

Topics in Vegetable Production: Volume I- Fact Sheets

A class project prepared by the students of Vegetable Crop
Management Practicum (HORT 486B) and Warm Season Vegetable
Production (HORT 450B)

Taught by
Dr. Mark Uchanski

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Colorado State University
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Department of Horticulture and Landscape Architecture
College of Agricultural Sciences

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A class project prepared by the students of Vegetable Crop Management Practicum (HORT 486B) and Warm Season Vegetable Production courses (HORT 450B) under the direction of Dr. Mark E. Uchanski (Assistant Professor of Horticulture) at CSU, Department of Horticulture and Landscape Architecture.

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Introduction:

I have been teaching or helping to teach horticulture classes at the University of Illinois at Urbana-Champaign (UIUC), New Mexico State University (NMSU), and CSU since 2002. In that time, I have assigned numerous writing assignments on various horticultural topics. However, it has always bothered me that it was really only the instructor (and perhaps a few teaching assistants) that ever read these writing assignments. As a result, this information is not accessible to other students or the general public. To remedy this situation, I borrowed a novel concept from one my mentors (Dr. Bob Skirvin- UIUC) and decided publish the students' writing assignments in a form that could be assessed by other students and/or the general public.

At the start of this semester, the students in these two classes must select a topic for their writing assignment, and you will see a wide diversity of subjects represented. The students did a great job compiling information about each of their individual topics for their vegetable crop of choice in a form that was approachable by other students as well as the public. The end result of this effort is this bound volume on that same topic. This is the first (Volume I) of, hopefully, many volumes relating to vegetable crop management at CSU. Copies of this bound volume have been supplied to the students that contributed to it; there is also a copy in the instructor's private collection (211 Shepardson).

It was a joy to teach this class and learn from the students' research papers. I am looking forward to future volumes.

A handwritten signature in black ink, reading "Mark E. Uchanski". The signature is fluid and cursive, with the first name "Mark" and last name "Uchanski" clearly legible.

Mark E. Uchanski
Assistant Professor of Horticulture

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All About Okra

Ethan Aizikovitz

Vegetables are classed as either warm- or cool-season, depending on the temperatures they need for best growth. Warm-season veggies require both warm soil and high temperatures, with a light cooling at night to grow steadily and produce crops. To start off with, Okra is found in its wild state on the alluvial banks of the Nile. It was then moved through North Africa, the Mediterranean, and India. In the 1800's slaves from Africa used ground okra as a part of their diet, and this was heard to lead to the use of ground okra seeds as a coffee substitute by other southerners during the American Civil War blockades of the 1860's. Okra is a member of the Malvaceae family, which is the same family as the hibiscus. Stated in an article done by Clemson University, "Some recommended cultivars are Clemson spineless 80, Lee, Annie Oakley II, and Cajun Delight. (Smith, 2003)" Here is a Google image found of a healthy stand of okra.



When planting okra it's best to start from seed, it doesn't tend to transplant too well. The seed should be directly placed in the ground about two weeks after all danger of any frost damage has occurred. The

Figure 1, Healthy okra stand, 9/12/16.

basic rule is to keep the plants about 15 inches apart and the rows about 18 inches apart for a successful stand. Okra seeds are large and easy to handle. They will also germinate really well if the soil is warm enough, usually between the ranges of 65-85 degrees Fahrenheit. Most varieties will begin to yield about 60 days after planting your seed. Okra requires nice warm weather so in the northern climate you may not receive the same yield as you would in southern regions. Although, stated in an article by the UC Master Gardener Program of Sonoma County, “Okra is a flowering vegetable usually thought of as a southern crop. (Samuel)” The pods should be picked while they are tender and immature. They must be picked often; at least every other day. As stated in an article by North Carolina State University, “To achieve maximum yields the pods must be harvested every other day. (Sanders, 2001)” Okra plants have short hairs that may irritate your skin, so wear gloves and long sleeves while harvesting. Figure 2 shows the hairs that can begin to irritate bare skin.



Figure 2, Okra Stock, 9/12/16

Common problems with okra plants can be aphids and cabbage worms. As far as aphids go, it's very important to make sure they colonize on the underside of the leaves. The larval or worm stages of cabbage worms cause damage by eating holes in the leaves. The adult moths lay their eggs on the leaves but otherwise do not damage the plants. The worms are not easy to see because they are fairly

small and blend with the cabbage leaves. One cool fact is that every year in Burkville, Alabama, the Okra Festival is held. It is held right outside Montgomery, Alabama and historic Selma, Alabama. As far as nutrition goes, the pods contain good amounts of vitamin A, and flavonoid anti-oxidants such as beta-carotene, xanthin and lutein. It is one of the vegetables with highest levels of these anti-oxidants. The pods also contain good amounts of vitamin K. Vitamin K is a co-factor for blood clotting enzymes and is required for strengthening of bones. Along with vitamin C and K, these pods are good sources of iron, calcium, and magnesium.

In conclusion, the weather is the depending factor whether the crop is warm or cool season. As far as okra goes, it requires a nice warm soil and climate with a light cooling night. As stated in the article “Okra Seed”, “Okra goes really well when you cook it with tomatoes, onions, corn, and fish. (Anonymous)” I absolutely love fried okra!



Figure 3, Fried okra, 10/7/16

Being from Alabama I grew up on fried okra and highly recommend it as any side dish for any meal you cook!

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Colorado Cantaloupe

Farhan S. Alshammary

Introduction

Cantaloupes (scientific name: *Cucumis melo* L. cantaloupe)³

They are Muskmelons and are treated here as common melons, to differentiate them from watermelons, which belong to a different genus and species. Cantaloupes can be identified by some unique characteristics mainly a webbed surface, with ribs that are shallow, and rinds that are netted. A sure sign of a tasty, ripe melon is its sweet, musky aroma. They are considered a warm season (summer crop) annual crop because they are sensitive to freezing during all of its stages, and require warm conditions for germination with a minimum soil temperature of 60°F, with an ideal range of 70 to 95°F.⁷



1

History

As far back as 2400 B.C the Egyptians were the first civilization to inscribe about cantaloupes, then after many eras the Romans described their cultivation techniques of cantaloupes. Because it has a sweet and aromatic taste the cantaloupes popularity slowly rose until in the 1940s it reached France. During that time it began to spread throughout Europe especially in the center and north. Finally it reached the New World when Columbus brought its seeds on his voyage. Because the eastern part of North America was not suitable for cantaloupes it eventually made it to the west where now most of it is produced in California.⁴

Varieties

There are many Varieties of cantaloupe. Examples are the “Retato Degli Ortolani Cantaloupe” and the “Victoria Hybrid Cantaloupe”, but seed companies usually supply farmers the type that is best suited for their regions, soil type, and weather conditions. Average consumers cannot tell the difference because most of the varieties look similar.⁴

Planting

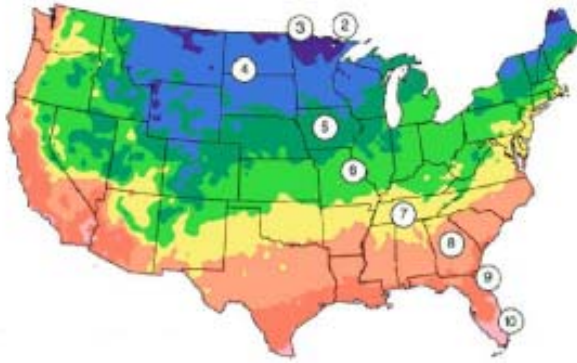
Cantaloupes are a warm season annual crop because they are sensitive to freezing during all of its stages, and require warm conditions for germination with a minimum soil temperature of 60°F, with an ideal range of 70 to 95°F. They are planted in the spring after the soil temperature is above 65°F. Cantaloupes are seeded, in a single line 3 to 6 inches under the soil, they are usually planted in beds that are raised so the surface of the soil can stay dry on the surface and the roots are moist.⁵

Cantaloupes are pollinated by bees therefore they are required in the pollination process. If the weather is not suitable for the bees during its pollination phase, the yield of the plant is affected.

Cantaloupes are known to have ground spot which is a result of contact with moist soil during its growing phase; these spots appear as blemish on the rind of the vegetable. Unfortunately these spots increase the risk of mold and diseases which can accelerate its decay as well. In many regions, farmers will hand turn the crop so they can prevent the development of these ground spots and have a healthy crop.⁵

Harvesting

Traditionally Cantaloupes are harvested by hand and are still harvested that way today, they are harvested when the melons are ripe, have a musky sweet smell, and have an orange yellow appearance. Some farmers incorporate technology during harvest by using trailers and conveyor belts. After harvest they are cleaned and packed in boxes at around 40 pounds per box. Then they are stored at temperatures typically from 36°F to 40°F preceding shipment.⁵



Domestic Harvest

- 2, 3, 4: August - September
- 5, 6: July – October
- 7: June – September
- 8, 9: May - July
- 10: April – June⁵

Food Safety

Unfortunately, physical characteristics of their rind and flesh make cantaloupes susceptible to pathogen contamination and growth; contamination can arise from soil, water, equipment, animals, or humans, and can occur at any phase of production it is important to understand the details of each. Also, production methods may vary considerably between growers or by region. The most recent outbreak from cantaloupe in Colorado was Listeriosis it made national news headline as it killed 33 Americans who consumed infected cantaloupe. It is recommended for consumers who are handling cantaloupe to wash it thoroughly and scrub the surface clean under clean running water as soon as they buy it.⁶

After the 2011 Listeriosis outbreak, 10 cantaloupe farmers from Colorado’s Rocky Ford region united to form the Rocky Ford Growers Association — to prevent future outbreaks, and protect their image in the eyes of the people and media. By joining the Association, they have agreed to have risk assessment and/or audit review of their farms and strict adherence to USDA Good Agricultural Practices (GAPs) and Good Handling Practices (GHPs).⁸

Marketing in Colorado

Based on data collected from 2011, around 2% of the total cantaloupes in the US is produces in Colorado. California produces over 90% Texas and Arizona also contribute to that percentage.

This ranks Colorado as sixth among other states regarding cantaloupe production. Below are important data from 2011 regarding the agriculture of cantaloupe in Colorado.²

- ❖ Planted: 2,200 Acres
- ❖ Dates Planted: April 15 – May 15
- ❖ Harvest: 2,100 Acres
- ❖ Harvest dates: June 15 – October 15
- ❖ Growing period: 80 days
- ❖ Crop was valued at 9 million dollars²

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Jalapeno Peppers Fact Sheet

Brianna Bade

Jalapeno peppers, *Capsicum annuum*, are one of the most popular varieties of pepper in the United States. In countries such as Mexico, it isn't uncommon for people to pick them from the side of the road, and they are often consumed as a snack (Hultquist, 2009). The fact that these fruits can be enjoyed straight from the plant makes them a vegetable. Doing best with air temperatures above 75 degrees Fahrenheit, this spicy warm season crop is easy to grow and will thrive in a home garden setting (Swiader & Ware, 2002).

Traditionally grown in Mexico, the jalapeno pepper is named after the city of Xalapa, and is an important part of Mexican-American cuisine (Bosland, 2009). The jalapeno pepper is best known for its smooth, bullet-shaped fruits. Varying colors indicate varying hotness (Swiader & Ware, 2002). These peppers are usually harvested when green and mildly flavored, but they turn bright red when mature (Swiader & Ware, 2002). This is when they are at their peak hotness. This 'hotness' we experience when eating a pepper is caused by the chemical capsaicin, which originates in the placenta of the fruit (Hultquist, 2009). The placenta of the fruit includes places near the stem and in the seeds, and these parts can be up to 16 times hotter than the rest of the pepper (Hultquist, 2009). Capsaicin is not only good for spicing up a plate of food, but it is the main ingredient in pepper spray. Who would have thought that pepper spray would actually have peppers in it? Another use for capsaicin is in cold and flu medications as a decongestant. A man by the name of Albert Szent-Gyorgyi won a Nobel Prize in 1937 for his work with chile peppers. He also found that they were a rich source of vitamin A, E, C, and folic acid (Hultquist, 2009).

According to Michael Hultquist (2009), a pharmacologist named Wilbur Scoville developed a test to measure the capsaicin levels in different peppers. He ground up different varieties of dried chile peppers, mixed them with sugar water and alcohol, and gave 5 lucky individuals (probably his interns) the task of tasting and rating them. He named the units after himself, and found that peppers range from 0 Scoville units (SHU) all the way to 300,000 for the hottest habanero. Being a much milder pepper, jalapenos fell at about 5,000 SHU (Hultquist, 2009). I myself can't eat a whole jalapeno without putting peanut butter or cheese in it, so I can't imagine eating a habanero with 300,000 SHU!



Fig. 1 - The "Nu-mex" variety of jalapeno peppers (Bosland, 2009).

