STORAGE AND QUALITY OF 'RANGER RUSSET' POTATOES

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Acreage in Idaho planted to 'Ranger Russet' potatoes has steadily increased since the cultivar's release in 1991. Plant growth habits and potato yield and grade make it a desirable variety for growers to produce. High recovery rate and fry quality make it an advantageous variety for processors to use. Unfortunately, the in-field and storage management practices required for optimum long-term storability of 'Ranger Russet' potatoes have not yet been completely determined. Some of the quality concerns with both short and long-term storage are increasing sugar content, parfry graying, and fry color darkening and mottling. Managing for black spot bruise is also a concern.

VINE KILL

Certified 'Ranger Russet' seed was planted in replicated plots for three consecutive years (2000-2002) at the University of Idaho Kimberly Research and Extension Center. Treatments included a) no vine kill b) vines killed two weeks prior to harvest c) vines killed four weeks prior to harvest and d) vines sprayed with maleic hydrazide (MH-30) killed two weeks prior to harvest. Vines were removed mechanically and MH-30 was applied at 1.33 gal/A four weeks prior to vine kill.

Table 1. Yield and grade of 'Ranger Russet' vine kill treatments at Kimberly, ID. (3-year data)

	Cwt/A							
Field Treatment	< 4 oz	4-6 oz	6–10 oz	10–12 oz	> 12 oz	US #1	US #2	Total Yield
No vine kill	15.3 a	25.1 a	92.8 b	57.4 a	215.9 a	391.1 a	75.2 a	482.2 a
2 week dead vine	15.5 a	23.8 a	98.7 ab	68.3 a	217.7 a	408.5 ab	59.7 a	484.1 a
4 week dead vine	16.5 a	28.3 a	110.0 a	59.9 a	175.2 b	373.4 b	74.8 a	465.2 a
2 week dead vine + MH30	14.0 a	25.5 a	95.7 b	61.5 a	230.0 a	412.8 a	59.5 a	486.7 a
Values in the same column followed by the same letters are not significantly different. $\alpha = 0.1$								

Tubers were harvested the fourth week of September and evaluated for yield and grade, impact bruise, specific gravity, and baseline sugar and fry color parameters. Tubers were then stored at 48°F with 95 percent relative humidity (%RH) until June. Samples were collected monthly for sugar and fry color evaluations.

Killing vines four weeks prior to harvest resulted in higher yields of 6-10 ounce tubers and lower yields of larger (greater than 12 ounces) tubers and US No. 1 potatoes, and

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lower specific gravity when compared to tubers from plots receiving no vine kill (Tables 1 and 2).

Table 2. At-harvest specific gravity, impact bruise, glucose, sucrose and fry color.

Field Treatment	Specific Gravity	Stem End Impact Bruise		Glucose (%fwt)	Sucrose (%fwt)	Stem[2] Fry Color
		Incidence, %	Severity[1]			
No vine kill	1.090 a	95.9 a	3.3 a	0.035 b	0.16 a	50.7 a
2 week dead vine	1.089 a	97.3 a	3.4 a	0.041 b	0.15 b	48.9 a
4 week dead vine	1.083 b	96.0 a	3.3 a	0.050 a	0.13 c	48.7 a
2 week dead vine + MH30	1.089 a	95.3 a	3.2 a	0.041 b	0.14 b	50.5 a

Values in the same column followed by the same letters are not significantly different. $\alpha = 0.05$

[1]Impact bruise rating: 1-4 using a bruise color chart where 1=no bruise and 4=black bruise

[2]USDA fry color rating #1≥ 44, #2 < 44 but ≥ 35, #3 = < 35 but ≥26 reflectance

Processing quality for tubers harvested from the no vine-kill treatment had the lowest glucose levels and the best fry quality throughout storage (Tables 2 and 3). Tubers from the two-week vine kill plots demonstrated acceptable quality, but tubers from the four-week vine kill plots had the lowest specific gravity and worst fry quality as seen by fry color and mottling. Greater differences between treatments were seen in years when vines stayed viable later in the season. The application of MH-30 showed no yield or quality differences when compared to two-week dead vine tubers.

Table 3. Storage season glucose, fry color and mottling severity for vine kill treatments.

Field Treatment	Glucose (%fwt)			Stem End Fry Color[1]			Mottling Severity[2]		
	Nov	Feb	June	Nov	Feb	June	Nov	Feb	June
No vine kill	0.05 c	0.06 c	0.06 c	48.2 a	47.2 a	45.1 a	1.4 a	1.8 b	2.0 c
2 wk dead vine	0.06 b	0.08 b	0.08 b	46.6 a	44.5 b	42.5 b	1.4 a	1.9 b	2.2 b
4 wk dead vine	0.07 a	0.10 a	0.12 a	46.2 a	42.3 c	39.2 c	1.5 a	2.1 a	2.7 a
2 wk dead vine + MH-30	0.06 b	0.08 b	0.07 b	46.5 a	43.8 b	43.8 b	1.4 a	1.9 b	2.2 b

Values in the same column followed by the same letters are not significantly different. $\alpha = 0.05$

[1]USDA fry color rating #1≥ 44, #2 < 44 but ≥ 35, #3 = < 35 but ≥26 reflectance

[2]Mottling 1=no mottling 2=mild 3=moderate 4=severe

STORAGE MANAGEMENT

For three consecutive years, commercially grown ‘Ranger Russet’ potatoes were brought to the Kimberly R&E Storage Facility following harvest, cured at 55°F with 95% RH for 14 days and the temperature lowered 0.5°/day until the tubers reached their storage temperature (Table 4). One treatment was stored at 38°F for six days prior to curing to mimic cold temperatures in the field and during harvest. Ranger Russet tubers exposed to 38°F for six days showed the least desirable quality immediately at the beginning of the storage season while 45°F storage resulted in less desirable quality later in the season.

