Disease Resistance in New Tri-State Potato Varieties

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The use of disease-resistant potato varieties is an important control method in the context of an integrated pest management strategy. Growers should be able to easily implement this control method by just planting resistant varieties; this would subsequently eliminate or significantly reduce the application of expensive and at times toxic chemicals resulting in cost reductions and protection of the potato crop and the environment. The Pacific Northwest "Tri-State" Potato Variety Development Program is increasingly emphasizing disease/pest resistance in its breeding and selection efforts. The hard work is beginning to pay off by generating new potato varieties that allow growers to diversify their potato crop and at the same time address disease resistance. From 2005 through 2009 the Tri-State Program has officially released 13 new Potato varieties: Blazer Russet, Premier Russet, Highland Russet, Yukon Gem, Gallatin Russet, A84180-8, Classic Russet, Alpine Russet, Clearwater Russet, Owyhee Russet, Red Sunset, Crimson Red, and Purple Pelisse. All varieties developed by the Tri-State Program have been licensed to the Potato Variety Management Institute (PVMI), a non-profit organization working on behalf of the program since 2005, with the goal of enhancing promotion and marketing efforts. Detailed information about these potato varieties can be found at the PVMI website, www.pvmi.org. The main strengths and weaknesses, related with diseases, of potato varieties recently released by the Tri-State Program are highlighted below.

Blazer Russet is an early to mid-season variety notable for its high yield of oblong-long, medium-russeted tubers and resistances to sugar ends, tuber malformations and most internal and external defects. It shows good potential for both processing and fresh markets, with the processing industry viewing Blazer Russet as a replacement for Shepody—an early harvest variety widely grown in the U.S. It is resistant to common and powdery scab and PVX, moderately resistant to tuber late blight and net necrosis, and moderately susceptible to PVY.

Premier Russet is a mid- to late-season variety notable for its high yield, high percentage of U.S. No. 1's, attractive tuber appearance, high specific gravity, excellent fry color from cold storage and resistances to sugar ends, tuber malformations and most internal and external defects. Premier Russet is highly resistant to the accumulation of reducing sugars following long-term storage at 40-45^{o}F, resulting in a low acrylamide-forming potential. Its cold-sweetening resistance allows storage at colder temperatures, thereby prolonging tuber dormancy and quality for processing or fresh pack use. Premier Russet should be useful in both tablestock and processing markets. It is resistant to PVY^{O}, common and powdery scab, moderately resistant to early dying, tuber early blight and soft rot, and susceptible to dry rot.

Highland Russet is a mid- to late-season variety notable for its high yield of large, uniform tubers, moderately high specific gravity and resistances to tuber malformations and most internal and external defects. It has been successfully grown and processed in commercial trials. Fry recovery from the field and storage has been high and it shows good potential for the processing market. Currently, it is being processed by Lamb Weston and J.R Simplot Co. to meet the specific product needs of several of their QSR customers. It is resistant to PVX, moderately resistant to PVY^{O}, common scab, early and late tuber blight, and it is more susceptible to powdery scab than Russet Burbank.

Yukon Gem is a yellow skinned variety with light-yellow flesh and higher yield potential than Yukon Gold (its paternal parent). Total yield across all Western regional sites was significantly greater than Yukon Gold and its merit for fresh pack is comparable to that of Yukon Gold. It is currently being processed into specialty fry products by Lamb Weston and also is being marketed for tablestock use in the Northwest and upper Midwest. Yukon Gem is resistant to PVX, moderately resistant to PVY^{O}, common scab, early and late tuber blight, and more susceptible to powdery scab than Russet Burbank.

Gallatin Russet is a late maturing selection with medium to heavy russet skin. Compared to Russet Burbank, Gallatin Russet produces substantially greater U.S. No. 1 yields, with similar specific gravity and processing quality. It has much better resistance to Verticillium wilt, PLRV, common scab and soft rot than Russet Burbank, making it a good candidate for organic production, which is its primary use at this point.

A84180-8 is a late maturing, medium-russet cultivar with good culinary quality and good potential for the fresh market. U.S. No. 1 yields for A84180-8 were 26%, 11% and 10% higher than Russet Burbank in eastern Idaho, western and central Idaho, and Washington, respectively. It has good resistance to internal and external defects and has high vitamin C content. A84180-8 has been licensed by a major fresh pack company for production under a trademarked name. It is resistant to common scab, moderately resistant to Verticillium and susceptible to PLRV.

Classic Russet is an early to medium maturing variety with early bulking potential and high yields of oblong-long, medium-russeted tubers having higher protein content than those of standard potato varieties. It produces a very high proportion of U.S. No. 1 tubers, which are very smooth and attractive. It also has moderate specific gravity and resistances to sugar ends, tuber malformations and most internal and external defects. Classic Russet has excellent culinary qualities that are comparable to Russet Burbank. It shows good potential for early processing and fresh markets, with the fresh industry viewing Classic Russet as a potential replacement for Russet Norkotah. In a recent survey, 87% of growers who responded said that they are interested in growing Classic Russet. It is resistant to common scab, moderately resistant to dry rot, and susceptible to PVY.

