

Capsicum: Herb of the Year 2016 Fire in the Garden

Charles E. Voigt
University of Illinois, Urbana-Champaign
Department of Crop Sciences
W-503 Turner Hall, Urbana IL 61801
(217) 333-1969 - Fax (217) 244-3469

When the author was a young 4-H vegetable gardener, hot peppers were something exotic, not something in every garden or kitchen. Hungarian Wax, a hot banana pepper, was about the only one commonly available in east-central Illinois. Since then, waves of immigrants have brought a broad range of cuisines to the US, with accompanying hot pepper diversity. Coupled with Americans eating out much more than they did in the 1950s, this has exposed people to the zing that hot peppers can bring to eating. Some have embraced it wholeheartedly, while others approach with more caution.

Why is the confusing name “pepper” used? Well, when Christopher Columbus “discovered” peppers, or chiles, (*Capsicum* species) on a Caribbean island in 1492, he was searching for true pepper, *Piper nigrum*. Since the burning sensation each produced was similar, and he was eager to justify his conclusion that he had reached India, or the Spice Islands, he dubbed them “peppers.” In fact, Native Americans probably began using and domesticating these plants at least 6,000-10,000 years earlier, in or near, what is today Bolivia.

After Columbus returned to Spain carrying seeds and dried pods of *Capsicum*, it took only 20 years for this plant to travel and become popular all over Europe and Asia, and as far away as Indonesia and the "Spice Islands" which Columbus originally sought to find. Dubbed “the poor man’s spice,” it was quickly adopted where it traveled, to the extent that people all over the world soon thought they had always had chile peppers in their lands. Chile pepper has become the most frequently used seasoning and condiment in the world. It is a spice for all levels of society, cheap enough for the least affluent peasant, and complex enough for royal palates.

The unacclimated human palate can detect the presence of capsaicin, the chemical which produces the "heat," at levels as small as one part per million. Capsaicin is really a group of related chemical compounds which produce the burning sensation, but which do not actually affect temperature. Each of these 7 capsaicinoids has a slightly different mode of action, which is why different peppers affect taste in different ways. Some bite the front of the tongue, while others “sneak up” farther back.

The heat index of a chile pepper is measured in "Scoville Units," using a method developed by Wilbur Scoville in 1912. It is based on sequential dilutions until it can no longer be detected. This pungency is measured in multiples of 100 Scoville Units (SCU) ranging from the sweet bell pepper at zero on the scale, to the extremely hot habanero at 200,000 to 300,000 SCU. Newer discoveries and breeding have resulted in concentrations of over 2 million SCU in individual fruits. Pure capsaicin is rated at 16 million SCU, so these peppers are one eighth capsaicin, by weight, a staggering concentration.

The white placenta, the ribs or membranes within the pepper fruits, contain up to 80% of the capsaicin in the peppers. Seeds themselves do not produce the chemical, but pick it up by being attached to the membrane within the pepper fruit. Neither cooking nor freezing diminishes

the pungency, but removing the veins and seeds is reasonably successful in lowering the heat. Chilehead purists would surely call this a crime against peppers.

Water stress on pepper plants can increase pungency, while an overabundance of moisture may lower the overall heat. Cooler than normal weather can also lower the heat, while hot temperatures and bright sunlight produce the highest levels of capsaicin. For this reason, parts of the desert southwestern US have the reputation of producing the most fiery pepper pods. While this may be true to some extent, some really pungent peppers can be grown almost anywhere in the US.

Capsaicin is not water soluble, so water and water-based drinks will not douse the heat induced by eating hot peppers. Since they are soluble in alcohol, drinks high in ethanol can help move the chemical out of the mouth. Casein in milk can also surround the molecules and carry them on their way, so dairy products, the fattier the better, may help. The fat in these dairy products is effective in surrounding and defusing the heat-generating compounds. Finally, absorbent materials like crusty bread, crackers, and chips may help soak up the heat and clear the palate.

