

Transcript of Questions received from Symposium participants via Live Chat and possible answers. No attempt has been made to edit the questions or answers, nor subjected to clearance from USDA/ARS office of communications as this simply is an academic conversation. Hence, this transcript may not be considered as being endorsed by the symposium organizers. Thank you.

Sweetpotato Breeding

From Jan Low to Everyone: 01:43 PM

What is the diversity of purple types in the USDA collection?

Phil Wadl – The genetic diversity of the purple types in the USDA-GRIN collection is unknown at this point, but this work is ongoing. However, Jackson et al., (2018; <https://link.springer.com/article/10.1007/s10722-018-0609-6>) reported on the phenotypic diversity of skin and flesh color of storage roots. In this study only 13 of the 707 accessions were reported to have purple flesh color. Based on phenotypic diversity, the diversity of purple types in the collection is low.

From Ilenys Perez-Diaz to Everyone: 01:44 PM

Is sweetpotato breeding focused primarily on industrially and field relevant characteristics or is healthfulness and bioactivity also considered in modifying germplasms?

Phil Wadl – The USDA breeding program is focused primarily on developing insect/nematode/virus/weed tolerant germplasm that meets consumer quality and taste profiles.

Summary of Craig Yencho's response – breeding for bioactive compounds such as beta carotene and anthocyanins are a focus for the North Carolina State University (NCSU) sweetpotato breeding program in addition to the horticulture and sensory properties.

From Jonathan Schultheis to Everyone: 01:45 PM

Phil, Do you see part of USDA's role in releasing finished sweetpotato varieties?

Phil Wadl – I do see USDA having a role in releasing improved germplasm and finished varieties. We are currently partnering with North Carolina State University, Louisiana State University, and Mississippi State University to jointly select and release improved/finished varieties to stakeholders.

From Tawanda Muzhingi to Everyone: 01:47 PM

Hi Craig Yencho. How is your breeding program dealing with climate change. NC is now prone to hurricanes and droughts sometimes? Also how can Sweetpotato industry in the US match the Almond or blueberries?

From Craig Yencho to Everyone: 01:53 PM

Climate change is an important part of our research. Ironically, we can be planting in a drought and harvesting in a flood due to our climate as you note. We try to use both to our advantage when the situation arises.

*From Craig Yencho to Everyone: 01:54 PM
Breeding for drought and heat tolerance is extremely complicated.*

*From Phillip Wadl to Everyone: 01:54 PM
The USDA program has a proposal under review to investigate mid to late season flooding on Sweetpotato. We do the same as the situation arises in SC.*

Sweetpotato Processing and Chemistry

From Tyler Brown to Everyone: 01:50 PM

Hello Everyone, Are there any active plans or study's on finding outlets for the sweet potato leaves/plants?

*From Craig Yencho to Everyone: 01:53 PM
Not really. There are reports of some people harvesting leaves from fields for Asian markets in NYC, but it is very small*

Suzanne Johanningsmeier:

From Jan Low to Everyone: 02:06 PM

Has the use of sweetpotato puree expanded in the US during the past 5 year? Which product use dominates?

From Josip Simunovic to Everyone: 02:10 PM

Yes. Baby and infant foods (sweet potato is a #1 Gerber product) and pie fillings - there is also a broad variety of other new products, pasta, bakery items - we will share the book chapter Dr Muzhingi and I have been working on describing the new sweet potato based products (esp using puree as ingredient) in the US consumer and commercial marketplace.

From Jan Low to Everyone: 02:06 PM

I am still running into US folks that are confused by the misnaming of sp as yam... What are the strategies to fix this?

Matt Allan - Depending on the location within the US, orange-fleshed sweetpotatoes are labeled as "yams" in the grocery store. It is an artifact of previous marketing strategies. The North Carolina Sweetpotato Commission has a resource available for the yam vs sweetpotato question (this is their #1 visited web page of the entire site).

<https://ncsweetpotatoes.com/sweet-potatoes-101/difference-between-yam-and-sweet-potato/>

From April Bauder to Everyone: 02:13 PM

How do different cooking methods impact nutrients?

