



# Potato Progress

Research and Extension for Washington's Potato Industry

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## The Potato: History and New Ways to Enhance Its Value as a Healthy Food

The potato (*Solanum tuberosum*) is a perennial plant of the Solanaceae, or nightshade, family, commonly grown for its starchy tuber in a diversity of colors and shapes. Potatoes are the most important vegetable in the world in terms of consumption and overall nutritional value. One small baked potato (138g) provides 21% of the daily value (DV) of potassium (twice as much as bananas), 12% DV of dietary fiber, 22% DV of vitamin C (a potent antioxidant), 21% DV of vitamin B6, 7% DV of protein. Potatoes are fat- and cholesterol-free while containing only 1% DV of sodium and 128 calories per serving (<http://www.nutritiondata.com/facts-C00001-01c20ig.html>).

Potatoes originated in the Andes, somewhere in Peru and/or Bolivia, and spread to the rest of the world after European's contact with the Americas in the late 1400s and early 1500s. By the seventeenth century the potato became firmly established in Britain, Germany, Czech Republic, Poland, Russia, and other Northern or Eastern European nations, due to their ability to thrive in cold, damp climates.

Although potatoes were called "potatoes of the Virginia" by early English botanists, now we know that they were in fact from South America, not Virginia. The first mention of potatoes in North America came in an account of Scots-Irish settlers at Londonderry, New Hampshire in 1719. Potatoes were used for food and as animal feed. The first potatoes planted in Idaho were in 1836 but it was not until after the development by Luther Burbank of the Russet potato that potatoes became a major Idaho crop, at the beginning of the 20th century.

Potatoes are the leading vegetable crop in the USA (not including sweet potatoes), contributing about 15 percent of farm sales receipts for vegetables. Americans consume about 130 pounds of fresh and processed potatoes annually, 40 pounds more than tomatoes, the next most commonly eaten vegetable. Over 50 percent of potato sales are to processors for French fries, chips, dehydrated potatoes, and other potato products, while the remainder goes to the fresh market. Since 1990, in the US, the consumption of potato products declined by 14.75%, and fresh potato consumption declined at a more alarming rate of 27% during the same period. This is reflected in a decline of US potato production of 4% per year.

One way to help reverse this declining trend in potato consumption is by developing popular potato snack foods with reduced fat content, balanced nutrients and with enhanced healthy, sensorial and stable characteristics. A synergistic team composed of scientists from the USDA laboratory in Albany, CA, Dr. Jose De J. Berrios and Washington State University, Drs. Juming Tang, Lalan Sinha, Barry G. Swanson and Jinwen Zhang, are working in the development of novel nutritious and healthy food alternatives from potato using extrusion cooking technology. Extrusion cooking is accomplished in a unique machine (twin screw extruder) that combines several operations including mixing, kneading, cooking, expansion/puffing and drying, that

otherwise would required several machines to accomplish. It is a high temperature-short time process that can incorporate complex carbohydrates, proteins, dietary fibers and other nutrient-rich plant sources with potential to produce value-added snacks and breakfast cereal-type products with superior health promoting characteristics, texture and taste. The short cooking time and the capability to blend varieties of food ingredients made extrusion technology suitable for production of low cost and nutritionally improved food products from potato.

This team is in the process of developing special formulations to produce French fry prototype products or other similar products which are high in protein and dietary fibers and very low in fat. Early versions of the products scored high in preliminary sensory evaluation tests. Optimization of the formulation and extrusion processing parameters in future studies will further improve the products' sensory and nutritional quality, eventually leading to commercial production of new potato based nutritional and healthy food products.

The commercial availability of nutritionally enhanced potato based extruded products may help to expand the market for potato crops grown in Washington and also help establish innovative entrepreneurial activities in the region.

Support for this research from the Washington State Potato Commission is acknowledged and is greatly appreciated.

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Dr Lalan Sinha, Mr. James Pan and Dr Jose Berrios with  
Twin screw extruder being used to develop potato based products

# Glycoalkaloids: Old enemies, new friends?

Roy Navarre, Roshani Shakya and Joanne Holden  
USDA-ARS Prosser and Washington State University, Prosser

What health related compounds are in potato? Do some varieties have much more than others? How much variation is there from variety to variety? We have been analyzing the chemical makeup of diverse potato germplasm, focusing on detecting compounds that either have potential dietary importance for human health or compounds that contribute to making potatoes resistant to diseases and pests. Among the many different types of compounds we measure are ones called glycoalkaloids.