The jalapeno market has expanded greatly along with rapidly increasing technology. Not only can they be eaten whole and raw, but they are also canned, frozen, sliced, and pickled. This makes it convenient for the consumer to get exactly

what they want. According to the US Department of Agriculture (2015), 462.5

million pounds of chile type peppers (such as jalapenos) were produced in the United States in the year 2014. This makes pepper production in the United States a large and profitable industry. Still, about 38.5 million pounds of these peppers were imported from Mexico that year, meaning consumer demand is still higher than what we can produce here (Wells et al., 2015).

Peppers are typically quite hardy and will do well in a home garden setting. The main things that jalapeno plants need to be successful are moderate soil moisture and high temperatures. Jalapenos, like many other vegetable crops, require an abundance of water during

fruiting. The small stature of the plants, however, means that the water requirement isn't as high as it is with larger plants. Good drainage is important, but they will do well in almost any soil. Probably the most important factor in having successful jalapeno plants is temperature. Peppers will not set fruit if temperatures are less than 60 degrees (Swiader & Ware, 2002). Being a warm season crop, these plants perform the best at temperatures between 65-86°F. Temperatures above 90°F will actually increase fruit set in jalapenos, and night temperatures above 70° are important for success (Swiader & Ware, 2002).

The reason that I decided to do a fact sheet on jalapenos stems from my deep love of the plant. My family has had a large garden ever since I can remember, and my mother cans the best salsa I've ever tasted. Some of my fondest childhood memories consist of watering and picking peppers in the garden (along with sneaking a few into my pocket as a snack for later), and the smell of chopped and boiled jalapenos brings back memories of the good old days. Still today, my jalapeno plants are my pride and joy and the first thing I show people that visit my garden. I love them so much I have even tried growing them in a dorm room (with little success due to the temperature requirements). Living in extreme northeastern Colorado, conditions are perfect for high yields and strong, healthy plants.

Jalapeno peppers, *Capsicum annuum*, are one of the most popular varieties of pepper in the United States. They are hardy, easy to grow, and make a great addition to any garden.

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***Phaseolus lunatus* Lima Beans: A Brief Overview of This Protein**

Brandi L. Barrett

Phaseolus lunatus is the scientific name for Lima beans (Swiader & Ware, 1992). Lima beans belong to the family, Fabaceae. They are considered a warm season crop which means that growing conditions for the plant are best at temperatures between 65-86 degrees Fahrenheit, whereas cool season vegetables are considered to grow best at temperatures of 45-65 degrees Fahrenheit (Swiader & Ware, 1992). Lima beans are classified as a vegetable. There are two types of vegetable beans; one type is snap beans and the other, known as Lima beans (Soler, 2011). The scientific study of vegetables is known as olericulture. In order for any food to be classified as a vegetable, it needs to be consumed either raw or cooked as part of a main entrée in a person's life (Uchanski, Ch. 1, 2). It may not always be clear, but when we eat vegetables we are eating certain parts of the vegetable for example, the stem, root or petiole. When we eat Lima beans, we are eating edible seeds (Uchanski, Ch. 2, 5).

Phaseolus lunatus belongs to the family Fabaceae. It is estimated that Lima beans have been cultivated for more than seven-thousand years and originated in Central and South America. They made their way up through Mexico and landed in Florida and then spread to Virginia, then made their way to Europe. Once established in Europe many different cultivars emerged (Swiader & Ware, 1992).

Centers of origin of selected crops



Note: The pointer locations indicate general regions where crops are believed to have first been domesticated. In some cases, the center of origin is uncertain. Other geographic regions also harbor important genetic diversity for these crops.

Source: This map was developed by the General Accounting Office using data provided by the National Plant Germplasm System's Plant Exchange Office.

Map 1: shows the origins of Lima Beans (USDA, 2016).

There are different cultivars of Lima beans, including vine-types and bush-types. Small-seeded Lima beans are one type which are known by their scientific name of *Phaseolus lunatus*, and are commonly known as sieva or butter bean. The bush form of Lima Beans is known as *Phaseolus lunatus* var. *lunonanus* (Swiader & Ware, 1992).



Fig. 1: *Phaseolus lunatus* in the pod (Nayyar, 2016)



Fig. 2: *Phaseolus lunatus* var. *lunonanus* (Slotta, 2016)

Typically, Lima beans take about 60 to 110 days to reach maturity. Lima beans are a nutritious addition to meals. They are important because they provide protein, vitamins A and B and minerals such as calcium, phosphorus and iron. These beans are relatively low in calories and high in fiber. Beans typically are a mainstay in a vegetarian's life as an alternative to animal proteins. Beans may be prepared in a number of ways including, stir-frying, boiling, and being cooked after being dried (Swiader & Ware, 1992).

I chose this crop because I remember being in elementary school and this was the first plant I ever grew from seed, and I was so proud of myself when germination occurred. I still enjoy Lima beans as an adult. They are super delicious and filling. I personally like to boil my Lima beans, strain them then add lime juice, lime zest, and parmesan cheese plus a little pepper. It is a nice addition to the meaty taste of the bean.

Here are some interesting facts about Lima beans: The flowers attract honey bees with the nectar that they produce. Bees are the main way pollination is achieved, however, Lima beans are able to self-pollinate when pollinators are not around. The colors of Lima beans can vary from green cream colored to white and most beans have reddish-brown markings on them. The small bean types are known as sieva and the large bean types are known as Lima. The specific epithet, *lunatus* means crescent-shape in Latin, in regards to the seed's crescent moon shape. Lima beans contain a dangerous compound in them by the name of cyanide glycoside; therefore the beans must be cooked before enjoying. The average American consumes 0.3 pounds of Lima beans each year. The fiber found in Lima beans can be a very healthy addition to a person's life. The benefits from the fiber in the Lima beans include constipation prevention, blood sugar level regulation, and it can lower blood cholesterol levels. The Lima bean plant is a perennial which means its life cycle is two years, or more, but it is grown as an annual which means the plant will go seed to seed in one year (Anonymous, 2016). Lima beans also create their own nitrogen which comprises many fertilizers and may help mend soils that are deficient in nitrogen (Soler, 2011).

Climate and cultural requirements are important for any crop that is being produced. Lima beans are no exception. In order for the beans to reach maturity, there must not be any temperature extremes because the Lima bean plant is not hardy; it will die if it is exposed to frost. In order for germination to occur, the seeds need to be planted in warm soils. The bean seeds are planted directly in the soil in rows. Lima beans require lots of water, so it is important to keep the soil moist (Swiader & Ware, 1992).

Lima beans can be infected by different diseases and insects, some examples include, Mexican Bean Beetle, Bean Leaf Beetle, and Adult Bean Weevil. Some diseases that can infect Lima bean plants include Rust, Root Rot, and Downy Mildew (Swiader & Ware, 1992).

Marketing is an important aspect to selling vegetables. Consumers expect near perfection when purchasing vegetables. Any deviation from perfection could compromise the sale-ability of the product. According to the USDA, there are clear guidelines that should be adhered to. Lima beans should be uniform in shape, not too small, should not show signs of decay, and should not be overly ripe. The vegetable should be protected from hail, freezing, disease and insects as well. By weight of the Lima bean pods, only a ten percent deviation may be permitted (Lima Bean Grades and Standards).

In conclusion, Lima beans are an important warm season vegetable that has been cultivated for thousands of years, first being cultivated in Central and South America, and slowly being exposed to North America and then introduced to the European countries. This fabulous edible protein, vitamin, and mineral packed seed can also be of dietary and health benefit, and it is no wonder why so many people enjoy incorporating the vegetable into their daily meals.

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Pumpkin

Daniel Boyer

The term Pumpkin is derived from the French *pampion* meaning “sun-baked squash” (Kemble et al., 2000). Pumpkins are one of the most recognizable vegetable crops. Pumpkins fall into the Cucurbitaceae family which also includes summer squash, watermelons, and muskmelons. Pumpkins are a warm season crop as they should be planted at least a week after the last spring frost date, and then grown throughout the warm summer season (Basham & Ells, 2014).

Pumpkins are native to the Americas, and were grown by the Native Americans before the European colonization of the continent (Kemble et al., 2000). Remains of pumpkins have been discovered among old cliff dwelling ruins in the southwestern United States, and distinct Asian forms suggest pumpkins made their way east in the sixteenth and seventeenth centuries (Orzolek et al., 2016). There are four species of Cucurbit that contain pumpkin; *Cucurbita pepo*, *Cucurbita moschata*, *Cucurbita argyrosperma*, and *Cucurbita maxima* (Swiader & Ware, 2002). The different species have different characteristics with *Cucurbita pepo* containing most traditional field varieties, *Cucurbita moschata* and *Cucurbita argyrosperma* containing a few rare commercial varieties, and *Cucurbita maxima* containing the giant varieties prized for large fruit (Kelley & Langston, 2009). The largest pumpkin ever recorded currently was a 2,323.7-pound behemoth grown by German Beni Meier at the European Championship Weigh-off in 2014. This outplaced Tim Mathison’s 2,032-pound beast from a 2013 California competition (World Record Giant Pumpkins, 2014). There is a variety of pumpkin cultivars commonly grown as there is within them a range of days to maturity (typically 85-120), and also in fruit size (from less than 1 to multiple hundred pounds) as shown in figures 1 and 2 (Orzolek et al., 2016). Some

of the most common cultivars listed from smallest to largest fruit size include Munchkin, Baby Boo, Baby Pam, Hybrid Pam, Magician, Sorcerer, Solid Gold, Gladiator, Alladin, Growers Giant, and Prizewinner (Orzolek et al., 2016). The cultivar(s) you select to grow will be based upon your local growing period length and your desired size of pumpkin, which will in turn be based off of your desired market and use. The biggest use of pumpkins is for ornamental decoration for the holiday Halloween (Kemble et al., 2000). Past that, almost all pumpkins are edible and are used in a variety of ways as food, flavoring, spice, etc. Pumpkin pie, pumpkin seeds, pumpkin butter, pumpkin spiced beers and coffee drinks, and just cooked pumpkin in a myriad of ways are all common culinary uses.



Figure 1 – *Cucurbita pepo* (La Chaim, 2009)



Figure 2 - *Cucurbita maxima* (Rainger, 2016)

Pumpkins are a monoecious crop which means that separate male and female flowers will occur on the same plant. Insects are required to cross pollinate pumpkins as a result (Kemble et al., 2000). Pumpkins typically take from 85-120 days to reach maturity depending on species and specific cultivar (Kemble et al., 2000). You will want to direct seed your pumpkin in soil temperatures between 70 and 90 degrees Fahrenheit to provide for optimal germination (Kemble et al., 2000). Pumpkins are fairly easy to grow but will prefer certain soil types if available. The most optimal is a well-drained, sandy loam soil with a pH of 6-6.5 and high organic matter content (Kemble et al., 2000). Crop rotation can be extremely beneficial in pest and pathogen

prevention for pumpkins. If possible, do not plant pumpkins in soils that have grown Cucurbits in the last 2-3 years (Kemble et al., 2000). As with farming of almost any plant you will want to test the soil for the fields in which pumpkin will be grown to gather information on the fertility and physical properties. Typical guidelines for pumpkin production are 50 pounds per acre of nitrogen at seeding, and then continuing with 20-30 pounds per acre N and 60-100 pounds per acre K side-dressed on young plants at 3-6 weeks (Kemble et al., 2000). There is some important methodology in seeding and plant spacing for optimal pumpkin production. Pumpkin seeds should be planted from .75 - 1.5 inches deep in the soil, with two to three seed per hill. With emergence you will return and thin to only the healthiest seedling (Kemble et al., 2000). Plastic mulch is a very good option in pumpkin production with benefits such as increasing soil temperature, accelerating plant growth, conserving soil moisture, reducing compaction, reducing fertilizer leaching, reducing weed competition, and more (Kemble et al., 2000). The most common insect pests for pumpkin include cucumber beetles, squash bugs, cutworms, squash vine borers, and aphids (Kemble et al., 2000). Regular scouting is the best way to stay knowledgeable about your pest situation and to identify when control or management techniques are needed to protect your produce. Chemical insecticide techniques with a combination of biological control methods specific to your pest are typically the best options in pumpkin production. You must be careful when using these methods to not harm the beneficial pollinator insects as they are necessary to receive good fruit set across your population (Kemble et al., 2000). Pathogens are another concern, as with every vegetable. Downy mildew, powdery mildew, black rot, anthracnose, and cucumber mosaic virus tend to be the most common onslaught of diseases towards pumpkins (Kemble et al., 2000). Certified disease free seed at planting, culling of infected plants and litter, planting of resistant cultivars, well-drained soil, good airflow, and crop

rotation sum up the list of defenses one can use against pathogenic pests (Kemble et al., 2000). Sprinkler irrigation is considered the norm for pumpkin and gourd production currently, but any system will suffice as long as it can adequately provide an inch of water every four days at a rate slow enough to prevent excessive runoff (Kelley & Langston, 2009). Drip irrigation is gaining in prevalence and shows markedly improved water efficiency and somewhat decreased weed pressure when used correctly (Kelley & Langston, 2009).

