

Caribbean Agricultural Research and Development Institute (CARDI)

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Recently there has been a lot of media attention surrounding the chile pepper ‘Trinidad Scorpion’. Our Chile Pepper Institute member and colleague, Herman Adams at the Caribbean Agriculture Research and Development Institute (CARDI), introduced the ‘Trinidad Scorpion’ to the United States and the rest of the world. It is interesting to note that in Trinidad and Tobago, work is being done to claim the intellectual property rights for the world’s hottest pepper, the ‘Trinidad Scorpion’, and its offshoots like the ‘New Mexican Scorpion’ and the Australian ‘Butch T’. He is leading the charge for at least “geographical indication” rights to the variety. He believes the country should move more aggressively to lay claim to the chile pepper. The Intellectual Property Office of the Ministry of Legal Affairs already has a brief before it on the issue. Growers and processors of the “Scorpion” in Australia have openly acknowledged its origins and it is being marketed as a “Trinidad” variety.

Mr. Adams sent us information about the

chile pepper program in Trinidad, which has provided assistance to the agricultural sector for more than 30 years.



CARDI’s hot chile pepper program uses a commodity value chain approach to pursue the development of the regional industry. The specific actions along the commodity value chain are the enhancement of the productivity of commercial varieties through the development and improvement of varieties for use across the region, production of high quality seeds,

establishment of productivity indices and investment profiles for these varieties, and the improvement and stabilization of indigenous varieties of interest to specific countries. CARDI regional varietal improvement program is currently focused on exploiting the variability within the ‘Red Congo’ and ‘Scotch Bonnet’ x ‘Bird Pepper’ populations. Three outstanding variants (two red and one yellow) from ‘Red Congo’ and four selections (three red and one yellow) from the ‘Scotch Bonnet’ x ‘Bird Pepper’ hybridization have been selected to undergo



‘Trinidad Scorpion’

yield trials. Breeder seed for the eight stabilized commercial cultivars – ‘Red

Congo', 'Yellow Congo', 'Scotch Bonnet', 'Cayenne', 'Tiger Teeth', 'CARDI Green', 'CARDI Red' and 'West Indies Red' – was produced in Barbados.

Research on pests and diseases that reduce productivity of hot chile peppers has been ongoing at CARDI. In Belize, baseline data collected on major pests in the Cayo and Belize districts, showed that whiteflies and cucumber beetles were the most prevalent pests. Virus infection is still a major problem for hot chile pepper production. Screening of hot pepper fields in Barbados for Potato Virus Y (PVY) and Cucumber Mosaic Virus (CMV) revealed that 60% of the samples were positive for CMV and 78% for PVY. A survey of common weeds in the fields showed many of them testing positive for the viruses. Future studies will investigate weed seeds as sources of the viruses. Meanwhile, the results suggest that field sanitation will be important in managing the viruses.

CARDI maintains a germplasm collection in Barbados for many of the indigenous hot chile pepper landraces, so that they are not lost to future generations. These landraces represent a critical genetic resource for the region. Seeds are maintained in a seed room and need to be regenerated every three years to sustain viability. During 2009, 27 of these



'7 Pod' variety

accessions were planted, seeds extracted, dried and returned to storage. CARDI is also involved in research and improvement of seven landrace varieties, the "Super Hots," that are garnering a lot of attention these days. The Hood, Scorpion, Seven Pod, Faria, Moruga Yellow, Moruga Red and Bejucal varieties are some of the landraces included in the "Super Hots" category of chile peppers. For more information about CARDI, visit their website at <http://www.cardi.org/>.