Matt Allan - In a 2015 review article by De Moura, Miloff, and Boy, it was reported that steaming for 30 min, frying from 1 to 10 min, and roasting (no time given) orange-fleshed sweetpotatoes were all similar with about 20-30% decrease in provitamin A (i.e., β -carotene). Similarly, the glycemic index of steamed, baked, and microwaved Beauregard sweetpotatoes were all the same (Allen, Corbitt, Maloney, Butt, and Truong, 2012).

From Tawanda to Everyone: 02:13 PM

For food science there is growing interest from pet food industry and for livestock feed. Is USDA responding to this need?

From Paul V to Everyone: 02:31 PM

pet markets are very large for dried sweet potato. however, Chinese imports have prices way down, where it most times doesn't make sense to compete. Peru/ecuador

Ondulla Toomer (USDA-ARS FSMQHRU Research Food Technologist)-According to the FAO (2011), about 53% of the world sweetpotato supply is utilized for human food, 40% as animal feed, with about 7% (7.7 million tons) remaining as waste (small tubers that do not meet grading requirements, damaged tubers, peels, trimmings, and chunks of tubers) which are traditionally discarded within landfills (Akoetey et al., 2017). Nevertheless, these agricultural waste by-products are a valuable source of residual nutrients containing vitamins and minerals (Yu et al., 2005).

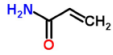
Early studies by Aina et al., (1997) demonstrated that feeding a sun-dried sweetpotato meal and soybean meal diet to egg producing hens did not adversely affect production performance (growth, production of eggs, feed intake). Other studies have shown that dried sweetpotatoes in the diet of egg producing hens significantly increased the egg yolk color (Kay et al., 2009).

We are currently conducting a layer hen feeding trial utilizing sweetpotato waste by-products as an alternative value-added feed ingredient for egg-producing hens as a means to enrich the eggs that are produced for improved egg nutrition and/or quality.

This hypothesis holds true for other animals. In the future we also aim to determine the effect of sweetpotatoes and/or sweetpotato by-products in the diet of broiler chickens, layer hens, swine, aquaculture and companion animals as a means to enhance animal health or the nutrition of the meat and eggs produced.

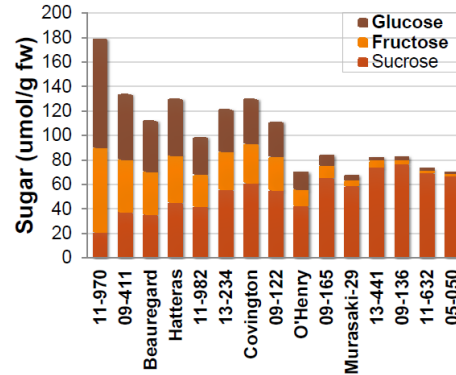
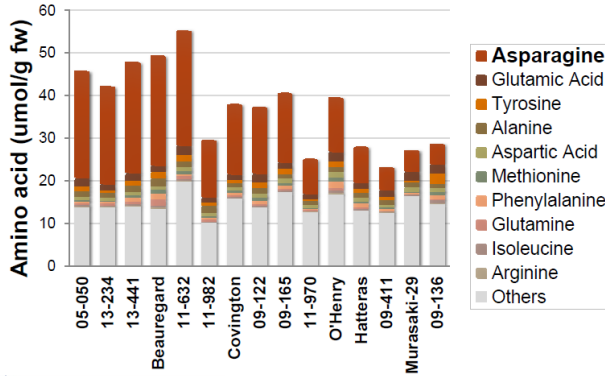
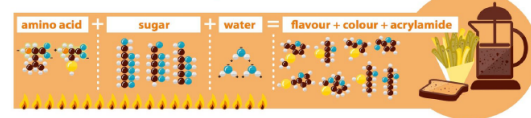
From Paul V to Everyone: 02:18 PM

can you share the acrylamide slide?