Pumpkins are unique in being an edible vegetable crop that is primarily used ornamentally. Overall pumpkin usage in the United States is increasing. The USDA Economic Research Service shows per capita pumpkin consumption rising from 4.67 pounds in 2013, to 5.39 pounds in 2014 (Wells & Ferreira, 2015). Another example is pumpkin-flavored options gaining in prevalence, with pumpkin-flavored beer sales increasing more than 1500% over the last ten years, and the number of pumpkin beers branded increasing from 2 in 2000, to 65 in 2015 (Ferdman, 2014). Well-known companies have also joined the pumpkin-craze over the last few years with Nabisco launching Pumpkin Spice Oreos, Mars launching Pumpkin M&Ms, and Starbucks Pumpkin Spice Latte being released early this year due to popularity (Ferdman, 2014). Along with the increase in use has come the increase in production, with USDA showing 1.12 billion pounds produced in 2013 rising to 1.31 billion pounds in 2014 (Wells & Ferreira, 2015). The recent resurgence and diversification in the edible market along with longstanding ornamental capacity is encouraging more and more producers to investigate pumpkin as a viable crop.

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‘Desert King’ Watermelon: *Citrullus lanatus*
Nicole Brothers

Citrullus lanatus, commonly known as watermelon is an herbaceous annual that is from the Cucurbitaceae (squash) family. It is a warm season plant meaning that it thrives in temperatures that are above 70°F, and a long season plant due to the fact that it needs 65-90 days of warm weather with out danger of frost to produce fruit. Watermelon is typically thought of as a fruit because of the way that the fruit grows botanically as a seed-bearing structure that develops from the ovary of a flowering plant, but can be defined as a vegetable by the way that it is produced.

Watermelon is said to be native to North Eastern Africa where wild species can still be found. Harry S. Paris, a researcher with the Agriculture Research Organization of Israel, who is dedicated to understanding all he can about the history, genetics and evolution of cucurbits (Paris, 2016), says watermelons are crop that has been grown for food since ancient times and are native to Africa. The native or wild version of watermelon are unlike the sweet version known today, they are hard in texture, bland or bitter, and lacking red flesh (Paris, 2015).

In his research paper Origin and emergence of the sweet dessert watermelon, *Citrullus lanatus*, he found that the remains of seeds have been found as early as 3,000 BCE in Egypt and Libya, and that the domestication of the dessert watermelon happened somewhere around 2,000 B.C.E., where the remains of fruit and illustrations where found in Egyptian tombs (Paris, 2105). In 2011 the production guidelines for watermelon put out by the Department of Agriculture, Forestry and Fisheries of the Republic of South Africa said that watermelon has long been cultivated in the semi-desert regions of Africa for water content which is

roughly around 92%. There are now hundreds of watermelon cultivars grown all over the world. These cultivars are chosen and grown for their specific traits.

The 'Desert King' variety has specific traits of its own. It has a monoecious vine, with branched tendrils that have small yellow flowers and large divided leaves. The fruit of the 'Desert King' watermelon has a light green rind and yellow flesh. (Fig 1)



(Photo cred. Washington State University Vegetable Research and Extension, Miles, 2006)

Washington State University grew over one hundred different varieties of watermelon and found that the 'Desert King' has approximately 95 days to maturity and has an average fruit weight of 19.4 lbs. This specific cultivar is often grown for its ability to handle high temperatures and its drought resistance. This is a helpful aspect of this specific variety when growing the 'Desert King' in semi-arid regions. According to the members of Folia a gardening forum, the 'Desert King' needs a moderate amount of maintenance sowing the seeds in a sandy soil with a pH of 6.5-

7.5 and when soil temperatures are above 60° F. This cultivar is also resistant to “sunburn” which can happen among other cultivar. Sunburn happens when the flesh of the watermelon turns brown and loses its texture.

In the United States, watermelon is mainly produced in Florida, Georgia and California (USDA ERS, 2013). It has been produced for its sweet and refreshing fleshy fruit and is best consumed cold on hot summer days. The people of Rocky Ford, Colorado know this well and celebrate watermelons every year with a watermelon day (www.arkvallyfair.com, 1946). They say this tradition started with one of their first settlers George Washington Swink had such a successful crop of watermelons that he flagged down a passenger train and offered watermelon to every passenger (Arnold, 1946). One of the citizens of Rocky Ford described watermelon best when he said, “It’s a wonderful fruit, you eat, you drink, you wash your face”(Caruso, 1946).

Watermelon is not only a wonderful fruit because of its refreshing and tasty qualities it also has some beneficial nutritional values. Vitamins A, B6, and C are all found in watermelon. Vitamin A supports eye health and boost immunity. Vitamin B6 helps break down proteins and helps the immune system produce antibodies. Vitamin C also helps support the immune system (watermelon.org, 2016). Due to the unique characteristics of the ‘Desert King’ watermelon, it is an ideal cultivar to grow in Colorado. Its drought tolerant characteristic combined with tolerance of high temperatures makes it easy to cultivate and the yellow color of the flesh and beneficial vitamins make it a refreshing snack for the summertime.

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Warm Season Crop Fact Sheet: Watermelon

Casey Brown

Introduction:

Mark Twain once said, “when one has tasted watermelon, he knows what the angels eat” (Quotes and Sayings). Many people associate watermelon with summer, as it is considered a tender, warm-season vegetable (Anonymous, 2016). Watermelon can be grown just about anywhere with warm temperatures and long growing seasons (Anonymous, 2016). It is easy to agree with the wise words of Mark Twain. Nothing beats taking that first bite of a chilled watermelon slice and feeling the juice burst in your mouth and dribble down your chin. Watermelon is now the most-consumed melon in the United States and has the entire month of July dedicated to it as “National Watermelon Month” (Mercola, 2014). Watermelons are a huge part of summertime snacking and have been around for nearly 5,000 years (Johnson, 2015). There are so many aspects of watermelon that make it a unique warm season vegetable crop.

Background:

According to National Geographic, the first ancestral species of watermelon can be traced back to the Kalahari Desert in southern Africa all the way back to the 18th century (Strauss, 2015). Watermelon has been cultivated as early as 2000 B.C. with the first recorded watermelon harvest occurring nearly 5,000 years ago in Egypt (Thompson, 2015). Remains of watermelon seeds have been discovered in the tomb of the Egyptian Pharaoh Tutankhamen, and in other sites of the 12th



Figure 1: Giuseppe Recco's Painting entitled *Still Life with Fruit*

Egyptian Dynasty (Thompson, 2015). From Africa, watermelon crossed to Europe where it grew successfully in the warmer parts of Mediterranean (Anonymous, 2014). By the 7th century, different species reached India and eventually reached China in the 10th century (Anonymous, 2014). The watermelon has inspired artists with its bright colors and unique shape (Strauss, 2015). Figure 1 is a painting of Giuesppe Recco's *Still Life with Fruit*, painted between 1634-1695 (Strauss 2015). Today, China is the world's number one producer of watermelon, producing more than 90% of the world's watermelons (Thompson, 2015).

Growing Watermelon:

Like many warm season vegetables, timing and care are two of the most important aspects when growing watermelon. It is recommended by The University of Illinois Extension website that watermelon should be planted after the soil is warm and there is no danger of delayed frosts (Anonymous, 2016). However if growing in a cooler location, like Colorado, it is recommended to start the seeds inside for about a month before transplanting. When planting, it is important to consider the types of soil conditions the melons grow best in. Watermelons have been proven to favor sandy loam soils, although they can also thrive in clay soils with raised planting rows and black film (Anonymous, 2016). Typically, watermelons prefer soils with a pH between 6 and 6.8 (Johnson, 2014). When planting watermelon vines, it is required to allow them a considerable amount of space. University of Illinois Extension recommends to plant seeds one inch deep on hills spaced six feet apart, allowing seven to ten feet between each row. Once seedlings have established, thin the row to the best three plants per hill, allowing for less competition and extra space for the watermelon plant to thrive (Anonymous, 2016). Watermelons grow best in full sun in hardiness zones 3-11 (Johnson, 2014). According to

Gardening Know How, growing watermelons takes about 120 days from start to finish

(Mierzejewski, 2016). When they are ripe and ready to harvest the curly tendrils will turn brown and get a little crisp. Another indication is that color of the melon will get duller (Mierzejewski, 2016). The skin of the watermelon will be hard and resistant to penetration (Mierzejewski, 2016).



Figure 2: Two Varieties of Watermelon

Another way to know if the melon is ripe is to pick one up and turn it over. If the bottom where it sits in the soil is yellow, the watermelon is probably ripe (Mierzejewski, 2016). If one is trying to grow watermelon in cooler conditions with unexpected frosts, it is important to protect your plants from harsh mountain storms and cold weather (Shelton, 2016). Using plant blankets or water-filled insulators to raise the temperature of the soil during these cold spells will help in making sure the crop is hardy enough and prepared to take on the unexpected Colorado weather (Shelton, 2016). Watermelon plants are a very tender warm-season vegetable and typically do not withstand frosts or freezing temperatures (Shelton, 2016).

Varieties:

More than 1,200 varieties of watermelons are grown worldwide in 96 countries, many of which are different shapes and sizes (Thompson, 2015). In recent years, watermelons have been crossbred to yield more fruit and less rind, to have harder rinds, and be pest-resistant (Thompson, 2015). Watermelons have been bred to be pink, red, blue, yellow, orange, and white and come in all sizes of ovals and even squares. Figure 2 demonstrates how different watermelons can be by a side-by-side comparison between a pink and yellow fruit.

Fun Facts:

The following facts have been provided by the Town Dish Website (Johnson, 2015)

- Watermelon is a vegetable! It is related to cucumbers, pumpkins and squash.
- By weight, a watermelon contains about 6% sugar and 92% water
- Early explorers used watermelons as canteens.
- Watermelon is grown in over 96 countries worldwide.
- Every part of a watermelon is edible, even the seeds and rinds

Conclusion:

In conclusion, watermelons are a unique and dynamic warm season vegetable. With a rich history and diverse varieties, watermelons are recognized world wide as a delicious fruit. Watermelons take a lot of attention to detail when growing, especially in Colorado. While the crop can be considered hardy, it is important to consider the weather conditions in the location of the growing area. Watermelons have many interesting facts and grow in many shapes and sizes.



Figure 3: Delicious Watermelon Slices

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Figure 1: Giuesppe Recco's Painting entitled *Still Life with Fruit*

Strauss, Mark. "The 5,000-Year Secret History of the Watermelon." National Geographic. National Geographic Society, 21 Aug. 2015. Web. 12 Sept. 2016

Figure 2: Two Varieties of Watermelon

"Back To Organic – Yellow-and-red-watermelon-cut-in-half-showing-the-pattern-in-the-watermelon." *Back To Organic RSS*. N.p., 05 Aug. 2013. Web. 10 Oct. 2016.

Figure 3: Delicious Watermelon Slices

"The Watermelon: 92% Water + 8% Delicious Healthy Goodness." *The Flavor Run*. N.p., 19 Mar. 2015. Web. 10 Oct. 2016.

Golden Zucchini

By: Gian Camilli

Zucchini has had a long road of evolution to become what it is today. Zucchini belongs to the *Cucurbita* genus and the *Cucurbita pepo* species. *C. pepo* contains vegetables such as pumpkin, summer squash, and zucchini. This group is native to the Americas and has been grown here for thousands of years. The cucurbits of the past, however, are vastly different than today's. It is theorized that modern *C. pepo* cultivars are wild varieties taken from Northern Mexico and Texas. It wasn't until 50 years or so after Columbus that *C. pepo* was recorded in Europe. "Zucchini" is an Italian word that constitutes the plural of "Summer Squash". It wasn't until 1920's that the distinct zucchini group we know was



Figure 1: Golden Zucchini
(Burpee, 2016)

introduced back into commercial North American farms. (Paris S. Harry, 1989) Zucchini is considered a summer squash, that is: a type of cucurbit that is picked immaturity. Some varieties at maturity as well as gourds are relatively hard and inedible. Zucchini has since been selected for characteristics such as flavor, texture, and color, to make it into what it is today.

Once such variety, golden zucchini, has caught my particular interest as my family has been enjoying them for years, thinking they were squash!

Golden zucchini is a delicious, tender, zucchini, with a flavor I really only know how to describe as “golden”. When eaten side by side a normal cucumber the distinct flavor is evident. Golden zucchini is delicious when cooked in a skillet with some olive oil or butter, and spices.

