Alpine Russet Management Recommendations – Idaho

Alpine Russet is a high yielding, medium to late maturing cultivar with oblong tubers, light russet skin and excellent processing quality following long-term storage. It has moderately high specific gravity, resistances to sugar ends, tuber malformations and most internal and external defects. It is notable for tuber dormancy most similar to that of Russet Burbank, making it an excellent candidate for long-term storage, with processing characteristics superior to that of Russet Burbank. Alpine Russet is a product of the cooperative USDA/ARS, University of Idaho breeding program in Aberdeen, and was released jointly in 2008 by the USDA/ARS and the experiment stations of Idaho, Washington, and Oregon.

Tuber Yield:
Alpine Russet consistently produced higher average total and U.S. No. 1 yields than either Ranger Russet or Russet Burbank in 23 late harvest trials grown in eastern Idaho, Western and Central Idaho, Oregon and Washington (Table 1).

Table 1 Total and U.S. No. 1 yields for Alpine Russet as compared to those of Ranger Russet and Russet Burbank in late harvest trials.

Location	Variety	Total Yield	U.S. No. 1 Yield
		(cwt/A)	(cwt/A)
Eastern Idaho[1]	Alpine Russet	563	454
	Ranger Russet	476	389
	Russet Burbank	441	270
Western and Central Idaho [2]	Alpine Russet	521	442
	Ranger Russet	476	344
	Russet Burbank	499	321
Oregon[3]	Alpine Russet	753	556
	Ranger Russet	632	481
	Russet Burbank	660	368
Washington[4]	Alpine Russet	765	640
	Ranger Russet	724	622
	Russet Burbank	698	494

[1] Data from 7 trials conducted from 2002-2004 in Aberdeen, Shelley, and Rexburg, Idaho.
[2] Data from 4 trials conducted from 1999-2004 in Kimberly and Parma, Idaho.
[3] Data from 9 trials conducted from 2002-2004 in Hermiston, Malheur, and Klamath Falls, OR.
[4] Data from 3 trials conducted from 2002-2004 in Othello, WA.

Total yields for Alpine Russet were 6 to19% higher than Ranger Russet and 5 to 28% higher than Russet Burbank, while U.S. No. 1 yields were 3 to 28% higher than Ranger Russet and 30 to 68% higher than Russet Burbank.

Tuber Quality Characteristics:
In 18 trials grown in Idaho, Oregon, and Washington, average specific gravity and percent solids for Alpine Russet were intermediate between Russet Burbank and Ranger Russet (Table 2). Alpine Russet produced significantly lighter colored fries than either Ranger Russet or Russet Burbank out of 45°F storage.

Table 2 Tuber specific gravity french fry color of Alpine Russet as compared with Ranger Russet and Russet Burbank.

Characteristic	**Alpine Russet**	**Ranger Russet**	**Russet Burbank**
Specific gravity[1]	1.082	1.086	1.077
Fry color (45°F storage)[2]	0.7	1.1	1.6
Solids (%)	21.4	21.9	20.7

[1] Specific gravity data from 18 trials grown in Idaho, Oregon and Washington.
[2] French fry color data from 15 (45°F) trials grown in Idaho, Oregon and Washington. USDA color chart [00 – 4.0(darkest)]

Internal and External Defects:
Alpine Russet has exhibited lower susceptibility to growth cracks and secondary growth than Ranger Russet and Russet Burbank (Table 3), particularly under high stress conditions. Alpine Russet's susceptibility to blackspot bruise is similar to Russet Burbank but less than Ranger Russet. It also is resistant to hollow heart.

A susceptibility to net necrosis/vascular discoloration was noted in early harvest trials of the 2002 -2004 Western Regional Potato Variety Trials, but this tuber defect was not observed in full-season trials. With its medium-late maturity, a full growing season is recommended for Alpine Russet, and this tuber defect is not expected to be a problem.

Table 3 Internal and external defects of Alpine Russet tubers compared with those of Ranger Russet and Russet Burbank. Data taken are from trials grown in Idaho, Oregon and Washington from 2002-2004.

Defect	**Alpine Russet**	**Ranger Russet**	**Russet Burbank**
Growth cracks[1]	4.6	4.4	3.5
Second growth[1]	4.6	4.5	3.5
Blackspot bruise[1]	4.1	3.5	4.0
Hollow heart/Brown Center[2]	0%	0%	7%

[1] Growth cracks, second growth, and blackspot bruise rated on a scale 1-5 where 1 = severe occurrence of the defect and 5 = no occurrence of the defect.
[2] Hollow heart/Brown Center measured as percent of >12 oz tubers with the defect.