Fresh chilies are high in vitamin C, containing twice as much as citrus fruits. They are also high in vitamin A, folic acid, potassium, and vitamin E. Dried, they lose most of their vitamin C, but the vitamin A content increases drastically.

Eating foods spiced with hot varieties of *Capsicum* can be addictive. The painful heat sensation actually causes the body to produce endorphins, the body's natural pain killers. These endorphins bring on a mild state of euphoria. Like other stimulants, the body gradually becomes acclimated to lower levels of capsaicin, and requires higher and higher amounts for the same endorphin buzz. This is why those addicted to this sensation need hotter and hotter peppers to keep the buzz coming.

Hot peppers should be handled with care, especially the profoundly hot varieties. They should be chopped or processed in a well-ventilated area. One should not touch their eyes, nose, mouth, or any other moist body orifice, or intense and lasting pain may result. After handling, hands should be washed thoroughly in soapy water, scrubbing with a brush. The most ferociously hot varieties can actually irritate and blister the skin. Plastic or rubber gloves or other protective wear may be advisable, especially when working with large quantities. Eye protection might also be helpful.

To neutralize the burning on hands or other strictly external body parts, a mixture of one part household bleach to five parts water can be used. Hands should be washed in the solution and rinsed thoroughly. This bleach solution should **never** be used on eyes or other moist orifices.

The best that can be done for eyes and other moist burning orifices is to flush with plain cold water. This will sting like crazy for a while, but should not cause permanent damage. This is the theory behind the concentrated pepper sprays used today in place of the more dangerous mace. Concentrated capsaicin can be as debilitating as mace, usually with much less chance of permanent damage, compared to mace.

One of the main reasons for developing the Scoville Scale was to standardize capsaicin for treatments for chronic pain. These "deep heating rubs" give their warming chemical "heat," the pain of which overloads the body's pain sensors, causing them to cease sending pain messages for a time, giving temporary relief.

Though perennial in their native habitat, peppers are grown as annuals in the temperate regions of the world, including most of the United States. By starting the seeds indoors or in greenhouses, the shorter warm growing seasons of much of the lower 48 states can accommodate

ripening of all but the most stubbornly tropical types. Depending on species, seeds should be sown from 6 to 10 weeks before conditions can be expected to be favorable for transplanting outdoors. *Capsicum chinense* types germinate especially slowly and the young seedlings also develop slowly, so this species will need longer than most others. Ideal greenhouse conditions will speed growth, while less than perfect windowsills will mature plants more slowly.

If space allows, seeds can be sown in individual cell packs, one or two seeds per cell. A relatively fine textured commercial soilless medium works well, and has been pre-sterilized. Cover seeds ¼ to ½ inch deep. Bottom heat of about 75°F will speed germination and plant development. Once germination and emergence is complete, these seedlings can be singulated, either by thinning or transplanting extras to their own cells. If space is limited, seeds can be started in a small container, then transplanted into individual cells or small pots once the first true leaf develops.

Daytime temperatures in the 70-75°F range are near ideal for growing the seedlings. Night temperatures can be 5-10°F cooler. If on a windowsill, containers may need to be rotated regularly to even out growth. If natural light is inadequate, seedlings will stretch out, with weak, slender stems. Artificial lights, usually cool white fluorescent tubes, can be hung about 4 inches above the tops of the seedlings. These should not be on 24 hours a day. Plants need some dark time to respire.

As plants near the size to move to the garden, they should be acclimated for a week or more, gradually introducing them to full sunlight, wind, and outdoor conditions. This is called “hardening off.” The process allows the plants to form a thicker wax layer on the leaves, which will help them to withstand full infrared radiation, wind, and temperature fluctuations. Peppers will be greatly stunted if moved to the garden too soon and then subjected to cold temperatures. These stunted plants’ development may be retarded for some time after temperatures warm. Later transplants, which are not chilled, may actually surpass those that are.