According to a botanical definition zucchini is considered a fruit, however, it is grown and behaves much more like a vegetable. Even though the fruit bear seeds it does not require as much intensive care and grows like a weed when established. Zucchini is grown as an annual and is “open pollinated” – meaning this plant can be bred with the same variety or be self-pollinated. It also means that as long as this variety is kept isolated from others, it will produce offspring of almost the exact same type as the parent. (Ben Watson, 2016) The leaves of this plant are distinct wide, furry, and green, while the flowers are a brilliant yellow.

Growing Facts:

Golden Zucchini is considered a warm season vegetable because it grows optimally in warm conditions of 68-78 degrees. Golden zucchini in particular is a very easy crop to grow. It can tolerate very hot days, as well as cold temperatures. Keep this plant away from frost, though, as frost may kill it or permanently stunt its growth.

It is imperative to wait until all frost has passed to plant seeds. Seeds can be planted about an inch deep under full sun. You want to plant only 1-2 seeds together and they need to be at least 36 inches apart. Thin to 1 seedling in each spot. Keep the soil evenly moist but not soaked. (Burpee, 2016)

Seeds can be planted in raised beds, pots, or boxes. The root system is shallow so wide containers are best. When planted in a large, raised box, this plant seems to do the best. This plant may sap the soil of nutrients so it is best not to plant one where another zucchini has been planted in the past 2 years. (Burpee, 2016) Also, the risk of disease and pests increases if you do this. Alternatively, using a compost or nutrient mix and an integrated pest management strategy can fix this. Usually,

composting should be done after harvest the previous year. The part where most people go wrong is letting the soil get too dry. Keep a close watch and make sure to give the plant plenty of water. Soon enough, your **plant will explode!**

Figure 2: Giant Irish Zucchini plant (Sue Schaffer, 2009)



Harvesting golden zucchini is extremely easy. They are very easy to see and are generally numerous. IMPORTANT: golden zucchini must be picked when they are considered “immature”. This means at 6-8” long, when the skin is smooth and shiny. If any of the vegetables are allowed to mature on the plant, it may stop producing for that year. Seed to harvest can take anywhere from 35-60 days. (Burpee, 2016) Golden zucchini are notorious for a very fast growing season as well as bountiful harvests. Zucchini should be stored in a cool, dry place. Burpee suggests putting them in plastic bags and into the refrigerator. They can be stored this way for up to 2 weeks, but generally start going bad after the first.

According to FAO stats, the worldwide production of summer squash exceeded 6,300,000 metric tons during the late 1980s! (Paris S. Harry, 1989) “The United States imports the most squash in the world. On average, the United States imports 300,000 MT of squash each year. In 2013, squash imports were valued at \$317 million. Mexico supplies 95 percent of the squash imports to the United

States.” (Malinda Geisler, 2014) This includes both summer and winter squash. Obviously, we love squash! Since it is so easy to grow, I suggest everyone tries to grow at least one. It can be extremely fun and rewarding!

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Okra: A Growers Guide and Fact Sheet

Alex Cass

Introduction

Okra (*Abelmoschus esculentus*), otherwise and more informally known as gumbo, is a popular warm season vegetable in the Southern United States. Okra is mostly considered a warm season crop, as it is very tender and grows best at temperatures above 85° F and in regions with warm nights (Swiader and Ware, 2002). Because of the way it is consumed, cooked as part of a main meal, okra is considered a vegetable. I chose to create a fact sheet on okra because of my love for gumbo (the stew) and general interest in its production. This fact sheet will be a general guide for outdoor production of okra and will include some information on producing the vegetable in Colorado.



Figure 1 – Botanical Illustration of Okra

General Information

The okra plant is part of the mallow family, known as Malvaceae, which also includes important agronomic crops such as cotton and cacao. Although unknown with certainty, okra's center of origin is thought to be in Western Africa and Ethiopia or Southern Asia, and records of its use date back to 12th century Egypt. The plant was brought to the Americas by African slaves, as they consumed a significant amount in their diet (Swiader and Ware, 2002). Okra is almost exclusively grown commercially in the Southern United States and is considered of slight importance as a horticultural crop.

The undeveloped pods from the plant are typically consumed either as "side dish," boiled or fried, or they are imparted into soups and stews. For soups and stews, the vegetable is used to contribute a slimy, gelatinous consistency, often called "gumbo" (Swiader and Ware, 2002).

The okra plant is a very tender annual, which can grow to a height of 3 to 7 feet, depending on the climate and cultivar. The partly-woody stem has a large number of short axillary shoots, with a flower bud at most of the axils. The blossoms, which open one at a time, are red to yellow colored and resemble hibiscus



Figure 2 – Long pod okra with hibiscus-like flower

flowers (Manning and Brainard, 2011). Each self-pollinating blossom produces one fruit, a pod, which is most often ribbed and can grow up to 8 inches in length. Immature pods are a green or red in color and brown as they mature.



Figure 3 – Red okra pod

For okra, cultivars can be classified in many different ways, but height, pod characteristics, and color are the most popular. For height okra can be classified as dwarf, intermediate, or tall. For pod characteristics, length and ridge depth the most common way of classification, but they are also classified as spineless or not. And for color, okra plants can be classified as either red or green (Hemphill, 2010).

Site Selection

Because of its tropical origins, okra grows best in warm areas with full sun. Days above 85° F and warm nights, above 55° F, produce the best growth. In general, okra has relatively low water requirements. Cool, wet or cloudy conditions can seriously hamper plant growth. For Colorado, commercial production should only take place in the warmest parts of the state. (Andersen, 2013)

Okra grows best in well drained, sandy loam soils high in organic matter. Poor draining and heavy clay soils will not produce good stands and can result in drowning of the plants (Sanders, 2001). Okra can be grown in slightly acidic to slightly alkaline soils, and can tolerate a soil pH from 6-8 (Hemphill, 2010). Highly acidic soils can result in poor pod development.

Planting

For establishment, okra can either be direct seeded or transplanted. Okra seeds should be sown one to two weeks after the danger of frost has passed, mid to late June in Colorado, and the minimum soil temperature is 60° F. Optimum soil temperature for planting seed is 75-90° F. For Colorado, this is likely somewhere around the first week of June. Germination time for okra seeds is 5-10 days and germination rates can be improved by soaking the seeds in water for 4-6 hours. Okra should be planted at a rate of 6-12 lbs of seed/acre. Seeds should be planted 1" deep with a 12-24" spacing between plants, depending on the cultivar, and 2-3' between the rows. For transplants, seeds should be sown 4-5 weeks before transplanting and should be planted outside at the same spacing as for direct seeding. (Hemphill, 2010) (Jauron, 2015)

Fertilization

Fertilizer recommendations are a generalization and it is recommended that a soil sample be taken prior to planting to understand your current soil fertility. For fertilization, apply a general 10-10-10 fertilizer at a rate of 1 to 2 pounds per 100 square feet of row space before planting. If necessary, side dress with nitrogen throughout the growing season and as harvest begins. Excessive nitrogen applications should be avoided, as they can produce excessive vegetative growth. (Hemphill, 2010) (Jauron, 2015)

Irrigation

For watering, okra requires a relatively low amount throughout its life. A deep soak every 7-10 days during dry conditions should be adequate, but climactic conditions should be considered. Adequate moisture is particularly important during flowering and pod development. Avoid excessive watering early on as this can cool the soil and stunt plant growth. (Hemphill, 2010) (Jauron, 2015)

Harvesting

Okra is ready to harvest in 80-90 days if planted from seed and 40-70 days if from transplant, depending on the cultivar. Pods are generally harvested when they are 2 to 3 inches long, and can be harvested up to 5 inches in length as long as they are still tender. Pods are ready to harvest around 4 to 7 days after the flower has opened. Older pods should be removed as they will become tough and fibrous and will hamper pod set and yield if left on the plant. Harvest should occur around 3 times per week, depending on vigor, to promote more flowering. Pods can either be broken off by hand or cut off with a knife, but workers should wear gloves and long sleeves to prevent rashes or allergic reactions from the spines. Average yields are

around 250 bushels per acre. (Andersen, 2013) (Hemphill, 2010) (Manning and Brainard, 2011) (Sanders, 2001)

Storage

Okra deteriorates very quickly after harvest and is typically only stored for very short periods. For fresh eating, okra should be used as soon as possible after picking. If the pods are in good condition they be stored for 7 to 10 days at 45-50° F and 90-95% relative humidity. Below 45° F, okra can be subject to chilling injury, resulting in discoloration and pitting. Fresh okra can be easily bruised and will blacken within a few hours. Containers for storage should allow good ventilation. Large amounts of okra are often frozen, canned, or pickled. (Hemphill, 2010) (Jauron, 2015) (Sanders, 2001)

Pests

Various beetles and worms, as well as aphids and nematodes are the most common pests of okra. Okra is especially susceptible to root-knot nematodes, so care to avoid infected soils is crucial. Aphids attack young leaves and developing flowers and fruit and can cause pods to become misshapen. Corn earworms can attack and burrow into the pods, but they are generally not a problem unless you are saving seed. Fire ants have been known to attack the flowers and pods at the base, causing losses of both. (Andersen, 2013)

Diseases

Depending on where you live, disease pressure for okra can change dramatically. Common diseases for okra include Southern stem blight and wilt, *Verticillium* wilt and *Fusarium*

wilt. Damping off of young seedling and transplants can also be a problem, especially when planting in soils that are too cold. (Andersen, 2013) (Sanders, 2001) (Swiader and Ware, 2002)

Popular Cultivars

- **‘Clemson Spineless’** - A uniform spineless variety with medium dark green, angular pods. It requires 55 to 58 days from seeding to maturity. Plants 5' tall, pods 5-6" long, large diameter, most commonly available variety. (Sanders, 2001) (Hemphill, 2010)
- **‘Emerald’** - A spineless variety with dark green, smooth, round pods. It requires 58 to 60 days from seeding to maturity. Plants 5' tall, pods to 8" long, small diameter. (Sanders, 2001) (Hemphill, 2010)
- **‘Lee’** - A spineless variety with deep bright green, very straight angular pods. The plant is a semi-dwarf type (Sanders, 2001).
- **‘Annie Oakley’** - A hybrid, spineless variety with bright green, angular pods. It requires 53 to 55 days from seeding to maturity (Sanders, 2001).
- **‘Prelude (PVP)’** - A new open pollinated, spineless variety with very dark glossy green fluted pods. It can be harvested when pods are $\frac{1}{2}$ to $\frac{3}{4}$ inches longer than other varieties and still remain tender. It requires 50 to 55 days from seed and generally yields better than Clemson (Sanders, 2001).
- **‘Red Okra’** - 55 to 65 days to harvest, 3 to 4' tall, bushy plants with 6 to 7" pods (Hemphill, 2010).
- **‘Blondy’** - 48-50 days to harvest, dwarf plant 3' high, spineless, ribbed, lime-green (Hemphill, 2010).
- **‘Perkins Mammoth Long Pod’** - 60 days to harvest, plants 6 to 10' tall, pods 7-8" long, intense green (Hemphill, 2010).

Conclusion

Okra's roots are steeped in a Southern tradition of hearty food and African influence dating back centuries. Although traditionally considered a "Southern-grown" crop, okra certainly has potential to be successfully grown in the northern and central regions of the United States. Okra's relatively short growing season and low water requirements seem suited for the warmer areas of Colorado, where summer temps soar and water can be very limiting.

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Cucumbers
Jacob Darville



Figure 1: A cucumber.

(Malyshchyts, 2015)

Cucumbers are delicious, and healthy for you. *Cucumis sativus*, the common cucumber, is a warm season crop. It is in the plant family *Cucurbits*; the reason why I chose the cucumber is because I think they are the tastiest out of the list that was given to me. What makes it a warm season crop is that the cucumber needs both warm soil and temperature to grow steadily. You will want to wait until the soil gets to at least 65°F, while the air can range from 60-90°F (Anon, 2006). Also, cucumbers do not grow on a woody plant, but a herbaceous one, so by the horticultural definition of a vegetable, cucumber is one. Another argument is that once vegetable products are harvested, the plant dies, the same goes for the cucumber (Tommies, 2015)!

The common cucumber is thought to have originated in northwest India. There is evidence of the plant being cultivated 3,000 years ago. The family also made it to Europe very early, and was grown everywhere by the 1700s. Cucumbers are usually sliced and put on salads, or pickled to make pickles (Burpee, 2016).

