Potato Progress

Research and Extension for Washington's Potato Industry
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How much Folate (Vitamin B9) is in Potatoes?

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As the most eaten vegetable by far in the U.S., potato has unique potential to be a key source of vitamins and phytonutrients in the diet. Over the last few years, the WSPC has been generous in funding our research on health-promoting compounds in potatoes. Numerous exciting results have resulted from this ongoing research. This article will focus on one of these findings: what we are discovering about folate (Vitamin B9) in potato.

Why is folate important?

Folate (vitamin B9), is essential in the diet and folate deficiency is implicated in numerous diseases. Globally, folate deficiency is one of the most severe nutritional problems. Folate has good name recognition among the public and particularly among women because almost all pregnant women are advised by their doctors to take folate supplements.

Over 500,000 infants with severe birth defects are born each year due to folate deficiency. A recent study reported that the children born to mothers who took a folic acid supplement during pregnancy had a lower incidence of three of the most common childhood cancers. Other studies have linked folate deficiency to an increased risk of heart attacks, strokes and anemia.

Many governments, including in the United States, combat folate deficiency through fortification programs, in which folic acid is added to certain foods, such as bread. Some interesting recent medical research suggested that folate from foods has more efficacy against some diseases than folic acid from supplements. There are several different types of folates occurring naturally in plants, whereas folic acid is the form found in most supplements.

What did we do and why?

We believe vitamin and phytonutrient research on potato is more important today than ever before, given the substantial negative publicity of recent years about potatoes in the diet. Almost nothing is known about folates in diverse potato germplasm, as only a handful of cultivars have ever been examined. Consequently, we have little idea as to how much folate is in potato or how significant a source of dietary folate potatoes are or can be. Almost nothing is known about how much, if at all, folate concentrations differ from variety to variety. To the best of our knowledge, no attempt has ever been made anywhere in the world to increase folate concentrations in potato. Nor

has any attempt ever been made to take advantage of the tremendous genetic diversity that exists among potato cultivars and wild species to boost folate levels.

We would like to maximize the amount of folate in potatoes. As steps towards this goal, we

1. Measured folate concentrations in diverse germplasm.
2. Identified varieties with the highest amounts of folate.
3. Determined what happens to folate levels during storage.
4. Determined how folate concentrations change during tuber development.

What did we learn?

We used a microbial assay to measure folate levels in mature tubers from ~80 different cultivars and wild species. We found about a 3-fold difference in folate concentrations between tubers with the lowest and highest concentrations. Of the top 10 varieties, 7 were yellow fleshed, 2 were red fleshed and one was white fleshed. Of the white fleshed varieties examined, Winema had the highest amounts of folate and Ranger second highest. Among the top yellow cultivars were Satina, Golden Sunburst and Carola. Colorado Rose was the top red-fleshed cultivar. Also in the top 10 were breeding lines from Washington, Oregon and Colorado. No wild species was in the top 10, however, the wild species appeared to have a greater range of folate concentrations than the cultivars, which suggests we should examine more wild species.

As potatoes are typically stored for several months, the question of what happens to folate during storage is an important one. For example, Vitamin C is known to substantially decrease during cold storage. We found that folate levels were stable or may have very slightly increased during storage-we will do additional experiments to confirm this. The fact that folate is stable during storage is very desirable and encouraging for developing potatoes as a significant source of folate in the diet.

We also looked at folate levels during tuber development and found that "new potatoes/baby potatoes" of around the one ounce size have higher amounts of folate than mature tubers. So far we have looked at folate during tuber development from about 5-6 different cultivars and find quite a range. In one case (Russet Burbank) we observed much higher amounts of folate in the smaller tubers, whereas in the other lines the increase in folate in the smaller tubers was more modest. We want to examine additional material to confirm these findings, but they suggest that "new potatoes" will have higher amounts of folate than mature tubers. This could be quite desirable to the type of consumer who shops for "new potatoes" and pays more for a premium product. Furthermore, "new potatoes" cook faster, which is also likely to be a strong plus for the type of consumer purchasing them.

How might this research impact the potato industry?

This type of research is important to the potato industry for numerous reasons, a few of which are summarized below.

1. Potential to help sales and create new marketing opportunities.
2. Publishing this type of information helps highlight the positive nutritional value of potato and provides important facts for nutritionists and medical researchers who have been and will continue to make the dietary recommendations upon which many consumers base their purchasing decisions.
3. For the potato scientific community, this type of information is helpful towards efforts to maximize the nutritional potential of potatoes.

Pesticide Storage Requirements

Excerpted from: WASHINGTON PESTICIDE LAWS
and
OTHER RELATED REGULATIONS
Hand-Out Booklet

WSDA rules set forth requirements for storage of unattended pesticides and their containers, unless the containers have been triple-rinsed (WAC 16-228-1220 (6) & (7)). The storage requirements vary depending on the signal word of the pesticide(s) being stored. Please note - WSDA also has rules relating to the storage of bulk pesticides (Chapter 16-229 WAC). Bulk pesticides are defined as registered pesticides that are transported or held in individual containers in undivided quantities of greater than fifty-five U.S. gallons liquid measure or one hundred pounds net dry weight. Storage of greater than 500 gallons liquid or 2,000 pounds of dry "bulk" pesticide triggers the Secondary Containment rules. (To obtain a copy of these rules, use the order form on the last page.)