If plants get too tall, they may be planted deeper than they originally grew. Nightshades have the ability to form adventitious roots on the buried stem section, giving a larger, stronger root system. Dig planting holes, fill with water and add a starter fertilizer solution high in phosphorus to get roots established quickly. Roots need to be feathered out if they are circling the cell or pot, then placed in the mud at the bottom of the hole, covered with dry soil, and not watered from above for a day or two. This will minimize evaporation and allow the plants to get established, unless extremely hot or windy conditions prevail.

Fertility for peppers should be well balanced. While high nitrogen is often said to cause lots of leaves, at the expense of fruit, this is not necessarily the case. High nitrogen will make larger plants, which may become brittle and need to be staked. A good garden fertilizer with balanced quantities of the three major nutrients, nitrogen, phosphorus, and potassium, should yield good results, unless the soil is unusually poor. Compost tea or other organic sources can also be used. Some types tend to grow wide-spreading upper branches, which may need some support as a heavy fruit load develops. Others will do well with no assistance. Particularly sweet bell peppers, but also most other types, may not set fruit above 95°F. The blossoms will simply abort.

Spacing will vary greatly with the variety of pepper that is being grown. Some may be only a foot or so tall, while others may grow to be small shrubs 3-4 feet high in a single season. Variety descriptions should provide an approximate mature size, which should be taken into account when planting. Commercially, double rows may be grown, with plants spaced 15-18 inches apart and offset from each other. On raised beds, plants may be spaced about their mature

size apart in all directions. Plants too thickly planted may be more prone to disease development, because of decreased air circulation.

If all goes well, blossoms should begin to appear soon after transplanting. Any fruits that have set before transplanting should be removed to promote vegetative growth first. If temperatures are favorable, fruit should soon follow blossoms. Once the plants have sufficient leaf surface, these should develop normally. After fruit are set, the New Mexico state question, “Green or Red?” must be answered. Heat may be more pronounced in green chiles, because the sugars in ripe fruit temper it a little. Also, ripening fruit will take more energy, so the overall yield may be somewhat less. Many chiles are so prolific this will not matter. Fruit should be cut with garden shears or pruners. Pulling them free may severely damage the plant. Whole branches may break off.

Diseases may sometimes be a problem with any pepper variety. Some of the rarest ones may come with seed-borne diseases afflicting them. More reliable seed sources should have done seed treatments to minimize these diseases. Some common problems include bacterial spot, anthracnose, and various viruses. Tobacco mosaic virus can be transferred from tobacco products to the hands of users, and from there to pepper or tomato plants, so hands should be washed thoroughly after use and before touching plants.

Like tomatoes, peppers are sometimes subject to blossom end rot, a problem of calcium mobility within the plant. While calcium may be adequate in the soil, it may not always be available to the farthest regions of the plant, i.e. the growing tips and the blossom ends of fruit. Calcium travels with water in the plant, and anything that slows or stops water movement through the plant stops the delivery of calcium. High heat and drought are major causes, and some varieties are much more susceptible than others. Even water supply, mulches to provide even soil temperature and moisture, and good siting can help. In severe situations, a dilute spray of calcium chloride may help to stop the problem. Once a fruit is damaged, it cannot be “fixed”, however. Only new fruit can be saved.

Insects that can attack peppers include aphids, cutworms, corn earworms, European corn borers, tobacco hornworms, flea beetles, and spider mites. Cutworms attack newly set transplants, curling around the base of the stem and severing it in one night. In small patches, cutworms can be deterred by placing cutworm collars around the seedlings. These are merely barriers that the caterpillars can't climb. Any slippery circular container will do. *Bacillus thuringiensis* will help control young caterpillars. Hand picking works pretty well for tobacco hornworms, and parasitic wasps may eventually kill them, too. Insecticidal soap may be effective against aphids and spider mites. A high pressure water stream can sometimes wash away both aphids and mites.