Development Leadership Council Update: Celebrations and Progress

By Mark Gladden

This year is shaping up to be a big year for the Chile Pepper Institute. On January 31st, the night before the New Mexico Chile Conference, the Institute's highest-level group met for an exclusive dinner prepared by NMSU Chef Maurice Zeck. The group is known as the Development Leadership Council, and membership is exclusive to donors \$1,500 and above. It's literally the "who's-who" of chile pepper, and the generosity and networking activity among the members has combined to form a powerful team. Dr. Paul Bosland delivered an inside look at the Chinese chile pepper industry and its forthcoming international developments, while Mark Gladden, ACES Development Director, delivered the good news: over one-third of a million dollars have been raised toward a permanent Chile Pepper Endowed Chair. This endowment will guarantee that chile pepper research continues forever at New

Mexico State University. The chair is still unnamed, and with two thirds of the way to go, there remains ample opportunity for new donors and companies to join the Council.

This summer, Chris and Anna Biad of Biad Chili (members of the Council) will be finalizing plans to launch their highly-prized Biad's Reserve Heritage Green Chile pepper line throughout the United States. They are introducing a new website, and an upgraded fulfillment system to allow them to ship chile peppers to NMSU alumni and green chile lovers across the nation. Proceeds from the sale of Biad's Reserve help add to the Endowed Chair, and the quality of the green chile is unbeatable – it's "heritage," meaning it's from the *original* green chile line that became so popular in the '60's and '70's.

For more information on the Endowed Chair or the exclusive Development Leadership Council, contact Mark Gladden at (575) 680-5247.

Forget Eating Your Greens: Red and Blue Foods are the Cancer Fighters

Natural pigments that give certain fruit and vegetables a rich red, purple or blue color act as powerful anti-cancer agents, according to a recent study by Monica Giusti. The compounds, found in foods such as red cabbage, elderberries and blueberries, and purple chile peppers restricted the growth of cancer cells and in some cases killed them off entirely, leaving healthy cells unharmed. The study combined laboratory tests on human cancer cells with experiments on animals that were designed to see whether a diet rich in the foods made a difference to their risk of developing cancer.

Foods with the highest levels of the compounds were most effective at slowing cancer growth, with exotic purple corn and chokeberries stopping the growth of colon cancer cells and killing 20% in lab tests.

Foods less enriched with the pigments, such as radishes and black carrots, slowed the growth of colon cancer cells by 50% to 80%. The findings bring scientists closer to unraveling the key ingredients responsible for giving fruit and vegetables their cancer-fighting properties.

Because the pigments, which belong to a class of antioxidant compounds known as anthocyanins, are not easily absorbed by the bloodstream, they travel through the stomach to the gastrointestinal tract, where they are taken up by surrounding tissues. Their survival through to the lower part of the

intestine may be the key to their role in preventing cancers in the tract, the scientists believe. Researchers led by Monica Giusti, an expert in plant nutrients at Ohio State University, extracted anthocyanins from a variety of exotic and more common fruits and vegetables that all had a deep red, blue or purple hue and added them to flasks containing a suspension of human colon cancer cells. When the team calculated how much of each

extract was needed to reduce cancer cell growth by 50%, they found anthocyanin from purple corn to be the most potent. Chokeberries and bilberries were nearly nine times as much - or 131 micrograms per ml of cancer cell solution to cut cell growth by half.

In a second study, the researchers fed rats with colon cancer a diet of anthocyanin extracts from bilberries and chokeberries, which are most often used as flavorings in jams and fruit drinks. Colon

tumors in the rats fell by 60% to 70% compared with a control group that were not given anthocyanin.

"These foods contain many compounds and we're just starting to figure out what they are and which ones provide the best health effects," said Dr Giusti.

"All fruits and vegetables that are rich in anthocyanins have compounds that can slow down the growth of colon cancer cells, whether in experiments in laboratory dishes or inside the body."

The Guardian, 2007.



'NuMex Centennial' chile pepper fruits

The Chile Pepper Institute's Development Leadership Council

The Development Leadership Council is a dynamic group of chile pepper industry leaders. Their purpose - to raise \$10 million to build the new energy efficient Chile Pepper Institute, featuring a tourist venue for chile conferences, a sustainable teaching and demonstration garden/greenhouse, and to fund the Endowed (Chile) Chair to continue the legacy of NMSU's chile pepper research.

