	57	13	342	80	1.081	-19
	34	737	719	77	2	21	5.8	11.0	57	12	420	92	1.081	0
	p-Value	ns	ns	ns	ns	ns	ns	0.0047	ns	ns	ns	ns	ns	ns
	LSD							1.9						
Chieftain	28	784	745	88	0	12	9.2	6.1	81	44	635	343	1.067	Not
	30	940	889	88	2	10	10.0	7.2	82	55	771	514	1.066	Calculated due
	32	808	802	92	1	7	9.1	7.3	83	45	671	361	1.065	to lack of
	34	809	795	89	0	11	8.1	8.7	76	35	615	281	1.068	pricing structure
	p-Value	ns	ns	ns	ns	ns	ns	0.0198	ns	ns	ns	ns	ns	
	LSD							1.4						
Yukon Nugget	28	542	520	70	1	29	5.1	7.6	49	8	266	42	1.082	Not
	30	573	551	73	1	26	5.1	8.5	52	11	298	64	1.080	Calculated due
	32	505	470	68	2	30	5.1	8.1	47	12	237	60	1.078	to lack of
	34	653	635	74	1	25	5.1	11.1	53	11	346	74	1.078	pricing structure
	p-Value	ns	0.0507	ns	ns	ns	ns	0.0017	ns	ns	ns	ns	ns	
	LSD		113					1.4						
Averaged across all varieties	28	630	599	82	4	14	7.9	5.8	72	27	454	173	1.079	-15
	30	688	645	81	4	15	8.0	6.8	70	32	482	220	1.078	-10
	32	671	631	80	5	15	8.4	6.7	73	32	490	218	1.075	-12
	34	756	714	81	4	15	8.0	8.4	71	29	537	221	1.076	0
	p-Value	0.0002	0.0001	ns	ns	ns	ns	0.0001	ns	ns	ns	ns	0.0011	0.0015
	LSD	54	49					0.5					0.002	9

*In-row spacing was 10 inches. Percent values may not total 100% due to rounding. ns = treatments are not significantly different from each other at the 5% level using Fisher's LSD Test. LSD = Least Significant Difference.

**Economic value based on a typical Columbia Basin processing or fresh market (R. Norkotah only) contract minus seed cost differences. Cut and treated (fungicide and insecticide) seed costs were estimated at \$20.00/CWT. A seed piece weight of 3 oz was used in the seed cost calculation. A fresh market value was calculated for Russet Norkotah and Teton Russet. Chieftain and Yukon Nugget econ not calculated due to lack of a pricing structure

Table 2. Results from 2011-13 WSU row width by variety trial which included six varieties by four row widths.

2011-13 WSU Row Width X Variety Trial														
ENTRY	Row* Width inches	TOTAL YIELD (CWT/A)	US # 1's* > 4 oz ----- % of Total Yield	US # 2's* > 4 oz ----- % of Total Yield	Culls* & < 4 oz	(Final Harvest)		PROCESS YIELD				Specific Gravity	Seed-Cost	
						AVERAGE TUBER		US 1's and 2's					Adjusted	
						WEIGHT oz	NUMBER Tubers/Plant	> 6 oz	> 12 oz	Process Value**				
		CWT/A		Gross \$/A										
Alturas (2011-13)	30	788 a	74	7	19	6.7	8.9	522 a	143 a	1.091	4780 a			
	32	729 ab	73	6	21	6.6	9.1	468 ab	133 a	1.085	4300 ab			
	34	668 b	74	8	18	6.7	8.6	450 b	136 a	1.082	4170 b			
	36	661 b	75	5	20	6.6	9.1	432 b	113 b	1.082	3975 b			
	p-Value	0.0024	ns	ns	ns	ns	ns	0.0024	0.0032	ns	0.0176			
Ranger R. (2012-13)	30	735 ab	75	4	22	6.2	9.2	456 ab	134	1.084	4280 ab			
	32	798 a	76	6	18	6.5	9.9	512 a	137	1.088	5030 a			
	34	651 bc	75	4	21	6.6	8.6	411 bc	139	1.086	4020 b			
	36	626 b	79	4	17	6.6	8.7	422 b	134	1.084	4060 b			
	p-Value	0.0016	ns	ns	ns	ns	ns	0.0432	ns	ns	0.0412			
R. Burbank (2011-13)	30	669 a	71	5	24	6.5	8.0	408 a	129	1.080	3920			
	32	615 ab	71	7	22	6.7	7.6	382 ab	138	1.082	3800			
	34	594 bc	75	6	19	6.6	7.8	381 bc	121	1.077	3870			
	36	582 c	74	6	20	7.1	7.7	374 c	156	1.079	3820			
	p-Value	0.0765	ns	ns	ns	ns	ns	0.0500	ns	ns	ns			
R. Norkotah (2012-13)	30	617 a	70	2	28	5.7	8.3	310 a	73	1.073	3830 a			
	32	582 a	67	3	30	6.0	7.8	305 a	112	1.076	3690 ab			
	34	480 b	64	2	34	5.5	7.1	216 b	72	1.071	3020 c			
	36	463 b	67	2	32	5.5	7.2	213 b	69	1.071	3090 bc			
	p-Value	0.0027	ns	ns	ns	ns	ns	0.0027	ns	ns	0.0418			
Umatilla R. (2011-13)	30	778 a	70	2	28	5.5	10.8	391 a	83 a	1.086	4180 a			
	32	670 b	71	1	29	5.4	10.1	308 b	65 b	1.085	3750 ab			
	34	605 c	71	2	27	5.5	9.1	291 c	65 b	1.086	3445 b			
	36	575 c	71	2	27	5.6	10.0	289 c	68 b	1.084	3250 b			
	p-Value	0.0001	ns	ns	ns	ns	ns	0.0001	0.0001	ns	0.0066			
Chieftain (2012-13)	30	801 a	91	2	6	9.5	6.6	689 a	360 b	1.067	na			
	32	811 a	92	1	7	9.2	7.8	673 b	381 a	1.066	na			
	34	786 a	92	2	7	9.7	7.2	675 bc	362 b	1.069	na			
	36	640 b	92	1	7	8.8	7.6	531 c	262 c	1.069	na			
	p-Value	0.0302	ns	ns	ns	ns	ns	0.0302	0.0204	ns				
Averaged across varieties grown 2011-13 (Uma, RB, Alt)	30	745 a	71	5	24 a	6.3	9.2	490 a	134 a	1.086 a	4290 a			
	32	671 b	72	4	24 a	6.2	8.9	414 b	123 ab	1.084 ab	3960 b			
	34	612 c	73	5	22 b	6.3	8.5	388 c	111 b	1.082 b	3770 b			
	36	616 c	73	5	23 ab	6.4	9.0	368 c	112 b	1.082 b	3745 b			
	p-Value	0.0001	ns	ns	0.0249	ns	ns	0.0001	0.0176	0.0159	0.0001			

*In-row spacing was 10 inches. Percent values may not total 100% due to rounding. **Bolded** values are significantly different from each other at the 5% level using Fisher's LSD Test when followed by a different letter. Values for each variety and category are not significantly different if followed by the same letter.

**Economic value based on a typical Columbia Basin processing or fresh market (R. Norkotah only) contract minus seed cost differences. Cut and treated (fungicide and insecticide) seed costs were estimated at \$20.00/CWT. A seed piece weight of 3 oz was used in the seed cost calculation. A fresh market value was calculated for Russet Norkotah.