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, good resistance to sugar ends, and produces significantly lighter colored fries than either Ranger Russet or Russet Burbank out of 45^{o}F storage. Alpine Russet has exhibited lower susceptibility to growth cracks and secondary growth than Ranger Russet and Russet Burbank, particularly under high stress conditions. Alpine Russet is notable for tuber dormancy similar to that of Russet Burbank, making it an excellent candidate for long-term storage, with processing characteristics superior to that of Russet Burbank. It is resistant to common scab, moderately susceptible to dry rot, and susceptible to PVY.

Clearwater Russet is a moderately high yielding, medium-late maturing variety, with oblong-long tubers and an attractive medium-russet skin. Tubers of Clearwater Russet exhibit excellent fry color out of storage which, coupled with their attractive appearance, makes this variety suitable for both processing and fresh market usage. It has high specific gravity and is resistant to cold-induced sweetening and sugar ends as well as most internal and external tuber defects. Clearwater Russet is also notable for having a protein content that is 35% higher than Russet Burbank. It is resistant to tuber late blight and PVX, moderately resistant to Verticillium, common scab and PVY^{O}, and moderately susceptible to tuber early blight and dry rot.

Owyhee Russet is a medium to late maturing potato clone with long, medium-russeted tubers suitable for both the fresh and processing markets. Owyhee produces total yields that approach those of Russet Burbank, but U.S. No. 1 yields are significantly higher. Owyhee has medium specific gravity, light fry color, few sugar ends, and attractive tuber type. It is less susceptible to black spot bruise than Russet Burbank. Owyhee demonstrates resistance to common scab and moderate resistance to Verticillium wilt, foliar early blight and bacterial soft rot, and is susceptible to PVY.

Red Sunset is a medium maturity potato clone with red skin/white flesh and round tubers suitable for fresh market. It has high yields of U.S. No. 1 tubers, bright skin color, high iron levels, few internal and external defects, low specific gravity and high fresh market merits. A potential weakness is its moderate potential for skinning. It is resistant to common scab, and susceptible to foliar and tuber late blight.

Crimson Red is a medium maturing potato clone with red skin/white flesh and round tubers suitable for fresh market use. The U.S. No. 1 yields of Crimson Red are similar to Dark Red Norland and Red LaSoda; specific gravity is medium but significantly higher than the controls. Crimson Red has bright red skin, few internal and external defects, and high fresh market merits. This cultivar was a retread variety and has been exclusively sub-licensed. It is susceptible to foliar late blight.

Purple Pelisse was competitively sub-licensed by PVMI in 2009 to a southern-Oregon based potato cooperative, Klamath Basin Fresh Direct, with the goal of maximizing the promotion and marketing of this unusual potato. Purple Pelisse is a mid season specialty potato with purple skin, dark purple flesh and high levels of antioxidants. This selection is unique among commercially available purple varieties in that plants set a large number of smooth, small, fingerling-shaped tubers. Tubers have medium specific gravity and are ideal for boiling or roasting whole. Chips made from Purple Pelisse tubers retain their bright purple color and resist fading. It is moderately resistant to common and powdery scab, PVY and net necrosis, and susceptible to PLRV, and foliar and tuber late blight.

Breeding efforts focused on crosses to introgress genetic resistance to diseases: late blight, corky ringspot, PLRV, PVY, PVX, verticillium wilt, early blight, common scab, and zebra chip; nematodes: Root-knot and potato cyst nematodes; and insects: aphids, wireworms, and tuber moth will soon generate additional Tri-State disease/pest resistant potato varieties that would increase the catalog of available options for growers in the U.S. Pacific Northwest and worldwide. Molecular breeding approaches are being implemented to complement and enhance conventional breeding efforts. Resistance traits targeted by the Tri-State Program via marker-assisted selection (MAS) include PVY (Ottoman et al., 2009, Vales et al., 2010 and Whitworth et al., 2009), PLRV (Kelley et al., 2009), Columbia root knot nematode (Zhang et al., 2007), and late blight (*RB* gene). Our conventional disease/pest breeding efforts will benefit tremendously from international and national efforts to implement molecular breeding. It is expected that with the sequencing of the potato genome (http://www.potatogenome.net/ and translational genomic projects (i.e. SolCAP, http://solcap.msu.edu/), biology-based solutions will enhance potato breeding activities.

References

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applicators must take measures to protect occupants. If you're applying under inversion conditions when there is a house nearby and someone gets sick, we're going to pursue penalties against you. So, you still need to take necessary precautions.

Buffers in 2011 – Buffers won't be required until 2011 but just to give you an idea… at 140# a.i. and 120 acres, the following buffers will be required:

- High Release Ht (over 8'), = 900' buffer
- Medium Release Ht (4 – 8') = 700' buffer
- Low Release Ht solid stream (drizzle boom) <4' = 525'
- Shanked = 225'

EPA has indicated that "credits" might be available that will reduce buffer size, but as far as I can tell most of the conditions and/or practices that could reduce buffers will not be applicable to the Columbia Basin. Let's hope that some of the work that Vince Hebert is doing will justify smaller buffers.

Thank you