PESTICIDES WITH SIGNAL WORDS DANGER, WARNING OR CAUTION

Pesticides with the signal words of "Danger," "Warning" or "Caution" must be stored in secured storage out of the reach of children in an acceptable enclosure (see below).

PESTICIDES WITH SIGNAL WORDS DANGER/POISON

Pesticides with the signal words of "Danger/Poison" must be stored in an acceptable locked and posted enclosure (see below) adequate to prevent children, unauthorized persons, livestock, or other animals from gaining entry. There are special, more stringent storage requirements for some rodent baits. The warning signs for storage areas containing pesticides with the signal words "Danger/Poison" shall show the skull and crossbones symbol and the words "Danger/Poison (or Pesticide or Chemical) Storage Area/Keep Out" in letters large enough to be legible from thirty feet. Refer to the diagram on the next page for a discussion of where to place warning signs when posting storage areas containing Danger/Poison labeled pesticides or their unrinsed containers.

ACCEPTABLE ENCLOSURES FOR ALL SIGNAL WORDS

i. Closed vehicle
ii. Closed trailer
iii. Building or room or fenced area with a fence at least six feet high
iv. Foot locker or other container that can be locked
v. Unattended trucks or trailers that have solid sideracks and secured tailgate at least six feet above ground, ramp or platform level
vi. Bulk storage containers fifty gallons and larger with tight screw-type bungs and/or secured or locked valves.

Other Acceptable Enclosures for Danger, Warning or Caution Labeled Pesticides

Metal containers, twenty-eight gallons and larger, with tight screw-type bungs and/or secured and locked valves and sealed five gallon containers (requiring a tool to unseal).

Find this complete document at: http://agr.wa.gov/PestFert/Pesticides/docs/PesticLawsBooklet.pdf.

Fumigation Season

We all know that Washington potato growers are the best in the country, producing large yields of high quality potatoes through careful stewardship. It is especially important this fall to maintain the industry's good management practices when it comes to soil fumigation. In recent years, EPA and various interest groups across the country are carefully scrutinizing off-gassing of soil fumigants such as metam sodium. Our industry should do everything possible to prevent off-site movement during chemical applications this fall. A pungent odor that is very irritating to the eyes and mucous membranes during or after application is a signal that the biologically active ingredient (MITC: methyl isothiocyanate) is escaping (MITC is the biologically active agent responsible for controlling soil-borne nematodes and diseases).

Metam rapidly converts to gaseous MITC on contact with moist soil. Because of its vapor pressure, MITC can readily escape into the atmosphere unless proper mitigation measures are used to minimize surface emissions. Any product loss will reduce the control effectiveness, but will also contribute to off-site movement of MITC.

For soil injection, the soil within the treatment zone should be moist – between 50 and 85 percent of field capacity – and the soil surface should be level and also free of residue and clods to help ensure soil surface sealing by the roller or packer at time of application. The soil profile within the treatment zone should be sufficiently loosened to allow for gas diffusion, thereby increasing contact with soil-borne pests.

For chemigation, field preparation is the same as for soil injection. To facilitate movement into the soil profile, metam should be applied with 0.75- to 1.0-inch of water. But in no case should application rate exceed the soil infiltration rate, which may result in surface runoff. An irrigation system may require a retrofit with different nozzle package to achieve the recommended water application rate.

Chemigation must not occur when air temperature is 90° F or higher or when wind speed will result in off-site movement. Wind velocity (in conjunction with release height) and droplet size are the two most influential factors affecting drift. Temperature and relative humidity influence the evaporation rates of droplets. Since evaporation of liquid from a droplet decreases its mass, it also influences the drift distance of the droplet. System pressure and the nozzle package significantly impact droplet size, which then is highly impacted by temperature, wind, and relative humidity. Concerning drift distances, the influence of these factors on smaller droplets (200 microns diameter and less) is much greater than on larger droplets. (The diameter of a human hair is roughly 75 to 100 microns; a paperclip wire is 850 microns.) Since larger spray droplets are less susceptible to drift and are more likely to reach the soil surface, management practices should be undertaken to increase droplet size, primarily, and to decrease release height. Remember: by reducing a droplet's size in half, eight times the number of droplets are created.

When a metam product is applied by chemigation, the following stewardship practices are recommended: disable the end gun; only apply through low pressure irrigation systems fitted with drop tubes; extend drop tubes to within 18 to 24 inches of the soil surface, if possible; do not apply during inversions; air temperature should not exceed 85° F; monitor the application constantly when operating close to sensitive areas; and consider soil injection on fields located near residential, business, or industrial areas.