The main reason why cucumbers are important is because they are healthy for you. There are many different health benefits of eating cucumbers, for example, it helps protect your

brain. There are nutrients in cucumbers that help improve your memory and helps protect your nerve cells from aging. Another health benefit is that it helps prevent cancer, which include uterine, breast, prostate, and ovarian. The last health benefit that I would like to mention is it helps support your digestive health. Just by adding a couple slices of cucumbers to your salad, you can meet your daily fiber intake, which can aid in digestion.

Growing cucumbers is not hard at all, and you can yield a lot, on average 10 6-ounce cucumbers (Allman, 2010). First off, you are going to want to test the pH of the soil to see where it is at. The sweet spot for cucumbers is at 6.8 pH. If the pH is not around there, add what is needed to get it there like some compost. The cucumbers are also going to need a lot of sunlight, so make sure to place them in the open. Once they are planted, they are going to need to be watered a lot as they are heavy feeders. Just make sure the soil stays evenly moist and they should grow. Drip irrigation is ideal, but not required. Once the cucumber plant begins to blossom, one should add a little soluble fertilizer to the patch. Another thing to keep in mind is to try and grow your cucumbers vertically. This will increase your yield, and prevent all the vines from the plant going into the rest of the garden. The best time to harvest would have to be when they are still young, and the seeds are still not fully developed. This will usually be between the cucumber being 6-8 inches long. Harvest in the morning before sunrise for best taste and texture. If you keep harvesting just the mature ones, the plant will keep producing more until the frost comes. Cucumbers do not store well, they will last about a week in a vegetable drawer in a fridge (Burpee, 2016).

There are a lot of health benefits of cucumbers, but there are also some cool facts about them too. Cucumbers can actually cool your internal temperature, hence where the phrase “cool as a cucumber” came from. Cucumbers can also kill bad breathe if you put a slice on the roof of

your mouth for 30 seconds. If someone really wanted to, they could replace their multi-vitamin pill with a cucumber (Hullen, 2013). Also, there is a little trick that you can do by wiping a slice of cucumber on your bathroom mirror, and it will not fog up while taking your shower. You can also use the outside wax coating of the vegetable to erase ink! These are just some random, interesting facts about cucumbers (Mercola, 2014).

There are many ongoing scientific research experiments going on right now that have to do with cucumbers. In this one report, these people are trying to find resistant proteins in cucumbers to the *Sphaerotheca fuliginea* (Sf) disease. As you can see in Figure 2, this disease looks like a powdery mildew and it affects the development and taste of cucumbers. These people did a bunch of different tests by pulling sister lines of a specific protein, and infecting it with the disease. They would keep doing this until they got enough data to come to conclusions. In the end, they found out that there are about 20 proteins in cucumbers that can fight this disease; their solution, if you increase the metabolism of the plant, these specific proteins will increase, thus making it more resistant. This is just one of many ongoing research experiments going on with cucumbers (Fan et al., 2014).



Figure 2: *Sphaerotheca fuliginea* on a cucumber leaf

(Clemson University, 2013)

In all, cucumbers are important for a few reasons. First, they are very easy to grow and can yield high yields, they can grow anywhere with sun and water, and they have a bunch of different health benefits. There is still many ongoing research with cucumbers, and I am interested to see what the results are. Between all the fun facts and science research that goes on with cucumbers, there is always something to learn about them.

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Figure 1. A mature Japanese long cucumber ready for harvest.
(Anonymous, 2016)

Japanese Long Cucumber

Jared Davis

Cucumbers are both aesthetically pleasing and delicious to consume on a summer evening accompanied with some sort of protein. Japanese long cucumbers are similar to English cucumbers with the exception that they have prickly skin. Cucumbers thrive in hot temperatures averaging between 65 to 75°F (Swiader and Ware, 2002), and as long as sufficient irrigation meets the plant's requirements this is what makes cucumbers a warm season crop. Young plants can be easily damaged by frost; 82 degrees Fahrenheit is the ideal growing temperature for cucumbers (Swiader and Ware, 2002). This will ensure that seeds have an optimal opportunity to reach conditions favorable to encourage germination. This also makes cucumbers a great crop to cultivate in Colorado. Cucumbers are a horticultural crop because it is a crop that can be enjoyed with minimal processing. A vegetable is a crop that is eaten either cooked or raw as part of the main meal (Uchanski, 2016). Cucumbers fulfill this definition and are therefore classified as a vegetable.

The Japanese long cucumber in the family Cucurbitaceae, *Cucumis sativus*, is a very popular crop to consume in Japan. It is a very productive crop with very dark green prickly skin and a firm consistency. The prickly skin of the vegetable is typically removed. What remains for the consumer is a succulent, fresh, and hydrating edible flesh that can be enjoyed raw. Adding some flavor to this already popular vegetable can be achieved by mixing white wine vinegar with sour cream together, then add the prepared cucumber to the mixture and stir it around a little to combine it all. To top it off add some smoked paprika, and this will freshen the dish, acting as a base to a spicy/acidic accompaniment.

Japanese long cucumbers are burpless meaning they are milder in taste and can be genetically bitter free (Wehner, 2000). Plants can grow to be six feet long with many blooms

making it extremely productive. The plant requires 60-75 days to reach maturity. This cultivar, *Cucumis sativus*, thrives through trellising. This action requires the vines to climb upwards allowing for fruiting bodies to hang and use gravity to its advantage to stretch the vegetable downwards to reach maximum length (Figure 2). Mature fruit can grow up to eighteen inches in length with a slight curl at the base. This crop stood out to me because I have always enjoyed eating cucumbers in general, but the lengths that the Japanese long variety can achieve are impressive. This variety is important because it can be used in culinary environments to replace any cucumber and achieve the same desired results. The Japanese Long cucumber is currently used in multiple California restaurants such as Sushi Ota, Half Door Brewing, and La Costa Resort & Spa Main Kitchen. These cucumbers are being used both casually and professionally to match flavors in the kitchen to stimulate the consumer's pallet. At its origin, the cucumbers were pickled and preserved to feed communities throughout the year.



Figure 2. Cucumbers climbing on the screen with fruit hanging downwards. (Andrychowicz, 2016).

According to Specialty Produce, cucumbers are derived from the wild cucumber, *Cucumis hardwickii*, which is native to the foothills of the Himalayas (2016). The first cultivar was domesticated in ancient Egypt and in areas surrounding the Fertile Crescent. Typically, growers use a rotation which include cucumbers, lettuce, and tomatoes. This helps aid in the disturbance of life cycles of disease such as angular leaf spot (Figure 3). As



Figure 3. A cucumber plant infested with angular leaf spot showing symptoms of chlorosis and necrosis on the leaf tissue. (Everts, 2013).

far as marketing goes, avoid trying to sell cucumbers that appear structurally jeopardized or chlorotic. During harvest it is important to handle the fruit with extreme care to prevent any biotic damage to the flesh. If the flesh is damaged, then this opens the door for abiotic damage to ensue as well. It is also important to consider the desired size when harvesting cucumbers. Cucumber fruits mature very quickly in warm weather and can have a 40 percent increase in weight in 24 hours (Swiader and Ware, 2002). Storage recommendations after harvest suggest that individual vegetables be unwashed and placed in a perforated plastic bag and stored in a refrigerator (Laurel and Aldridge, 2012). This will prevent conditions that are favorable for pathogens to infest and give the producer a greater yield.

The Japanese long cucumber cultivar can be purchased at the following website: <http://whiteharvestseed.com/japanese-long-cucumber.html>. Make sure to place your order sooner rather than later because this cultivar tends to be in high demand and seeds tend to sell out. The Japanese long cucumber can be a fun crop to experiment with. It would be interesting to conduct taste tests with other cultivars to determine preferable characteristics. Also, witnessing the differences in growth and nutrient requirements would be fascinating to note. Although these would not be ideal for pickling, they can mature to an impressive 18 inches and used as a unique talking point at garden parties or a wonderful gift to a neighbor. Cucumbers are an amazing warm season crop to produce and offer an immense amount of different ways to be consumed. The cultivar *Cucumis sativus* has amazing potential to be a high demand cultivar if it is managed and maintained with the care it deserves.

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Okra: Origins to Modern Cultivation

Mike DiLegge

Okra is a warm season, tall growing annual from the family Malvaceae, the mallow family, and is also known as *Abelmoschus esculentus*. Okra also has another common name; 'Ladies fingers'. *Abelmoschus* is a genus of tropical coarse herbs that have large, lobed leaves and often-yellow flowers (wordnik, n.d.). The specific epithet *esculentus* is the Latin word for edible (Hollinger, n.d.). Okra is a tropical plant that grows best in warm climates; the pods grow rapidly and can be available after just 60 days of summer weather. In fact, even storing the pods in temperatures below 45 degrees F can be damaging (Nolte, n.d.). The plant has origins dating back to Africa, in what was called the Abyssinaian center of origins of cultivated plants by geobotanists (Aggie H., n.d.). This area includes present day Ethiopia, the mountainous or plateau portion of Eritrea, and the eastern, high altitude part of Anglo-Egyptian Sudan (Aggie H., n.d.). It is documented that the region where okra originated had little contact with the rest of the world during this historic time, due to very little documented data, and conflicting centers of origins. It is inferred that okra was introduced to Arabia from Ethiopia, and then spread around the Mediterranean. Although commonly grown in modern times in India, the absence of any ancient Indian names for okra suggests it reached India after the beginning of the Christian era (Aggie H., n.d.). One of the earliest records of the species was written by a Spanish Moor visiting Egypt in 1216. The plant was described in detail, as the Egyptians cultivated it regularly. The man stated that the Egyptians ate the young pods of the okra plant with a type of meal.

The species is technically a perennial, but is often cultivated annually in temperate climates. The leaves can get from 10-20cm long, and are broad with a palmately lobed structure. One species is even cultivated for its edible leaves. The flowers have five white to yellow petals, and can range from 4-8cm in diameter. When the flower becomes fertilized, the plant bears a capsule like fruit up to 18cm long, and has a pentagonal cross section containing numerous seeds. (Figure 1)



Figure 1: A Cross section of an Okra Pod

<https://en.wikipedia.org/wiki/Okra>

When cultivated commercially, the seeds are soaked over night and then planted about 1-2cm in the ground. Germination can take from six days to three weeks, depending on the scarification/stratification techniques (if any) used by the grower. In harvesting, the seedpods must be collected within a week of the fruit having been pollinated, due to the fact that as the seedpods mature, they rapidly become fibrous and woody and become inedible.

Okra can be cultivated in two varieties, green and red (Figure 2); the two pods only differ in color, as they contain the same flavor. Something unusual about the red seedpod is that, when cooked, the pods turn green due to a reaction caused by the heat. I chose to write about okra because of its health benefits, and the fact that it is a very unique “southern delicacy”. Within the seedpod, the plant contains a good source of vitamin C, A, and B complexes, iron and calcium (Foodreference.com, n.d.). According to Nutrition-And-You.com, the pods are composed of flavonoid

anti-oxidants such as *beta-carotene*, *xanthin* and *lutein*. Okra is said to be one of the few vegetables with the highest levels of these antioxidants.

In the Southern US, Okra is used in Creole and Cajun Cuisine. “The pods, when cut, exude a mucilaginous juice that is used to thicken stews (especially gumbo), and have a flavor somewhat like a cross between asparagus and eggplant.”

(Nolte, n.d.). If not used in soups or stews, Okra is



Figure 2:Photo of Red Okra Pod
(Kochhar, 2010)

<http://www.neurophys.wisc.edu/ravi/okra/>

often sliced thinly and fried with meal. Most Americans consider okra too “goosey” or mucilaginous to suit their tastes. However, in recent years, “it has become an important commercial crop in certain localities in the South, where tons of

thousands of the pods are grown for the large soup companies.” (Aggie H., n.d.).

Okra is also often dried for later use, much like an herb or spice. According to Aggie Horticulture, in eastern countries, the seeds are valued more than the young pods.

Within Mediterranean countries, the ripe seeds yield oil that is the equal of many other cooking oils, and is of no rarity in the pantry. Some people will even ground the dried seeds and use them as a substitute for coffee! In Turkey, the leaves are used in preparing a medicament to soothe or reduce inflammation (Aggie H, n.d.).

The plant can also be used industrially to make rope and paper, as it full of bast fibers. As stated above, once matured, the plant pods become woody and fibrous. These fibers are harvested and repurposed to be woven to be used commercially.

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Lambs Quarters: Weed or Oft Overlooked Food Source?