Table 4 Disease reactions of Alpine Russet tubers compared with those of Russet Burbank.

Disease Responses[1]	**Alpine Russet**	**Russet Burbank**
Verticillium Wilt	MR	S
Foliar Early blight	S	S
Tuber Early blight	MS	MS
Late blight (foliar)	S	S
Late blight (tuber)	MS	S
Common Scab	MR	MR
(PLRV) Net necrosis/serious defect	MS	S
Corky ring spot	S	S
Root knot nematode	S	S
Dry rot (*F. sam*)	S	S
Dry rot (*F. sol*. var. *coer*.)	MS	S
Pectobacterium soft rot	S	S
PVX	S	VS
PVY^{O}	S	S
PLRV	S	VS

1 Responses of Alpine Russet to diseases were based on a minimum of two years of controlled field evaluations. Responses were defined as very resistant (VR), resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S), and very susceptible (VS).
2 Virus responses are based on seed borne infections as determined by ELISA, following field infection with PLRV from aphid vectored sources of inter-planted virus infected potato, mechanical inoculation and aphid vectored PVY, and mechanical inoculation with PVX.

Disease Reactions:
Alpine Russet is significantly more resistant to Verticillium wilt than Russet Burbank, and has similar resistance to common scab (Table 4). It has similar susceptibility to foliar and tuber early blight, foliar late blight, dry and soft rots. However, it is slightly less susceptible to tuber late blight infections and PLRV net necrosis.

Management Recommendations

A limited number of studies for developing management practices optimal for the production of Alpine Russet were conducted in southern Idaho. Results of these studies may provide growers in these and other production regions with a basis for developing appropriate management guidelines for their locale.

Seed and Pest Management
Efforts should be made to avoid allowing seed of Alpine Russet to sprout in the pile prior to planting. Alpine does not recover as well as Russet Burbank from having sprouts knocked off during the planting operation, which may reduce early season growth.

Inspect seed carefully for dry rot. Seed should be warmed to at least 50^{o}F before handling and cutting to minimize injury and promote rapid healing. Seed cutting and handling equipment should be disinfected often to avoid spreading the disease. Cut seed should be treated with a recommended fungicide prior to planting. If possible, it is best to plant in well-drained soils when soil temperatures are above 50^{o}F to promote early sprout growth and emergence, thereby lessening the chance for infection.

Optimal seed size for Alpine Russet is about 2 to 2 ½ oz. Seed should be planted near optimal soil temperatures (50-55^{o}F). Planting depth should be 6 to 8 inches from the top of the seed piece to the top of the hill. Seed piece spacing for 36 inch wide rows should be 10 to 12 inches for processing.

Alpine Russet has exhibited good resistance to metribuzin when applied at labeled rates. It has an erect, medium sized vine with medium-late maturity but competes reasonably well with weeds after row closure during early to mid-tuber bulking.

Soils infested with root-knot nematodes or a history of severe early die problems should be fumigated. Routine fungicide applications should also be made to prevent serious early blight infections. Early blight control for tubers in fields scheduled for storage can be facilitated by minimizing tuber skinning and bruising during harvest and subsequent handling and avoiding harvesting in wet weather conditions.

Nutrient Management:
Total seasonal nitrogen requirements for Alpine Russet are about 20 % less than Russet Burbank for a given amount of yield produced. Typically, 1/3 to 1/2 of the seasonal N requirement should be applied by row closure, with subsequent in-season applications being based on petiole nitrate concentrations. For southern Idaho, total soil plus fertilizer N recommendations range from about 200 lb N/acre in areas with a 400 cwt/acre yield

potential, 235 lb N/acre in areas with a 500 cwt/acre yield potential and 270 lb N/acre in areas with a 600 cwt/acre yield potential. Nitrogen uptake decreases significantly after mid August so N applications should not be made after that time.

Phosphorus, potassium and micronutrient requirements have not been established for Alpine Russet. Therefore, it is recommended that growers follow local nutrient management recommendations for Russet Burbank until new guidelines for Alpine Russet become available.

