



Potato Progress

Research and Extension for Washington's Potato Industry
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Andrew Jensen, Editor. Submit articles and comments to: ajensen@potatoes.com
108 Interlake Rd., Moses Lake, WA 98837; Phone: 509-765-8845.

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Potato Commission Research Review

Final Research Review, February 15-16, 2012

Red Lion Hotel, Pasco

Purpose: Hear results from 2011 potato commission research projects and listen to proposals for 2012 research

Who's Welcome: All Washington potato growers and other potato industry members

Location: Red Lion Hotel, Pasco, near the airport

Time: February 15, 8:00 am - 5:00 pm; February 16, 8:00 am - 12 noon

Pesticide Re-certification Credits: Will be available both days.

RSVP appreciated for meal planning purposes to Andy Jensen, ajensen@potatoes.com or 509-760-4859.

IPM Supplies Reminder

The commission is once again offering free supplies to WA growers for trapping leafhoppers and tuberworm. **The yellow sticky cards can also be used to trap potato psyllids!** We are also supplying WA growers with free beating sheets. We have both all black and two-sided white and black. The beating sheets are \$25 for non-WA growers and others. These supplies are pictured below.

To receive these supplies, simply call the commission office, or send an email to ajensen@potatoes.com specifying how many fields you need to monitor and/or how many traps you need, and whether you want a beating sheet. For help with insect identification or any other aspect of insect monitoring, call (509-765-8845) or email Andy Jensen at the commission office.



Attacking the Acrylamide Dilemma by Developing Low Sugar High Carotenoid Processing Potatoes

Aymeric Goyer, OSU-Hermiston
Charles Brown, USDA-ARS Prosser
Rick Knowles and Lisa Knowles, WSU-Pullman
John Bamberg, USDA-ARS Sturgeon Bay

Acrylamide is classified as a "probable human carcinogen" by the International Agency for Research on Cancer (1). In 2002, acrylamide was first reported to form in starchy foods during high-temperature cooking processes such as frying, roasting, or baking (2). Some fried potato products such as French fries and chips can have particularly high concentrations of acrylamide. To date no epidemiological study has found a link between dietary exposure to acrylamide and cancer risk in humans (3). Nevertheless, in 2005, California's Attorney General filed suit against nine manufacturers of potato chips and French fries (including Salem-based Kettle Foods) and called for warning labels about acrylamide in fries and chips. In 2008, a settlement was reached after the companies agreed to reduce acrylamide to 275 parts per billion. Today, substantial efforts are being made by potato researchers to address this issue which is threatening the entire potato processing industry.

Acrylamide is formed at temperatures higher than 120°C (248°F) as a result of the Maillard reaction between asparagine and reducing sugars, both naturally occurring in potatoes (4). The amount of acrylamide formed depends on the temperature of final cooking, the cooking time, and the amounts of asparagine and reducing sugars in potato. In general, the higher the levels of reducing sugars and asparagine, the higher the acrylamide forming potential. Low sugar potato varieties have been selected by breeders for many years for use by the potato processing industry. In addition, it is also standard practice to uniformly impart fry color by leaching out the native sugars, which may lead to overly dark color, and re-introducing sugar in a controlled fashion to achieve the same color with every batch (color is the result of Maillard reaction between sugars and amino acids). This practice is counterproductive because it leads to the formation of acrylamide as well as color. If golden color could be achieved by other means, this would allow for a breakthrough in lowering acrylamide. We believe acceptable color can be achieved by breeding low-sugar and high-carotenoid (LSHC) potatoes. Carotenoids are natural compounds that give the yellow to orange color in vegetables. Potatoes have the carotenoid lutein. However, in certain breeding materials with the right combination of genes, exceptionally high levels of carotenoids in the form of zeaxanthin and violaxanthin are obtained. Carotenoids are not water soluble and remain in the tuber flesh with unchanged color when exposed to frying. Therefore, a high carotenoid potato will be quite yellow before and after frying or other cooking methods.