Table 4. Three year glucose, fry color and mottling for three selected months in storage									
Storage Treatment	Glucose (%fwt)			Stem End Fry Color[1]			Mottling Severity[2]		
	Nov	Feb	June	Nov	Feb	June	Nov	Feb	June
48ºF	0.05 b	0.08 b	0.08 c	50.1 a	45.6 a	44.6 a	1.4 b	2.0 b	2.2 b
45°F	0.06 b	0.09 b	0.12b	49.3 a	43.7 b	39.8 b	1.5 b	2.0 b	2.7 a
38ºF 6 days/ 48ºF	0.20 a	0.16 a	0.14 a	34.4 b	33.3 c	35.2 c	2.8 a	2.6 a	2.7 a
Values in the same column followed by the same letters are not significantly different. α =0.05 [1]USDA fry color rating #1≥ 44, #2 < 44 but ≥ 35, #3 = < 35 but ≥26 reflectance [2]Mottling 1=no mottling 2=mild 3=moderate 4=severe									

Other storage regimes were tested for 2 years (Table 5). Curing at 60°F did not make a difference in processing quality when compared to curing at 55°F. The addition of a second CIPC application in late January caused a short-term increase in glucose concentrations and stem-end fry color. Low airflow may also cause some undesirable processing quality attributes. Exposure of 'Ranger Russet' tubers to temperatures of 45°F or less resulted in higher sugars, darker fry color and more severe mottling.

Table 5. Two year glucose, fry color and mottling severity for 3 selected months in storage									
Storage Treatment	Glucose (%fwt)			Stem End Fry Color[1]			Mottling Severity[2]		
	Nov	Feb	June	Nov	Feb	June	Nov	Feb	June
48ºF	0.03 a	0.067 d	0.08 c	52.7 a	45.9 a	42.6 a	1.3 a	2.0 a	2.26 c
Cure 60ºF /48ºF	0.03 a	0.072cd	0.09 c	53.9 a	45.5 ab	42.3 a	1.2 a	2.0 a	2.22 c
48ºF + 2nd CIPC	-	0.082 b	0.09 c	-	43.3 c	41.7 a	-	1.1 a	2.30bc
Low Air Flow(50%)	0.03 a	0.077bc	0.11 b	53.3 a	43.7 bc	40.4 ab	1.3 a	2. a	2.48 b
48ºF/45°F	-	0.098 a	0.14 a	-	40.4 d	39.0 b	-	2.3 a	2.88 a
45°F	0.04 a	0.089 b	0.12 b	52.5 a	42.9 c	35.9 c	1.4 a	2.2 a	2.78 a
Values in the same column followed by the same letters are not significantly different. α =0.05 [1]USDA fry color rating #1≥ 44, #2 < 44 but ≥ 35, #3 = < 35 but ≥26 reflectance [2]Mottling 1=no mottling 2=mild 3=moderate 4=severe									

COLD TEMPERATURES

Table 6. 2002 cold temperature treatments		
38ºF	42°F	45°F
1 day	3 days	6 days
3 days	6 days	9 days
6 days	9 days	13 days

In order to determine 'Ranger Russet' sensitivity to cold temperatures, tubers were placed at three temperatures for three durations immediately after harvest (Table 6). Once again, this procedure was to mimic cold temperatures that may occur late-season in the field or during harvest. Tubers were then stored at 55ºF until a total of 14 days from placement in storage occurred. The temperature was then decreased 0.5ºF /day and held at 48°F. Sugar content, fry color and mottling were assessed in November, February and June. Decreased tuber quality, as compared to tubers at 48°F with no cold temperature treatment, was seen for all cold treatments throughout the storage season (data not shown). The only exception was the 1 day at 38°F treatment that showed only a

slight increase in glucose and mottling severity later in the storage season. The decrease in glucose and increase in fry color reflectance shows that the tubers will naturally recondition at 48°F storage, but not necessarily to acceptable levels, nor to levels if not exposed to the cold. This experiment clearly indicates the acute sensitivity and prolonged affect of 'Ranger Russet' to even short durations of cold temperatures.

SUMMARY

Based upon these experiments, our conclusions for maintaining processing quality of 'Ranger Russet' potatoes in storage for longer durations were:

- Minimize the amount of time they are left in the ground after vine kill and prior to harvest.
- We recommend no vine kill but the practicality of getting through the vines may require vine kill prior to harvest
- Exposure to temperatures of 45°F or less in the field and in storage is detrimental to fry color, glucose levels and mottling
- Curing at 55°F or higher
- Store at 48°F
- A second application of CIPC may cause an increase in glucose and darker fry color short-term
- Variations in growing seasons will cause variability in tuber response to treatments.