By Jessica Edmondson



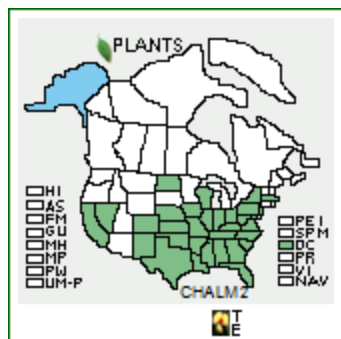
Figure 1. Lambs Quarters (Cornell University, 2015)

Described by Linnaeus in 1753, *Chenopodium album*, or common lambs quarters tends to grow upright at first, reaching heights of ten to one hundred fifty centimeters (rarely to 3 meters), but typically becomes recumbent after flowering, due to the weight of the foliage and seeds, unless supported by other plants. The leaves are alternate and varied in appearance. The first leaves, near the base of the plant, are toothed and roughly diamond-shaped, three to seven centimeters long and three to six centimeters broad. The leaves on the upper part of the flowering stems are entire and lanceolate-rhomboid (shaped like a lance head, long and narrow though wider at the base), one to five centimeters long and zero point four to two centimeters broad. The leaves are waxy-coated, unwettable and mealy in appearance, with a characteristic whitish coat. The small, inconspicuous flowers are radially symmetrical and grow in small cymes on a dense branched inflorescence ten to forty centimeters long. (Anonymous, 2016) The fruit is a small black seed enclosed in a dry greenish covering, which adheres very closely (Wooton, 1894).

The origin of *Chenopodium album*, Family Chenopodiaceae, is obscure due to extensive cultivation around the world. Currently, it is cultivated as a grain or vegetable crop as well as an animal feed in Asia and Africa, but generally regarded as a weed in Europe and North America, with some exceptions. (Anonymous, 2016)

The United States Department of Agriculture Natural Resources Conservation Service shows the variety *missouriensis* (Missouri lambs quarters) to be native to New Mexico and Colorado, the variety *striatum* (Lateflowering Goosefoot) to also be native to

Colorado, and the variety *album* (Common Lambs Quarters) to be introduced throughout the United States. (USDA NRCS, nd)



Native Range of *Chenopodium album* var. *missouriensis*

(USDA NRCS, nd)

When cooked as “greens” the plant is fondly called by its Mexican name, *Calites*, throughout the American Southwest and Mexico (Wooton, 1894). The young leaves are gathered and cooked as greens by most of the Pueblo Indians of the Rio Grande Valley, as well as the Zuni, the Mescalero Apache, and the Spanish Americans (Castetter, 1935).

“On a dark desert highway, cool wind in my hair // Warm smell of colitas, rising up through the air” Eagles. Hotel California.

The USDA nutritional analysis for *Calites* shows 43 Calories per one hundred grams or 3.5 ounces, 7.3g Carbohydrates, 4g Fiber, and 4.2g Protein. 73% of Vitamin A, 96% of Vitamin C, and 366% of Calcium. Cooked as a pot herb, served during the main part of the meal, and composed of the vegetative portion of the plant, *Calites* is a vegetable dish. Per the author’s experience, *Calites* is traditionally prepared by placing fresh or dried lambs quarters into a pot, covering with water, and bringing to a boil. Stir to ensure the leaves are covered with water, cover the pot, and simmer about 15 minutes. Pour the pot into a colander and rinse the greens, strain. Meanwhile, in a large skillet, sauté minced onion and garlic in butter or bacon fat. When the onion is translucent, add the cooked greens and salt to taste. Sauté an additional 10 minutes or until done. While nutritious and delicious, the dish should be eaten in moderation given the high levels of oxalic acid, nitrates, and saponins in lambs quarters, though these are mostly removed by cooking and pouring off the water (Cornell University, 2015).

The young plant leaves may be harvested and eaten fresh, but the plant can be eaten from early growth to after seed, as long as the leaves do not begin to dry out on the plant. To use fresh, simply strip the leaves from the plant and cook. To store, dry the leaves by spreading the plants or stripped leaves on trays or a tarp in the shade and turn twice daily until the leaves are dry and brittle. Store in food grade buckets or glass jars. (Hardin, 2008)

Lambs quarters will spread if allowed as it produces an abundance of seed (Wooton, 1894). The plant is well known to be weedy or invasive (Southern Weed Science Society, 1998) but can serve as a useful trap crop as a companion plant to trap leaf miners. However, it also acts as a host plant for the beet leafhopper, an insect which transmits curly top virus to beet crops. (Anonymous, 2016)

Traditionally foraged from wild plants, there are now cultivated varieties that can be grown specifically as a food crop, including Lambsquarter Magenta Spreen, *Chenopodium gigantea*. Direct seed in the garden after the last spring frost in succession every three weeks for continuous harvest. Optimum germination occurs in soils from 55°-70°F. For best results, sow seeds thickly, about one inch apart, 1/8th to 1/4-inch deep, in 4-inch wide bands allowing 6-8 inches between rows. Magenta Spreen is frost sensitive, but tolerates summer heat. This cultivar is an heirloom, open-pollinated, hardy, re-seeding annual. It is easy to grow in full sun to partial shade, requiring moderate water. Seeds germinate in 3-7 days and there are thirty days until harvest. (Seeds of Change, nd)



Figure 2. Lambsquarter Magenta Spreen (Seeds of Change, nd). This cultivar is unique, displaying lilac purple and magenta color on the leaves.

In addition to a food crop, *Chenopodium album* has traditionally been used medicinally as an anthelmintic, antioxidant, antibacterial, and anti-ulcer agent among other uses. Recently, some of these traditional uses have been supported by scientific testing. Jabbar et al. 2007 tested *Chenopodium album* against trichostrongylid nematodes in sheep and found the plant to exhibit dose and time-dependent anthelmintic effects, causing mortality of adult worms and inhibiting egg hatching. Jain and Singhai (2012) found an ethanol extract of *Chenopodium album* to have significant hepatoprotective properties and showed significant free radical scavenging activity. Singh, Dwevedi, and Dhakre (2011) showed antibacterial activity against five common human bacterial pathogens, including *Salmonella typhimurium*, *Staphylococcus aureus*, *Proteus vulgaris*, and *Pseudomonas aeruginosa*. *Chenopodium album* was even found to

prevent the progression of cell growth in human breast cancer cells (Khoobchandani et al. 2009).

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Tomato Selections and Culture for the Home Gardener

Bryan Fischer
Warm Season Veg. Production
September 14, 2016

Origins of the Tomato in the Home Garden:

The common garden tomato is a plant that has suffered a longstanding identity crisis. Originally domesticated around 2,000 years ago from wild, perennial, vining plants in the Andes mountains of South America and the jungles of Mexico, the tomato has been bred into a dizzying array of diversity and been met with worldwide enthusiasm over the past few centuries – it is now one of the most popular horticultural crops available. (Bai and Lindhout, 2007)

Referred to as a “love apple” upon its introduction to Europe in the mid-1500s, the plant is not an apple at all, as it actually belongs to the family Solanaceae (the nightshades) (Illinois Extension, 2016). Only deepening the issue is the fact that Europeans believed the tomato to be poisonous for decades. Likely, this is the result of their classification of the crop as a nightshade, a grouping which includes poisonous plants such as mandrake and deadly nightshade (Bai and Lindhout, 2007).

While these Europeans weren’t entirely wrong (the plant’s foliage contains the toxic alkaloids tomatine and solanine), the fruits are entirely safe to eat (Hessayon, 2001). Here can be found yet another feature of the tomato that has proven a point of confusion – the tomatoes themselves. While the tomato is used as a vegetable in the kitchen, it is actually considered a fruit botanically (Hessayon,

2001). Luckily for the home gardener, growing this fruit is much easier than its misunderstood history might suggest.

Tomato Culture and Use:

Tomato is classified as a “warm season crop”. This refers to the fact that it is a crop that grows best when average temperatures remain above 70 degrees F (University of Illinois Ext, 2016). It is also important to note that tomato is considered a “tender” crop, or a crop that will be damaged or killed by frost (temperatures under 32 degrees F) (Univ. of Illinois Ext., 2016). Tomatoes are vigorous plants as long as the weather remains warm and will require fertile soils and ample water to perform well (Hessayon, 2001).

At present, tomatoes are grown both in field and in greenhouse. Specialty cultivars have been bred that perform best in each of these situations in addition to the dozens of heirloom cultivars (history of cultivation for 50+ years) already in existence (Uchanski, 2016). Tomato plants grow with 1 of 2 general habits – determinate (d) or indeterminate (i). Determinate plants, developed relatively recently to reduce the need for staking tomato plants, grow 1-3 feet before stopping (Hessayon, 2001). Determinate plants begin to ripen most of their fruit in a flush once they slow their vertical growth (Illinois Ext., 2016). Indeterminate cultivars will grow steadily all season long and typically ripen their fruits at a more steady pace but will require staking to support their 6+ feet of aerial growth (Illinois Ext., 2016).

Tomatoes are used both fresh and processed. Fresh tomatoes rank as 4th among the most consumed fresh vegetables, generally sliced onto sandwiches and salads (Hodan, Bond, 2016). When one considers that processed tomatoes make up the majority of tomatoes consumed in the American diet, this ranking only becomes more impressive (Hodan, Bond, 2016). Here, processed tomatoes take shape in canned tomatoes, as well as tomato pastes, sauces, and stews. The US per capita consumption of tomato in 2015 was over 17.5 lbs annually, and rising (Hodan, Bond, 2016).

Tomato Fruit Classifications and Notable Cultivars:

Tomato fruits exhibit a variety of flavors, colors, shapes and sizes. At present, tomato cultivars exist as open pollinated (freely pollinating within the cultivar's population), heirloom (open pollinated with a 50+ year history of cultivation), and hybrid (specific, hand selected crosses between specially maintained parent lines). This distinction is relevant to the home gardener for two reasons: 1) while seeds can be saved from open pollinated varieties with a sufficient number of individuals, seeds cannot be saved from hybrid cultivars as they offspring of these plants will not remain true to cultivar, and (2) hybrid cultivars generally exhibit a greater degree of natural vigor and disease resistance than open pollinated varieties. Home gardeners should consider if either of these factors could make or break cultivar options for them. If neither is a primary factor, cultivar selection can be made off of the following tomato type and cultivar selection set.

For the sake of simplicity, these fruits are classified by shape and size into categories listed below:

Slicer

Paste



Cherry (center, red)

Beefsteak

Figure 1, above: A variety of tomato cultivars demonstrating the diversity of fruit shape, color and size available to the home gardener.

Cherry – The smallest of cultivated tomatoes, these fruits average .5 in to 1 in across.

They are used almost entirely for fresh eating and are generally grown in home gardens where their quick ripening, flavorful fruits are worth the extra picking.

(Hessayon, 2001)

‘Sungold’ – One of the most popular fresh eating tomatoes on the market today. ‘Sungold’ tomatoes ship poorly but the variety become well known

thanks to its sweet, tangy, low acid fruits and its excellent vigor and disease resistance. 65 DTM. (Burpee, 2016)

‘Gardener’s Delight’ – A German heirloom that has stood the test of time, this plant produces larger, red cherry tomatoes. 65 DTM. (Rutgers, 2016)

‘Super Sweet 100’ – In addition to producing massive numbers of small, sweet, red fruits, ‘Super Sweet 100’ has excellent vigor and resistance to verticillium and fusarium wilts. 70 DTM. (Burpee, 2016)

Plum, Paste, and Roma – These three groupings of tomatoes all exhibit an oblong shape and generally have thick “meaty” walls capable of holding up to cooking and fruits with few seeds. As a result, they are the varieties preferred for processing into sauces and pastes. Though less flavorful when compared to other tomato types, their superb processing qualities compensate if fresh eating is not desired. (Hessayon, 2001)

‘San Marzano’ – Considered by many chefs and home growers to be the premiere paste tomato. ‘San Marzano’ is an old Italian heirloom capable of producing large quantities of thick walled, red fruits. 80 DTM.

‘Amish Paste’ – These heirloom plants produce large, intensely flavored paste tomatoes. 85 DTM.

Slicing – Slicing tomatoes represent the embodiment of the classic garden tomato. Juicy, flavorful, and tender, the fruits need no further introduction. A plethora of heirloom and hybrid cultivars exist for the home gardener and commercial grower alike. (Hessayon, 2001)

‘Early Girl’ – A red slicing hybrid. Early girl produces heavy yields of moderate sized tomatoes and does so earlier than almost any other slicer. 60 DTM. (Burpee, 2016)

‘Jaunne Flamme’ – Small by slicer standards these French heirloom “saladette” tomatoes are renowned for a delicious, balanced flavor. ‘Jaunne Flamme’ plants are vigorous and bear fruit earlier than most slicers. 70 DTM. (Burpee, 2016)

‘Black Krim’ – Crimson and darker fruits that hold exceptional flavor. Prone to cracking if watering is uneven. 80 DTM. (Rutgers, 2016)

Beefsteak – The largest tomatoes available are generally classified here. With fewer seeds than classic slicers, but more than pastes, these tomatoes have a sturdy, meaty flesh that is preferred for use in sandwiches and on burgers. Beefsteak fruits can be slower to ripen than other types in the garden due to their large size and may be unreliable in areas with shorter summers. (Hessayon, 2001)

‘Brandywine’ – The tomato credited with starting the heirloom movement.