Leadership Council members provide:

- A yearly sustaining donation of \$1,500;
- Participation in bi-annual leadership council meetings;
- Facilitation of corporate sponsorships;
- ID of three or more colleagues who have the financial capacity to support the Institute's (ad)venture; and
- Encouragement of chile aficionados to become Chile Pepper Institute members.

Interested in joining the Council?

Reasonable Quantities of Red Pepper May Help Curb Appetite

A recent study in the latest issue of *Physiology and Behavior* found that consuming red pepper can help manage appetite and burn more calories after a meal, especially for individuals who do not consume the spice regularly. Dietary changes that don't require great effort to implement, like sprinkling red pepper on your meal, may be sustainable and beneficial in



the long run, especially when paired with exercise and healthy eating," said Richard Mattes, distinguished professor of foods and nutrition who collaborated with doctoral student Mary-Jon Ludy at Purdue University.

Other studies have found that capsaicin, the component that gives chile peppers their heat, can reduce hunger and increase energy expenditure, burning calories. The amounts tested, however, were not realistic for most people in the U. S. population, Mattes said.

The current study measured the spice's effects using quantities of red pepper 1 gram or half a teaspoon that are acceptable for many consumers. Other studies also have looked at consumption via a capsule, but Ludy and Mattes' study demonstrated that tasting the red pepper may optimize its effects. This study used ordinary dried, ground cayenne red pepper. Cayenne is among the most commonly consumed spices in the world.

Twenty-five non-overweight people, 13 who liked spicy food and 12 who did not, participated in the six

-week study. The preferred level of pepper for each group was determined in advance, and those who did not like red pepper preferred 0.3 grams compared to regular spice users who preferred 1.8 grams. In general, red pepper consumption did increase core body temperature and burn more calories through natural energy expenditure.

The study found that those who did not consume red pepper regularly experienced a decrease of hunger, especially for fatty, salty and sweet foods. "The appetite responses were different between those who liked red pepper and those who did not, suggesting that when the stimulus is unfamiliar it has a greater effect. Once it becomes familiar to people, it loses its efficacy. The finding that there is a difference between users and non-users is novel and requires further study to determine how long it will be effective and how to adjust the diet to improve continuous effectiveness."

The findings also show that red pepper should be consumed in non-capsule form because the taste, the sensory experience, maximizes the digestive process. "That burn in your mouth is responsible for that effect," he said. "It turns out you get a more robust effect if you include the sensory part because the burn contributes to a rise in body temperature, energy expenditure and appetite control." Mattes, who specializes in taste and directs Purdue's Ingestive Behavior Research Center, studies the role taste plays in feeding and digestion. "Taste works on two very different levels," he said. "First, it determines the palatability of foods, and that influences food choice. Second, it influences physiology, so it alters how you digest foods and the efficiency with which you absorb the nutrients from them and use them throughout the body."

Recipe - 'NuMex Heritage 6-4' Red Enchilada Sauce

2 tbsp. shortening or olive oil
2 tbsp. flour
1/4 c. pure ground 'NuMex Heritage 6-4' dried red chile powder
2 c. hot chicken stock or hot water
3/4 tsp. salt
1 clove garlic, crushed
Pinch of Mexican oregano
Pinch of ground cumin

Melt shortening over medium heat or heat olive oil in a saucepan. Add flour and stir until well blended and slightly golden. Stir in red chile powder. Turn heat to low and stir in stock or water, blending well. Add seasonings, cook on low

heat, stirring for at least 10 minutes. Then simmer for at least five minutes.

Use sauce for making enchiladas - dip corn tortillas in sauce. Add enchilada fixings - roll and pour remaining sauce over the top. Top with cheese and onions. Sauce can be frozen up to eight months.