We have selected specialized germplasm from South America in *Solanum tuberosum* Group *Phureja* for low sugars out of cold storage (Table 1). These cultivars have intense yellow to orange flesh color. Tubers were stored at 40°F for several months and then at 50°F for one week before processing. Longitudinal slices from whole tubers (not peeled) were prepared. A few slices were kept for asparagine and sugar analyses. The remaining chips were fried for ca. 2 min 30 sec (or until boiling stopped) at 375°F. After cooling, chips were crushed and stored in an ultra-low temperature freezer until acrylamide analysis. Acrylamide was analyzed by LC-MS/MS. As shown in Table 1, all our selections had relatively low amounts of acrylamide compared to Russet Norkotah and Ranger Russet. Acrylamide levels correlated with sugar levels (selections with low sugars gave low acrylamide chips while those with high sugars gave high acrylamide chips). Low sugar clones with high carotenoids (e.g. KCP063D) produced chips with highly desirable light yellow color while Ranger produced dark chips. Our results show that selection of low sugar/high carotenoid germplasm is a promising approach to maintaining low acrylamide content, while still achieving a desirable light yellow color.

References

- (1) Mucci, L. A.; Adami, H. O. The Plight of the Potato: Is Dietary Acrylamide a Risk Factor for Human Cancer? *Journal of the National Cancer Institute* **2009**, 101, 618-621.
- (2) Tareke, E.; Rydberg, P.; Karlsson, P.; Eriksson, S.; Tornqvist, M. Analysis of acrylamide, a carcinogen formed in heated foodstuffs. *J. Agric. Food Chem.* **2002**, 50, 4998-5006.
- (3) Mucci, L. A.; Wilson, K. M. Acrylamide intake through diet and human cancer risk. *J. Agric. Food Chem.* **2008**, 56, 6013-9.
- (4) Mottram, D. S.; Wedzicha, B. L.; Dodson, A. T. Acrylamide is formed in the Maillard reaction. *Nature* **2002**, 419, 448-9.

Table 1: Asparagine, glucose, and fructose, content in potato before processing and acrylamide content in chips after processing.

Sample	Asparagine (mg g ⁻¹ dry wt)	Glucose (mg g ⁻¹ dry wt)	Fructose (mg g ⁻¹ dry wt)	Acrylamide (ng g ⁻¹) ± SE
320377-6	33.5	5.33	2.71	272 ± 13 ²
320377-15	27.2	1.19	nd ¹	386 ± 58
KCP 035	27.2	0.57	nd	221 ± 6 ²
KCP 052	16.9	0.84	0.02	237 ± 20
KCP 064	26.2	1.27	nd	N/A ³
KCP 063A	19.1	0.15	nd	190 ± 20
KCP 063B	36.8	0.11	nd	373 ± 4
KCP 063D	39.1	0.22	nd	158 ± 5
KCP 065	46.5	0.50	0.28	370 ± 23 ²
KCP 071	33.8	6.60	3.95	267 ± 5
KCP 088	42.3	0.53	nd	211 ± 6
Norkotah	17.7	20.48	18.49	3355 ± 118
Ranger	16.3	25.04	19.11	4178 ± 87

¹Not detected

²Two technical replicates from one single batch of chips. For other clones, two technical replicates from two batches of chips

³Not Available

WSPC Provides Information Resources to Help Growers Pass “Sustainability” Audits

As many of you know, various buyers of potatoes are beginning to require farm audits that deal with “sustainability” issues including integrated pest management, pesticide use patterns, etc. A number of resources helpful in these audits can be found at the research section of the WSPC website:

www.potatoes.com/research.cfm. Some examples include:

1. Information on pesticide resistance management.
2. Lists of pesticides registered for use on potatoes, including relative toxicity, modes of action, spectra of control, and various other information.
3. Electronic versions of all 20 pest/disease/beneficial information cards.
4. The research library, which includes all past Proceedings from the potato conference, all past issues of Potato Progress, and much more.
5. PNW Insect and Mite Management Guidelines, authored and updated regularly by regional entomologists.

Western Washington Potato Workshop, February 17 WSU Northwestern Washington Research & Extension Center, Mount Vernon, WA

WSU Extension is hosting the annual Western Washington Potato Workshop on February 17 at the WSU Mount Vernon research center. Breakfast will be offered at 8 am, with the program beginning at 8:10 and lasting till 4:30, including a hosted lunch. Diverse topics will be discussed, including physiology of specialty cultivars, recent potato disease research, *Potato Virus Y*, irrigation management for western Washington, calcium and nitrogen nutrition, among others.

For more information, contact:

Don McMoran
Agriculture and Natural Resources Extension Educator
Director
WSU Skagit County Extension
11768 Westar Ln. Suite A
Burlington, WA 98233
(360) 428-4270, ext 225
<http://skagit.wsu.edu/>
E-mail: donaldm@co.skagit.wa.us