Acrylamide mitigation through varietal selection

Maillard reaction (or browning)



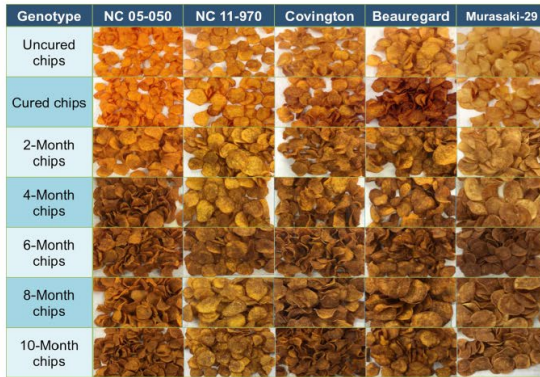
USDA United States Department of Agriculture
Agricultural Research Service



Xiao, Qiu. 2019. Nonenzymatic Browning and Acrylamide Formation in Fried Sweetpotato Chips. (Under the direction of Drs. Van-Den Truong and Suzanne D. Johanningsmeier). Dissertation. North Carolina State University, Raleigh, NC, USA

Acrylamide mitigation through varietal selection

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Summary of Stepwise Selection								
Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	Asn		1	0.5134	0.5134	593.494	441.06	<.0001
2	Glucose		2	0.1370	0.6504	311.354	163.35	<.0001
3	Phe		3	0.0751	0.7255	157.572	113.78	<.0001
4	Sucrose		4	0.0208	0.7463	116.418	34.02	<.0001
5	Pro		5	0.0165	0.7628	84.1433	28.83	<.0001
6	Fructose		6	0.0055	0.7683	74.6715	9.86	0.0018
7	Asp		7	0.0104	0.7787	55.1873	19.28	<.0001
8	Tyr		8	0.0083	0.7870	39.9374	16.04	<.0001
9	Ala		9	0.0048	0.7918	31.8976	9.53	0.0022
10	Lys		10	0.0017	0.7935	30.3760	3.36	0.0674
11	Gly		11	0.0015	0.7951	29.2009	3.05	0.0817
12	Ser		12	0.0022	0.7973	26.5732	4.48	0.0349
13	Glu		13	0.0045	0.8018	19.1778	9.28	0.0025
14	His		14	0.0025	0.8043	15.9942	5.17	0.0235
15	Gln		15	0.0021	0.8064	13.6314	4.39	0.0368

- ❖ Degree of browning had no relation to acrylamide content of the chips.
- ❖ Multiple components influenced the level of acrylamide formed.

Xiao, Qiu. 2019. Nonenzymatic Browning and Acrylamide Formation in Fried Sweetpotato Chips. (Under the direction of Drs. Van-Den Truong and Suzanne D. Johanningsmeier). Dissertation. North Carolina State University, Raleigh, NC, USA

From Jan Low to Everyone: 02:21 PM

Are there regulations being enforced on acrylamide levels in the USA? How does the problem in SP compare to potato?

From Paul V to Everyone: 02:22 PM

Europe has more of an issue with acrylamide than the usa...for dried sweet potato, at least. it's a prop 65 "chemical", so California companies are becoming aware of it.

From Craig Yencho to Everyone: 02:25 PM

My general impression is that the standard is that any new varieties introduced into the processing system can not be worse (I.e. have higher PPB) than what is currently being used. It's preferable to be lower and have consistently lower values.

This is related to acrylamides

Suzanne Johanningsmeier and Matt Allan –Acrylamide is not currently regulated nationwide in the USA. However, the U.S. Food and Drug Administration continues to collect data on acrylamide contents of foods, monitors the potential for adverse health effects, and encourages acrylamide mitigation strategies for producers to collectively reduce the overall levels of acrylamide in the food supply. French fries and potato products, breakfast cereal, cookies, potato chips, and crackers have been identified as major contributors to dietary intake of acrylamide in the US (Eileen et al 2019). Acrylamide mitigation in fried sweetpotato products may require a unique approach due to the abundance of reducing sugars. The USDA-ARS FSMQHRU has shown that this can be achieved through modifications in processing (Truong et al 2014) and varietal selection (Qiu et al, manuscript in preparation). California's Office of Environmental Health Hazard Assessment (OEHHA) Proposition 65 is often used as a guideline by industrial producers of fried products for development of new products and processes. This state specific regulation sets the limit for acrylamide in fried potato or sweetpotato products in general at 350 and 490 ppb for the maximum average concentration and maximum unit concentration, respectively. The limits are even lower for potato or sweetpotato chips (281 and 350 ppb, respectively). The most recent proposed language and limits can be found here: <https://www.jdsupra.com/legalnews/california-s-oehha-proposed-modified-8663066/#:~:text=On%20Friday%2C%2016%20April%202021%2C%20California%E2%80%99s%20Office%20of,is%20cooked%20or%20heat%20processed%2C%20such%20as%20acrylamide>. The California Proposition 65 limits are somewhat lower than the current benchmarks set forth by the European Union for fries (500 ppb) and crisps/chips (750 ppb) (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R2158>).