‘Brandywine’ is often considered the standard by which the flavor of garden tomatoes is judged. Brandywine is prone to cracking and catfacing (scarring on bottom of fruit). 85 DTM. (Burpee, 2016)

‘Cherokee Purple’ – One of the most flavorful tomatoes on the market today.

‘Cherokee purple’s’ mahogany fruits are borne on shorter, more manageable vines than most indeterminate tomatoes. 85 DTM. (Burpee, 2016)

While initially received with skepticism, the tomato has become one of the most popular home garden vegetables. Considering the plethora of tomato types and cultivars available, this is no surprise. Gardeners in nearly every part of the nation have a number of suitable varieties for their locale, and efforts remain underway to further improve and adapt the crop to cultivation. As long as care is taken to meet this warm season crop’s needs, including good soil moisture and drainage, high soil fertility, and a frost free growing window of 80+ days, tomatoes will perform admirably for nearly all gardeners.

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Okra: *Abelmoschus esculentus*

Kyle Fischer

Introduction:

Okra, or *A. esculentus*, is a flowering plant in the Malvaceae family and can be classified as both a fruit and a vegetable. If classified botanically okra is a fruit because it contains seeds and comes from the plant's ovary; however, okra is treated as a vegetable in the kitchen much like green beans and cucumbers. Okra is considered to be a warm season vegetable because it grows best in sub-tropical, tropical, and warm temperate weather conditions between 70-85° F, especially in places with warm nights. (Lloyd, 2008)



Figure 1: Okra Pods are harvested for use when are green, tender, and still at an immature stage (Joana, 2015).

Background Knowledge:

Okra is fairly easy to grow regarding soil conditions because it can grow well in almost any. The one type of soil okra struggles in is waterlogged soil; most problems in okra plants arise from soil that's kept too wet. From a nutritional standpoint okra is

actually very healthy! Okra is fat free, cholesterol free, very low in sodium, low in calories, an excellent source of vitamin C and A, and it is also good source of folate, magnesium and fiber. Although not an essential crop in America, okra is extremely healthy and is known to help manage diabetes. (Watson, 2016)

History and Uses:

The best records of okra can trace it to Asiatic origin, the most likely places being Ethiopia and the Upper regions of Sudan. The oldest record of the vegetable dates back to 12th century Egypt, meaning it most likely came to America during the African slave trade. (Swaider & Ware, 2012)



Figure 2: Shaded in gray on the above map are regions where traces of the okra plant's origins have been found.

(Anonymous)

The plants edible portion are the immature pods it produces, the pods can be fried or boiled and served by themselves, or often times they are cut up and cooked into soups and stews. The commonly heard name gumbo comes from the flavor and glutinous consistency that the vegetable imparts on soups. (Swaider & Ware, 2012)

Planting From Seed:

As mentioned before, the soil requirements for okra are fairly lenient. As long as the soil is well drained, not waterlogged, and warm enough okra can grow extremely well. As soon as the soil temperature goes above 70-75°F, and frost is no longer present, the seeds can be directly seeded into the field. Seeds should be planted approximately 1-1½ inches deep and between 12-18 inches apart. [Tip: Soak seeds in tepid water (110°F) overnight before planting to help speed up germination.] Plant seeds in an area with the most sunlight possible, okra requires full sunlight and the appropriate amount of water to thrive. Typically okra requires 1-1/2 inches of rain per week to produce large beautiful pods; however, okra could stay alive with less water if needed (Khan, 2013). If planting in plots multiple rows wide be sure to space rows 3-4 feet apart as the plants grow upright to between 3 and 7 feet tall and need space to spread out. In most areas moderate rainfall is sufficient enough to water this crop, but in drier areas with less rainfall additional irrigation may be needed. [Tip: Colorado is one of the areas that would require additional irrigation because of the extremely dry air.] In addition to varying water requirements, the fertilization requirements also vary with soil types; however, for most garden soils, 500 to 1,000 pounds of 5-10-5 fertilizer per acre should produce good yields (Swaidar & Ware, 2012).

Cultivation and Cultivars:

Cultivars of okra can be classified and separated a few different ways. The most common classification is by the height of the plant: dwarf, intermediate, or tall. Other classifications include pod length, pods with or without spines, smooth or ridged pods,

and pod color. Once plants are established, they are thinned according to the different cultivars. Dwarf cultivars are thinned so they're 12 inches apart, and larger cultivars are 18-24 inches apart.

Pests and Diseases:

Okra is susceptible to some of the same various insects and diseases that are found in cotton plants. Cotton bollworms, cotton aphids, stinkbugs, nematodes, and corn earworm are a few pests okra is prone to being invaded by. Along with pest issues, okra's disease problems are mostly common diseases such as *Pythium*, *Phytophthora*, *Fusarium*, *Cercospora*, Verticillium wilt, and *Rhizoctonia*. [Note: Although okra is as equally susceptible to disease as most other plants, under extremely wet soil conditions okra is especially prone to disease.]

Okra Facts:

1. Nutrition

Myth: Cooking okra increases some of its nutritional benefits.

Fact: One hundred grams of raw okra contains about 3.2 grams of fiber, while boiled okra contains about 2.5 grams of fiber. Raw okra also has more protein. One hundred grams of raw okra has 2 grams of protein, while boiling it reduces it to 1.87 grams and 1.69 grams by freezing it (Khan- 2013).

2. Preparation

Myth: Wash and cut okra thoroughly before you prepare it.

Fact: Don't wash okra until ready to use, or it will become slimy. When preparing, remember that the more it's cut, the slimier it will become (Khan- 2013).

Whenever growing okra it is important to keep a few things in mind: space, sunlight, and soil! Full sunlight, a lot of space for each plant, and decently fertile and wet soil are all that's required to grow okra well. Although not hugely popular in the United States, okra is a great plant to add to the garden or fridge of any interested consumer!

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Melons

Katie Gaudreau

Melons come in many different shapes, sizes, and colors. Melons are refreshing, sweet, and the perfect addition to any hot summer day. Melons are packed with nutrients and provide many health benefits. Botanically melons are a fruit, but they are often grouped within vegetable production. This is because melons are members of the gourd family, Cucurbitaceae. The Cucurbit family contains vegetables like pumpkin, squash, and cucumber. All of these crops grow on a vine. There are numerous types of melons, with the principal ones being muskmelons, watermelons, and honeydews.⁵ Some other types of melons are: cantaloupes, casabas, and crenshaws.⁵ Figure 1 shows an illustration of various types of melons.

Melons provide a great sources of vitamin C.⁶ Melons also contain phytonutrients called carotenoids, which are responsible for the red, yellow, and orange color of fruits and vegetables.⁶ Red watermelons contain lycopene, which is also a carotenoid. Carotenoids act as an antioxidant in the body and help reduce inflammation.⁶ Melons are a warm-season crop. They require warm temperatures for successful growth and are sensitive to cold temperatures. Warm-season crops perform best between temperatures of 65-86 degrees Fahrenheit, and melons grow best in the upper portion of that range. *Cucumis melo* is the species of all melons, except watermelons. Watermelons, on the other hand, are part of a different species, *Citrullus lanatus*. There are two groups of melons worth noting included in the species *Cucumis melo*: Reticulatus and Inodorus. The Reticulatus group refers to melons with a net-like pattern on the skin of the fruit.⁵ The Latin word *reticulum* means “small net”. These melons have orange flesh and the stem separates from the fruit when full maturity is reached.⁵ They also produce a

fragrant smell when ripe. Inodorus melons have white or green flesh, smooth skin, and the stem of this group does not separate from the fruit when full maturity is reached.⁵ This group of melons does not produce a fragrant smell when ripe. *Inodorus* means “unscented” in Latin.

Melons have been domesticated and cultivated for over 4,000 years.⁴ The center of origin can be traced back to Africa and Asia, but the exact center of origin is still debated.⁴ Watermelon seeds and paintings have been discovered in Egyptian tombs that are dated more than 4,000 years old.⁴ Because melons have been cultivated for so long, there are many different cultivars that are grown and produced today, however they all require similar growing environments for success. Commercially melons are produced in warm climates with long growing seasons, but many types of melons can be found in home gardens throughout the U.S.⁵ In Colorado, melons are most productive at elevations below 5,000 feet.¹

The quality of a melon is determined by the sugar content of the fruit.² High sugar content is achieved by avoiding plant stress throughout the growing season.² Common plant stress for melons include: foliar disease, insect pest, weeds, improper watering, and poor nutrition.² Because melons grow on vines they need a lot of space to spread out. If not given enough space fruit yields will be reduced. Plan on giving your melons space, with at least 6 feet to grow and spread out.² Melons grow best in full-sun and well-drained, sandy loam soils.² Be mindful when selecting a site to grow melons to ensure the best growth and establishment possible. In addition to space requirements, melons grow best in soils with a pH level between 6.0 and 6.5.² If your soil has not been tested for nutrients, apply 1 pound of nitrogen per 1,000 square feet.¹ The addition of manure or compost is beneficial for vine crops and also improves soil structure.²

Watermelons and muskmelons require an 80 to 95 day growing season.¹ Plant your melon seeds or transplant seedlings outside once soil temperatures have reached 60 degrees Fahrenheit recorded at a soil depth of 2 inches, and a week after the average last spring frost date for your area.¹ You can get a jump start on your melon growing season by starting seeds indoors 2-4 weeks before the average last spring frost date. Please take note that Cucurbits are known to have sensitive root systems that do not tolerate disturbance. It is best to transplant seedlings when they are smaller to mitigate the risk of disturbing the root system. Significant root damage can create plant stress and delay growth and establishment of your melon crop. Some literature may suggest using a biodegradable container for starting seedlings that can be transplanted directly into the soil to help alleviate root disturbance.² Be careful in doing so as biodegradable containers and other materials may not break down fast enough in the soil creating a barrier and not allowing roots to expand throughout the soil. Also, when planting your seeds or seedling transplants, it is recommended to plant them in a mound of soil. This is to help with water drainage. The use of plastic mulch in melon production can help assist with faster growth and establishment. Melons perform best under hot conditions, and the use of plastic mulches aide in warming the soils quickly, not to mention reduce weed competition and retain moisture in the soil. If you do not have a very long window for growing melons in your area, consider starting seeds indoors early for seedling transplants and also utilizing plastic mulch.

Once you have planted and melons are starting to establish they will require 1 to 1.5 inches of water each week.¹ Warmer temperature may warrant more water for your crops. Pay attention to your melon crop to determine if they are experiencing any water related stress

during dry and hot periods. For all members of the Cucurbit family it is best to water with drip irrigation, if possible, and to avoid any watering with overhead spray. Overhead spray can cause the spread of plant pathogens and be stressful to your crop. It is normal for plants to lose turgor pressure and look wilted during hot, dry days; however, if they look wilted in the morning that is a sign of water stress, and you should give your crop a nice deep watering. Watering crops can be challenging, both over and under watering will cause plant stress. The best rule of thumb is to water infrequently and deeply.

A melon's rind and skin do a very good job of protecting the delicious, fleshy fruit within the melon, and that can make it difficult to determine when your fruit is ready to be harvested. With muskmelons it is pretty straight forward. They will become fragrant and the stem should slip away from the fruit very easily. If the stem does not come away easily that is a sign that your fruit is not ripe nor ready for harvesting. Do not wait for the melon to separate from the vine on its own.² Also, muskmelon's skin will turn from green to yellow. Identifying ripe watermelons and honeydews can be more challenging, as most of these fruit types do not slip from the vine.² For harvesting watermelons, a thumping technique can be used. A dull sound indicates ripe and ringing sound indicates not ripe.¹ Remember, the quality of a melon is determined by its sugar content and once harvested the melon will no longer produce sugar, but it will continue to ripen and become soft.

Melons can be enjoyed fresh when ripe, eaten alone or prepared in a fresh salad or blended as a cold soup. Melons are great because, after harvesting, if stored at correct temperatures, they can last for a couple of weeks.³ Many cultivars of melons are available today, and their flavors can range in sweetness. The length of days from planting to harvest can

also vary between cultivars, so be sure to find a melon crop that will work for you in your growing environment. Here are some heirloom varieties that will add a sweet and juicy treat to your summer garden in Colorado: ‘Cream of Saskatchewan’, ‘Blacktail Mountain’, ‘Moon and Stars’, ‘Eden’s Gem’, ‘Collective Farm Woman’, ‘Ha’Ogen’, ‘Charantais’, and ‘Amorillo Oro’.



Figure 1.³

Illustration: Keith Ward

Various melons, left to right: watermelon, honeydew, crenshaw, muskmelon, & bitter melon.