Agricultural Science Summer Undergraduate Research Education and Development (ASSURED) Program Executive Summary

New Mexico State University's Chile Pepper Institute, in partnership with the National Science Foundation, has made a big difference in the lives of 90 college students. The ASSURED program concluded its final summer program this year after nine successful years. Dr. Bosland, CPI Director, had an idea nine years ago to start a summer program that gives children from migrant

farmworker backgrounds experience of what it is like to be a scientist. From picking chile pepper to chile pepper science, students benefitted from learning about agriculture science. The ASSURED program was financed by National

Science Foundation's Research Education for Undergraduates and in-kind resources, such as faculty expertise, time, and equipment from the College of Agriculture, Consumer, and Environmental Sciences at NMSU. The major goal was to interest these youth from migrant farm backgrounds in an agricultural science career. As a result of the program, 35% of participants changed their major to agriculture and 10% of the participants added an agricultural minor after the ASSURED program. As a 2005 ASSURED student stated, "I was astonished at how many different science careers there are in agriculture."

In addition, 98% of the ASSURED program participants graduated or are progressing to graduate from college. For 81% of the participants, they were the first in their family to go to college. Many spoke Spanish as their first language and all had a negative image of agriculture coming into the program. Having worked in the chile pepper and onion fields as children, most thought agriculture was mundane and hard work. As one 2009 ASSURED student remarked, "...coming into the ASSURED program I was very ignorant about what agriculture was even though I grew up surrounded

by agriculture fields."

Every one of the students who participated in the ASSURED Program had previously worked in the fields, onion sheds or helped do other rigorous, labor intensive farm work. Every participant had a negative view of the agricultural industry due to this hard work, and every participant changed their view or perception after successfully finishing the ASSURED Program.

None of the 90 participants had ever seen the inside of a scientific laboratory, and after the completion of the programs each student either worked, recorded data or spent their entire summer in a lab. All of the experiences in the program opened up new doors which helped provide this particular group of individuals with a better understanding of science and science careers.

Faculty research mentors also benefitted from program participation. They gained from interaction with their mentees, often reporting that program participation helped them renew their understanding of undergraduate

teaching. A 2011 ASSURED mentor stated, "I became more familiar with the current generation of students and how to teach them more effectively."

The interaction between the ASSURED mentee and mentor stimulated new research ideas, and four peer-reviewed journal publications were co-authored by mentors and mentees from research conducted together. The students also benefitted by being hired by their mentor to continue in the research program during the school year. Mentees appreciated the attention they received working in the laboratory. As one 2003 ASSURED student stated, "when I worked in the science lab, I felt like someone important." A 2007 ASSURED student wrote, "My involvement in this program opened up so many doors for me...I changed my major, started working for my mentor, and made several new friends in the lab."

Danise Coon, program coordinator, stated that "Each and every one of these students who have participated in this program has a new, fundamental view of the agricultural industry, they respect and acknowledge the science behind it."



Lucio Sanchez and Ricardo Trejo work on their summer research projects in the NMSU Quality Lab.

C A P S I C U M N E W S

NuMex Heritage 6-4 Red Chile Pepper Powder Now Available at The Chile Pepper Institute and The New Mexico State University Barnes and Noble Bookstore

The Chile Pepper Institute and Barnes and Noble at NMSU are now carrying 5 oz containers of 'NuMex Heritage 6-4' dried red chile powder. The robust flavor makes this powder perfect for red enchilada sauce; it does not have any of the bitterness normally associated with making red chile pepper sauce from powder. The 'NuMex Heritage 6-4' is one of the newest cultivars developed during the NMSU Chile Pepper Breeding Program's push for more flavorful varieties. The chile pepper variety was developed using seed samples that have been stored in the USDA Fort Collins Seed Storage Lab since the 1950's. Lines were grown out and taste tested for more than 10 years before the best line was chosen. The 'NuMex Heritage 6-4' has five times more flavor compounds than the varieties currently being grown and is considered a mild to medium heat level. For more information please contact the Chile Pepper Institute or visit the Chile Pepper Institute's on-line shop. www.chilepepperinstitute.org