Eileen Abt, Lauren Posnick Robin, Sara McGrath, Jannavi Srinivasan, Michael

DiNovi, Yoko Adachi & Stuart Chirtel (2019) Acrylamide levels and dietary exposure from foods in the United States, an update based on 2011-2015 data, Food Additives & Contaminants: Part A, 36:10, 1475-1490, DOI: 10.1080/19440049.2019.1637548

Truong VD, Pascua YT, Reynolds R, Thompson RL, Palazoglu K, Mogol B, Gokmen V. 2014. Processing treatments for mitigating acrylamide formation in sweetpotato French fries. J Agric Food Chem 62:310-316.

Qiu X, Reynolds R, Truong VD, Johanningsmeier SD, Pecota K, Yencho C, and Osborne JA. 2018. Free amino acids and sugars in fifteen sweetpotato genotypes: effects of storage and relationship with acrylamide formation in fried chips. Institute of Food Technologists Annual Meeting, Chicago, IL, July 15-18. Awarded 3rd place in the Fruits and Vegetables Division Poster Competition.

From Paul V to Everyone: 02:26 PM
so do you breed out asparagine? not sure on spelling

*From Craig Yencho to Everyone: 02:27 PM
Yes, it is a trait that we are actively working on and asp is one of the traits of interest, but not the only one re. acrylamides*

Matt Allan - Asparagine cannot be completely removed as it is an essential amino acid but reducing the amount of asparagine is a target for the NCSU breeders. Lowering the total reducing sugars, glucose and fructose, and increasing sucrose (nonreducing sugar) is another breeding target to lower acrylamide formation but maintain sweetness. There are also processing steps that can be used to reduce acrylamide formation, such as blanching in a dilute sodium acid pyrophosphate and/or cation (e.g., calcium) solution. These treatments decrease the reactivity of asparagine in the first step of the acrylamide pathway. If interested in more details, our research unit published an article titled "Processing Treatments for Reducing the Acrylamide Level in Sweetpotato French Fries" in Journal of Agricultural and Food Chemistry in 2013. It can be found on our website along with all of the sweetpotato publications from our unit: <https://www.ars.usda.gov/southeast-area/raleigh-nc/fsmqhr/ docs/sweetpotato-bibliography/>.

Sweetpotato Industry

From Ilenys Perez-Diaz to Everyone: 02:24 PM
What is the capacity of NC to continue to support sweetpotato industry growth? What is/are the upcoming new technology (ies) that will be impacting sweetpotato industry growth?

Summary of Craig Yencho's response – There is still room to grow in North Carolina by increasing acres planted, increasing yield with new varieties and crop management, access to a deep-water port in Wilmington, NC, and building sweetpotato processing facilities (one of the world's largest sweetpotato processing facilities will be built here in NC: <https://www.potatopro.com/nl/news/2021/new-construction-and-joint-venture-make-cardinal-foods-and-russet-house-one-largest-sweet>).

From Roger Townley to Everyone: 02:32 PM
With the increase in sweet potato sales revenue since 2000 what are the finished product components making up this growth by percentage?

Matt Allan - In 2019, 26% of utilized sweetpotatoes were processed, which was valued at \$82.8 million or 12.5% of the whole sweetpotato market value. USDA-NASS only recently started reporting processed sweetpotatoes, so it is unclear the magnitude of impact processed sweetpotatoes had on our rapidly growing industry.

From Jan Low to Everyone: 02:35 PM
How are ARS resource use prioritized? Are healthy foods increasing in priority?

Muquarrab Qureshi : ARS resources are allocated to several National Programs based on congressional intent and in response to stakeholder needs (<https://www.ars.usda.gov/research/programs/>). If our work is not relevant to our stakeholders then we have a problem. The entire intent therefore of this symposium is to share what we are currently doing and listen to our stakeholders if we are on the right track. We always tweak our research programs to ensure alignment with the stakeholder needs. Healthy foods have been a longstanding priority for NP107 Human Nutrition and NP306 Product Quality and New Uses Programs.