How can peppers be preserved? Thin-walled varieties can be air-dried. Thicker-walled types, such as Jalapeno, may need assistance, such as smoking, which turns them into chipotle. Dried Poblanos are called Anchos. Small home driers can be used, outdoor sunshine in dry climates can work, and older gas ovens with pilot lights work well, with the door ajar and just the pilot burning. When dry to crispness, these can be stored in glass jars.

There are five domesticated species of *Capsicum*. By far the most common species grown in the US is *Capsicum annuum*, which is technically incorrect, since they are natively perennial plants. There are more cultivars of this species in the world than all the other four combined. Sizes, shapes, and other characteristics vary widely. The most common flower color is white, but purple flowers also occur. Fruit color most commonly starts green and goes to red when ripe, but other colors also abound. The bulk of pepper production in the US and Mexico is of this species.

Flowers are typically white but some varieties are purple. These include many of the most common and best-known pepper varieties, such as Jalapeno, Poblano/Ancho, Serrano, Cayenne, Pepperoncini, Anaheim/Numex, and sweet bell peppers. Most of the ornamental varieties are also of this species.

Probably the second most numerous are cultivars of the species *Capsicum chinense*, another misnomer because these originate in South America, not China. Their fruits may have been thought to resemble Chinese lanterns. Some of the world's hottest varieties are from this species. It is especially popular in the Yucatan. Fruit come in a variety of colors with tropical, fruity flavors. They have multiple flowers per node, a constriction where the pedicel meets the fruit, and crinkled leaves. There is one cultivar, called "Aji Dulce," which has the flavor of Habanero, but little or no heat. Madalene Hill called this one "Orchid Pepper." Flowers are usually small and white, with a fruity scent. The heat of this species may be the most affected by environmental factors. Cultivars in this species include Habanero, Scotch Bonnet, Datil, Fatalli, and Billy Go.

One variety of the species *Capsicum frutescens* is more widely grown than all the others. In fact there are relatively few cultivars of this species. Plants are compact, making them good container specimens. Peppers grow upright rather than pendulous and are usually red, orange, or yellow. Tabasco is in this species, and is a trademarked name of the McIlhenny Spice Company in Louisiana. Tabasco peppers have been used and described since before the Spanish arrival. Other cultivars are Zimbabwe Bird Pepper, Cambodian Angkor Sunrise, and the Brazilian Malagueta.

Capsicum baccatum (little berry) is grown mainly in South America, where it is known simply as "Aji." Flowers are characterized by diffuse yellow or green spots on the base of the petals. Plants are tall for peppers, up to about 5 feet. Fruit vary in size from small berries for wild varieties to over a foot in length for cultivated varieties. They are often brightly colored and quite flavorful. Cultivars include Aji Amarillo, Aji Colorado, Aji Andean, and Lemon Drop.

Capsicum pubescens is the rarest of the five species. The name means "hairy" and the leaves are quite pubescent and furry. Seeds are unusually shaped and black or dark brown in color. None of the other species have these seed colors. They grow mostly in the mountainous regions of Central and South America. They are adapted to temperate climates and are more cold-tolerant than other species. A few do not produce well at high temperatures. Fruits are unusually thick-walled, shaped like small oval apples, and come in red, yellow, and orange. Flowers are typically purple. Under proper conditions, these can grow to nine feet or more in height. Their capsaicinoid profile is very different, giving them very different flavor and heat from more common species. Cultivars include Peruvian Rocotos, Bolivian Locatos, and Mexican Manzanos.

Breeding of hotter and hotter peppers has become an obsession among "chileheads." Interspecific hybrids like Bhut Jalokia have been made. Bhut Jalokia was the first pepper to top one million Scoville Units. It is a cross between *C. chinense* and *C. frutescens*. Others in this hotter than hot category include Infinity Chili, Naga Viper, Carolina Reaper, and Trinidad Moruga Scorpion. Individual fruits of the latter have topped two million Scoville Units. Pure capsaicin is rated at sixteen million Scoville Units, so one eighth of these peppers is made up of capsaicin. One can only wonder how much higher this concentration can go. Cautious enjoyment is encouraged.