Serbia: Pepper production up in 2009

In 2009, Serbia was one of the top pepper producing countries in Europe, with the third largest acreage devoted to the crop behind Spain and Romania. According to data from the Food and Agriculture Organization of the UN (FAO), the Eastern European country produced 171,366 tons of peppers in 2009, 13% more than in 2008. However, pepper production in 2009 remained below the volume of 177,255 tons recorded in 2006. On the other hand, the area devoted to pepper production has been falling since 2006. In 2006, peppers covered an area of 19,416 hectares, but by 2009 this figure had fallen 4.5% to



18,541 hectares. Vegetable production in Serbia totalled 1,324,210 tonnes in 2009, 2.5% up on the 1,291,932 tonnes recorded in 2008. Nevertheless, as the graph below shows, 2009 tonnage was 2.6% down on the volume corresponding to 2006.

NMSU Develops 'Green' Chemistry Extraction Method Developed for Chile Peppers

Until now, the common method for extracting red pigments from dried fruit of chile pepper has used hexane as the extraction solvent. A new research study at NMSU, published in HortScience, presents a process for efficient extraction of these red pigments using "green chemistry." The method recovers 85% or greater of the pigmented carotenoids from dried chile pepper and reduces the hazardous waste and environmental risks associated with traditional extraction methods.

Dr. Mary O'Connell and her lab created a "green chemical" method that generates an oleoresin from dried

chile pepper fruit with virtually the same carotene and xanthophyll composition as the hexane extraction method. The "green" extraction method includes a process that separates the pigments from the capsaicinoids, an important step that the researchers say increases the flexibility of the process to allow a variety of red chile pepper fruit to be used easily for pigment production. The researchers noted that this step in the process is critical, as it allows the pigment industry and chile pepper farmers to use virtually any variety of chile pepper regardless of heat level for pigment production. "Pungent chile peppers with high ASTA color values could be grown for either food/spice uses or pigment production." *HortScience, July 2010.*



A graduate student with carotenoids extracted from the dried powder of a red chile cultivar. (Credit: Photo by Rich Richins)

BURNING QUESTIONS

Q. I bought chile pepper seeds from your website and was wondering if I could save seeds from them for next year.

A. If chile pepper plants are isolated and there are no other chile pepper plants of the same species growing in close proximity, they will self-pollinate and the seeds saved will be true-to-type. However chile pepper varieties within the same species cross-pollinate very easily. If plants are growing outside and exposed to nature's pollinators it is very likely

that one can get cross-pollinated pods if there are other varieties of chile peppers growing in the area, and thus, the seed would not be worth saving.



Q. Do chile peppers continue to ripen after you have picked them as do tomatoes, and would the seeds be viable?

A. Yes, the plant will transfer nutrients to the fruits until it is dried up and dead. However, it does not mean that all "ripe" fruit will have viable seed. After removing the seed, if it looks normal, then it is safe to assume it will germinate. However, if the seeds are brown or black, it's best to throw them away.



Q. How do I know when my jalapenos and green chile are "ripe?"

A. Jalapenos and green chile peppers are both very firm at the green stage when they are ready for picking. If you give the pods a gentle squeeze and the pod gives a nice crackle sound, they are ready to pick.

Q. How tall will the 'Bhut Jolokia' plant grow? Mine is now about five feet tall. I thought they only grew to about three feet tall. I have a lot of green pods and so far only two are changing color. How long does this process take?

A. The 'Bhut Jolokia' plant can grow up to five feet tall and four feet wide, with some instances of the plants getting even taller. Once fruit starts to develop from the flowers it usually takes between 22-35 days to completely ripen and mature.



Pods are a deep red-orange color when fully mature.

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New NMSU publication available on-line Certified Seed Guide A-131, find it at www.chilepepperinstitute.org/chile_information.php