From Tawanda to Everyone: 02:35 PM

We need a sweet potato innovation lab with usaid and USDA support

From Josip Simunovic to Everyone: 02:36 PM

To Tawanda - Yes, the USAID has been a great source of support for sweet potato innovation in the US and internationally

Innovation in sweet potato processing is also driving innovation in other plant based processing - Yamco is currently marketing about a dozen fruit and vegetable purees: pumpkin, butternut squash, cauliflower, blueberries, purple SP puree etc.

From Craig Yencho to Everyone: 02:40 PM

Great point Josip

Sweetpotato Challenges

From Landry Jones to Everyone: 02:43 PM

Are there any plans to use irradiation to prolong the shelf life of sweetpotatoes? Especially for export?

From Paul V to Everyone: 03:29 PM

how about UV=B

Answered live by Dr. Lina Quesada (Follow up contact: lmquesad@ncsu.edu; 919.513.3530).

Matt Allan – Previous studies have shown promising results using irradiation and UV light to decrease sweetpotato rot in storage. The downside of irradiation is the high capital cost, safety risk, and too high of levels can affect the sensory quality of sweetpotatoes. Here are links to 3 resources.

<https://meridian.allenpress.com/jfp/article/53/3/223/195774/The-Effect-of-Ultraviolet-Radiation-on-Mold-Rots>

<https://link.springer.com/content/pdf/10.1007/BF03356519.pdf>

<https://www.tandfonline.com/doi/pdf/10.1080/10408390500455516?needAccess=true>

From Jan Low to Everyone: 03:00 PM

In Africa, cost of pheromones/attract and kill have been too high to facilitate use/adoption. Is this an issue in the USA?

Livy Williams - Apologies that during the symposium I did not hear the last part of this question concerning pheromone use in the USA.

There are several issues that affect use of pheromones for large-scale pest management. One is cost of production. Obviously, this depends on the chemical structure of the pheromone and how many compounds the pheromone is composed of, i.e., is the pheromone a single compound or a blend of compounds? It is interesting to note that recently there has been headway in pheromone manufacture by introducing genes for insect enzymes into yeast that then produces the pheromone during fermentation.

Another challenge is formulation and dispense/application of pheromones. Currently, pheromones are usually applied via rubber septa placed in traps (detection and monitoring), or in timed-release beads or twist-ties which are distributed in the field (management). However, more advanced systems of application for management, such as automated aerosol puffers that only dispense pheromone at the appropriate time (thus reducing costs), are gaining popularity.

Another important factor is human and environmental safety. Pheromones are non-toxic and do not persist in the environment, making them a valuable alternative to chemical control.

The above factors interact with the value of the crop and the severity of damage caused by the pest to determine whether pheromone use is a cost effective strategy for management. Obviously, the greater the value of the crop, the more likely that pheromone technology will be feasible. Integration of pheromone technology into an integrated pest management program has been an important factor in suppression of codling moth in apples.

Sweetpotatoes in School Lunches

From Tawanda Muzhingi to Everyone: 03:39 PM

Are there plans to work with school districts to have sweet potato on the school feeding and lunches?

From James Pritchett to Everyone: 03:40 PM

Tawanda - This is happening slowly in some places. Yamco has a few customers who supply those types of services. Has been a slow process!

From CoCo Daughtry to Everyone: 03:44 PM

Here is the link to the story : <https://theproducenews.com/sweet-potatoes/north-carolina-sweetpotato-commission-serves-foodservice-video-series>

From CoCo Daughtry to Everyone: 03:45 PM

Recipes will be coming soon on our website. Many can be found on Farm to School currently.

Presentation Comments

From Kay Rentzel to Everyone: 03:56 PM

USDA - ARS team, the US Sweet Potato Council continues to advocate for support via virtual means with all members of Congress. Thank you for what you do to support the industry! Kay Rentzel, US Sweet Potato Council.

From Craig Yencho to Everyone: 02:20 PM

I agree. Den Truong...a quiet giant! Thanks for everything Den!! We miss you but Matt is off to a great start