Irrigation Management:
Water use efficiency (yield per inch of water applied) for Alpine Russet is about 25% higher than Russet Burbank. Alpine Russet is also significantly more resistant to water stress-related tuber defects than Russet Burbank. Therefore, available soil moisture (ASM) should be maintained within the range of 65 to 80% for optimal yield and quality. Plant water uptake decreases appreciably in late August, so irrigation application rates need to be adjusted according to soil moisture measurements to avoid developing excessively wet soil conditions that promote disease and enlarged lenticels. Low soil moisture (<60%ASM) conditions should be avoided during tuber maturation and harvest to minimize tuber dehydration and blackspot bruise.

Harvest Management:
Proper vine kill management practices should be followed to promote uniformity of tuber maturity at harvest. Irrigation rates should be gradually reduced during the remaining few weeks prior to vine kill to avoid excessive soil moisture and allow tuber hydration to decrease to a moderate level during skin set. Standard practices for minimizing tuber impact damage during harvest and transfer to storage should be followed to reduce the potential for shatter and blackspot bruise.

Tuber damage should also be minimized to limit the potential for dry rot infection. Avoid harvesting in cold temperatures, which increases the potential for tuber injury. Wounds provide the entry points for infection to occur, and therefore need to be minimized to reduce the incidence of dry rot. Harvesting tubers with good skin set with pulp temperatures greater than 50^{o}F will help reduce development of the disease. Also use proper wound healing practices in storage to promote tuber suberization, which will help wall off the developing infection.

Storage Management:
Alpine russet has a dormancy length slightly longer than Russet Burbank. Even though the natural dormancy length of Alpine Russet is longer than Russet Burbank, sprout inhibitor application is still necessary if the intended storage duration is longer than the indicated dormancy length. Timing of application is comparable to that of Russet Burbank, i.e., after the curing period but well before dormancy break.

Variety	42°F	45°F	48°F
Russet Burbank	175 days	155 days	130 days
Alpine Russet	185 days	165 days	140 days

Three year averages indicate that Alpine Russet has a higher susceptibility to Fusarium dry rot than Russet Burbank. Mean dry rot decay (severity) in Alpine Russet was 19% compared to 10% for Russet Burbank. Percent dry rot incidence (rot >0%) was slightly higher in Alpine Russet, at 67% versus 55% for Russet Burbank. Total percent weight loss in Alpine Russet was not significantly different than Russet Burbank at 42 or 45°F, however at 48 °F, it was significant. On average, total weight loss in Alpine Russet was slightly more than Russet Burbank, averaging 5.3, 4.6, and 8.0% at 42, 45 and 48°F compared to Russet Burbank's weight loss of 4.4, 3.6, and 5.0%, respectively.

Glucose concentrations were lower than Russet Burbank across years, temperatures and dates in storage. Peak glucose concentration in Alpine Russet occurred at ~190 days after harvest in 2006-07 at 0.12% (fresh weight). Typically glucose concentrations remained below 0.10 % at 42°F in all three years and near or below 0.05% in the 45 and 48°F storages. Sucrose concentrations were higher in Alpine Russet at all temperatures and years compared to Russet Burbank. Fry color was less than or equal to a USDA 1 when stored at both 45 and 48 °F. At 42°F, fry color was USDA 2 or less, except in 06-07, between 70 and 180 days after harvest when fry color reached a USDA 3. Mottling, a dark, uneven coloration which can occur in fried products, scored at a mild level at 42°F, and mild to none at 45 and 48°F. Consequently, storage at 45^{o}F to 48^{o}F should produce light colored fries throughout the entire storage year.

Storage recommendations for Alpine Russet

Curing - Cure at 55°F and 95% relative humidity for 14 days.

Storage - Maintain 95% relative humidity throughout storage**.**

- ***Frozen processing,*** hold at 45°F.
- ***Fresh market,*** hold at 42°F.
- ***Dehydration processing,*** hold at 42°F to 45°F, depending on intended product.

Sprout inhibition - Apply CIPC before dormancy break but after curing. Timing of sprout inhibitor application is comparable to Russet Burbank

- 42°F - apply CIPC between 2 and 20 weeks after harvest
- 45°F - apply CIPC between 2 and 16 weeks after harvest

Storage duration - High processing quality persists throughout 250 days after harvest at 45°F.

Fry mottling - Mottling can occur in Alpine Russet at lower storage temperatures (42 ^{o}F and lower) in some years, to minimize mottling, store at 45 °F.

Fusarium dry rot - Alpine Russet is more susceptible to dry rot than Russet Burbank. Monitor stored tubers often for dry rot and grade out rotten tubers when removed from storage.