Potatoes and other Solanaceae, including tomato and eggplant, contain glycoalkaloids, which if eaten at high concentrations can have toxic effects, including vomiting and diarrhea. All existing and newly developed commercial potato varieties are required to contain total glycoalkaloid concentrations below 20 mg/100 gram fresh weight to ensure food safety. Thus, new varieties being considered for release from breeding programs are always screened to ensure they have safe glycoalkaloid levels. The majority of potato glycoalkaloids are found in the skin, where they are thought to be involved in resistance to pathogens and insects. The two primary glycoalkaloids in cultivated potatoes are solanine and chaconine, which comprise greater than 95% of total glycoalkaloid content in a tuber.

Recently, several different studies unexpectedly found that potato glycoalkaloids have anticancer properties. Using human cell cultures, potato glycoalkaloids were shown to have an effect on cervical, liver, lymphoma, stomach, skin, colon, prostate and breast cancer cell lines. Chaconine was generally found to be more effective than solanine. Separate studies have suggested that glycoalkaloids may boost the immune system, at least in mice. Mice fed a diet supplemented with glycoalkaloids were more resistant to infection with *Salmonella*. These studies are preliminary and much remains to be determined before one could know whether glycoalkaloids from the diet improve human health. Nevertheless, these are interesting findings and an exciting beginning to the study of dietary glycoalkaloids.

Medical studies are increasingly finding roles for plant compounds in human health. This field of science is a fairly new and active area of research that also shows how little is yet known about the relationship between diet and health. Such studies will be closely watched by plant biologists. From a plant biology perspective, if new medical research shows that certain compounds are desirable in the diet, then we can find ways to increase such compounds in potato. For example, with glycoalkaloids it may turn out that we want to keep the concentrations below the amount that might cause nausea in humans, but not so drastically low that any potential dietary benefit is lost, or the effect of glycoalkaloids against potato pathogens and pests is lost. Our work analyzing the chemical makeup of diverse potato germplasm has found wild potato species that have low amounts of solanine and chaconine, but high amounts of other glycoalkaloids. One can immediately wonder if these were introduced into new varieties, might these novel glycoalkaloids have additional health benefits or might they improve the resistance of potato to diseases or insects such as wireworm or Colorado potato beetle?

The role of diet in health is an extremely active area of research and a topic about which consumers are becoming increasingly aware, in part because of extensive media coverage. As the role of plant nutrients in human health becomes increasingly characterized, it will likely create new opportunities for potato breeding programs and new products for consumers.

# Washington State Potato Industry Long Range Planning Meeting

As the Washington State Potato Commission celebrates its 50<sup>th</sup> anniversary, it is time to reflect on the past and plan for the future. I would like to invite you to attend a long range planning meeting for the Washington potato industry. The meeting will be held December 12<sup>th</sup> and 13<sup>th</sup>, at the Pasco Red Lion Hotel. The meeting begins at 8:30am on Tuesday. This meeting is open to anyone associated with the Washington Potato Industry. Please RSVP with our office if you would like to participate so that we can insure enough meeting materials are provided.

This is an opportunity to examine the current trends in the industry and what their future impact may be on our industry. Below are some of the key issues we will be discussing.

## **China, Continued Opportunity or Competition**

China is already the largest potato producer in the world. We will discuss their potential to compete with us in the world market.

## **Corporate Citizenship and its Effect on the Potato Industry**

Some of the largest potato customers are requiring that their suppliers meet certain criteria regarding food safety, environmental protection, and social issues. We need to determine how this will affect our industry and what the WSPC can do to assist.

## **Changing Consumer Demographics**

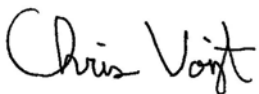
Life is not slowing down and some of our best customers are transitioning to become our worst customers. How should the industry react and what are the opportunities?

## **Finding Balance in Natural Resource Management**

Water and other natural resource issues are critical to the health of our industry. We will examine the current situation and opportunities to solving these critical issues.

The WSPC Long Range Planning meeting is an opportunity for the entire industry to come together to address and prioritize issues that deliver the best return on investment. Your input is critical in helping the Commission better serve the growers. The WSPC has a strong history of success. This meeting is truly a great opportunity to have input into how your resources should be channeled to better serve the industry in the coming years. On behalf of your 15 elected and appointed Commissioners, we welcome your participation and hope to see you in Pasco.

Sincerely,



Chris Voigt  
Executive Director