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Warm season crop

Cantaloupe

Harley Gifford

Figure 1. Cantaloupes in the field ready for harvest.



Photo: <http://www.freshplaza.com/article/153008> 1

Introduction

Cantaloupe (*Cucumis melo*) is a warm season crop grown and relished for its sweet, juicy, and vibrant orange-pink flesh. It is extremely susceptible to cold weather, and is therefore grown in warm regions with long growing seasons. Although mostly thought of as a fruit, since cantaloupe is grown from seed, harvested, and then removed from the field like other vegetables, it is considered a vegetable from a food crop perspective. Botanically speaking, it is a flowering

annual that grows vines and has a fibrous root system. It is in the gourd family, Cucurbitaceae, which houses most species of squashes and melons including pumpkins, zucchini, and cucumbers.

I chose to research this crop because it is one of my favorite snacks, and reminds me of summers with my grandma in southern Ohio.

A Brief History

The melon originated in Asia, but was first domesticated near the end of the fifteenth century in Paris. Its name is derived from the commune Cantalupo near Tivoli, Italy, and is a summer home of the Pope (*New World Encyclopedia*, 2008). Supposedly, Pope Innocent XIII enjoyed drinking port out of halved cantaloupes as an aperitif in the early eighteenth century. As for the New World, North American soil did not know cantaloupes until 1494 when Christopher Columbus brought them over on his second voyage.

A Delightful Trinity—The Three Cultivars

Figure 2. Grilled and dressed with a sweet-sour Italian sauce.



Photo: Drew Anthony Smith

Today, more than 500 years after the introduction of *Cucumis melo*, North Americans enjoy this sweet fruit in many ways: on its own as a refreshing snack, in salads, as a dessert with ice cream, and in creative dinner cuisine. To the left you will find pictured an appetizing and unique cantaloupe dish.

The cantaloupe known in North America is a member of the Reticulatus Group, one of three main cultivar groups. Technically these are muskmelons, but are referred to as cantaloupes by most North Americans (Boyhan, 2014). Familiar to practically anyone living in the United States, these melons have a corky, netted rind. This is why their group is named as such—the word *reticulate* means “marked in such a way as to resemble a net or network.”

Members of the Reticulatus Group are sweet and very aromatic when ripe, and are the most widely grown of the three groups. In the United States, 61-75% of “cantaloupes” (technically, muskmelons) are grown in California, while the others are grown in Arizona (20%), Texas, Georgia, Indiana, and Colorado. (Swiader, 2002).

The second group is the Cantalupensis Group. These are the true cantaloupes, but are not very widespread in North America. They are however very popular in Europe. These melons feature a rough rind peppered with warts and deep vein tracts (Boyhan, 2014). Their flavor and aroma is similar to the muskmelon.

The least known group is the Inodorous Group, and is grown in Asia, Spain, and Turkey. The common name of these melons is casaba, and as its group name implies, casabas are not as aromatic as their European and North American counterparts. Despite the lack of perfumed smell, these melons actually taste much sweeter than members of the Cantalupensis or Reticulatus Group. They also ripen much later in the season, and once picked, can last one month without spoiling. By comparison, the other two groups have a shelf-life of about 1 week.

Figure 3. *Cucumis melo* var. *cantalupensis* 'Canoe Creek Colossal' Cantaloupe.



Photo: Log House Plants, 2016

Producing and Harvesting Cantaloupes

Cantaloupes are tender annuals, and as such perform best in sunny locations during the warmest part of the year. In a home garden setting, it would be best to plant for southern exposure. They prefer to be grown in well-aerated, well-watered sandy soil. Sandy soil is best because it warms much more rapidly than silty or clay soils (Swiader, 2002). This allows the plant to quickly put out new growth, spreading so that it may absorb more sunlight for its photosynthesizing while taking up ground that could otherwise be colonized by weeds. These soils also drain quicker, reducing the risk of foliage in contact with the soil becoming diseased.

In order for seeds to germinate, temperatures must be at least 60° F, and are optimally 70-95° F. Germination may begin within three days if these conditions are met (Swiader, 2002). From the time of planting, cantaloupes require 65-120 days to produce fruit. Generally, cultivars with higher sugar contents require more time to ripen. The melons are harvested when stems begin to break away from the melon.

Cantaloupes rely on pollinators in order to set fruit. In commercial settings, at least one honeybee hive per acre of cantaloupe field is the USDA recommendation (*New World Encyclopedia*, 2008). These honeybees ensure that the plants produce many fruits, and that those

fruits have a marketable sugar content. Without proper pollination, fruits may be aborted or distorted. The biggest cantaloupes are those with the most seeds inside. The amount of seeds present is a function of the rate of pollination, and so pollination directly affects the size of the fruit (Swiader, 2002). Cantaloupe can be grown on a trellis, but due to the weight of the fruit, it is necessary to fix each one with its own cloth sling as it grows to prevent vine breakage.

In the Market

In the past, cantaloupes were considered “seasonal delights”, only available during the growing season. Due to production flexibility and increased imports, they are now available year-round in United States supermarkets. While they are sold as whole fruits, the growing trend of fast single-serving food options and the increase in small households has pushed marketers to sell cantaloupe in refrigerated packages where they are pre-cut and ready to eat. They are also sold in supermarket salad bars. (Borris, 2014).

The U.S. market value for cantaloupes was \$319 million in 2013. There are almost 75,000 acres of cantaloupe fields in the United States, but overall the country is a net importer. Most cantaloupes are imported from Latin American countries during the off-season (December-May). Each year, the average American consumes 27 pounds of melons, and about one third of those melons are cantaloupe. The popularity of cantaloupes is partly due to the growing health consciousness of consumers, increased availability, and the production of seedless varieties. (Borris, 2014)

Nutritional Value of Cantaloupes

It is uncommon that a sweet snack possesses significant nutritional value in the human diet. Cantaloupes are an exception though, and are providers of vitamin C, potassium, beta carotene, and polyphenol antioxidants. Following is a table listing the benefits of these vitamins and minerals.

Vitamin C (ascorbic acid)	<ul style="list-style-type: none">• Promotes growth, repair, and development of all body tissues• Important in the absorption of iron, immune system function, wound healing, and maintenance of bones, teeth, and cartilage
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Potassium	<ul style="list-style-type: none"> • Important in fluid balance and healthy blood pressure • Controls electrical activity of muscles, including the heart
Beta Carotene	<ul style="list-style-type: none"> • Converts into vitamin A (retinol) which contributes to healthy skin, good eye health, and immune system support
Polyphenol Antioxidants	<ul style="list-style-type: none"> • Benefits the immune and cardiovascular system • Regulates accumulation of nitric oxide, which helps to prevent heart attacks

Conclusion

Having gone from their origins in Asia to their domestication in Europe and finally to North America, cantaloupes have endured a long journey on their way into the hearts and stomachs of Americans. While there are three cultivar groups, it is the Reticulatus Group that is beloved for its sweet orange flesh, and easily recognized for its tan, netted rind. With a market value of several hundred millions of dollars, and thousands of productive southern acres, cantaloupes will continue to grace the plates and sticky up the hands of many generations to come.

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Capsicum Annuum ‘Banana Pepper’ Fact Sheet

By: Casey Gildea



<http://dacha-r.ru/ogorod-i-gryadki/perec/tonkosti-uxoda-za-rassadoj-perca-kak-uberech-rasteniya-i-poluchit-dostojnyj-urozhaj/>.html

Capsicum Annuum ‘Banana Pepper’ is like most pepper plants in that it needs lots of direct sunlight, warm soil and a long growing season, which makes it ideal for summer vegetable production (Grant, 2016). Capsicum Annuum encompasses many sweet peppers and hot chili’s and is a part of the Solanaceae family. Interestingly the “annuum” in the species name stands for annual, but the plant itself is not actually an annual and can survive for several seasons as a perennial if no winter frost affects it (Katzner, 2008). The ability of this vegetable to grow as a perennial can be seen in its center of origin or in a climate controlled greenhouse. The center of origin of this vegetable crop is slightly debated. It depends on what taxa you use. The current genus is limited to pungent taxa and has a center of origin of Brazil and Bolivia, but if non-pungent taxa are used then other centers of origin can be identified such as Central America and Southern Mexico (Eshbaugh, 1997).

Growing 'Banana Peppers' in Colorado can be very straightforward. Pepper seeds should be started indoors roughly a month before any frost could be a potential risk and when the soil temperature has reached, at a minimum, 60 degrees Fahrenheit (Grant, 2016). Before transplanting the pepper starts into the garden a proper soil pH test should be performed. In Colorado most soils are very alkaline, which means that they are above 7.0(neutral)(Pohly, 2010). Pepper plants have a high tolerance for either acidic or alkaline soils but grow optimally within a range of 5.5 – 7.0 pH which means that having soils on the acidic side of neutral will work best (Albert, 2016). Some possible soil amendments to lower the pH of Colorado soils range from the addition of soil organic matter to acidic peat moss and even acid forming fertilizers such as ammonium sulfate (Pohly, 2010). 'Banana Pepper' needs a minimum of 8 hours of sunlight in a soil that has good drainage (Grant, 2016). Because Colorado has very high clay content in the soils the addition of at least 50 – 80% of sand by volume will help improve drainage (Pohly, 2010). Pepper plants should be planted 18-24 inches apart and should be supported with either a stake or some sort of tomato cage (Bonnie, 2012). It is also recommended to fertilize plants once the first signs of fruit begin to show, with a 12-12-12 (N-P-K) fertilizer (Grant, 2016).

Caring for your pepper plants will require a keen eye. Removal of competitive weeds that will try to out compete the peppers for soil resources must be addressed weekly. Adding mulch around the base of the pepper plants can reduce weed pressure as well as help to maintain soil moisture (Grant, 2016). There are several pests that could potentially harm the pepper plants. Aphids, thrips, flea beetles and cutworms are just a few. Using a soapy spray will control most pests, and making sure not to top water will prevent most diseases on the plants (Grant, 2016).

Harvesting 'Banana Peppers' is a personal preference. 'Banana Peppers' are generally harvested when the peppers are full and have a hard waxy coating with a yellow color which is about 70 days after transplant (Grant, 2016). Although leaving them on the plant for a bit more time can reveal orange or even red colored "Banana Peppers" with a reported milder taste (Grant, 2016).

There are several cultivars to choose from when deciding to grow 'Banana Peppers'. These include 'Sweet Banana', 'Early Sweet Banana', 'Hungarian Yellow Wax' and 'Sweet Hungarian' (Andrews, 1995). The preparation of harvested 'Banana Peppers' can be quite creative. Most people use them as salad toppers, or pizza toppers. Some will pickle or can them for later use as well as roast them for added flavor to chili's and soups. The possibilities for this mild pepper are endless, its up to the consumers imagination on how best to utilize this great pepper.

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Chickpeas
A Fact Sheet to Cultivating and Harvesting Garbanzo Beans (*Cicer arietinum*)
Warm Season Crop Fact Sheet
Jessika Gill
Fall 2016

Introduction:

Garbanzo beans (also referred to as chick peas and gram) are considered to be a warm season crop because they require warmer temperatures (between 65 degrees Fahrenheit to 85 degrees Fahrenheit) for optimum growth (Swiader and Ware, 2002). According to dictionary.com, a vegetable is “any plant whose roots, seeds, roots, tubers, bulbs, stems, leaves, or flower parts are used as food”. Botanically, any part of a plant that is derived from a flowering structure is considered to be a fruit (i.e. seeds, fleshy casing around the seeds), and all other edible parts of the plant are considered to be ‘vegetative’, or a vegetable (i.e. stems, shoots, petioles, leaves, roots, tubers, and bulbs). In a culinary setting, a vegetable is any plant whose taste is not sweet or tart (as a culinary fruit would be), and may consist of botanical fruits, seeds, roots, shoots, stems, etc. By the culinary definition, beans are generally accepted as a vegetable (Nelson and Zeratsky, 2012). Garbanzo beans have a rich history dating back to ancient times, and have recently hit the media spotlight as a kind of nutritional novelty. This fact sheet provides both interesting and helpful information for those curious about garbanzo beans and how to cultivate them.

Why I chose this crop:

Garbanzo beans have a bit of sentimental meaning for me. When I was growing up, my mom always kept a can of them around to snack on. I kind of liked the bland flavor and the way the layers of the bean felt against the roof of my mouth as they gave way to the pressure of my tongue. Since coming to college, I have discovered hummus and taken a liking to this modified

garbanzo bean product. I am also interested in seeing if there are other ways to process garbanzo beans, or use them in cooking, that I am not aware of.

History:

Garbanzo beans, member of the Fabaceae family, originated in the Middle East and were first cultivated around 3000 B.C. near the Mediterranean in the Fertile Crescent region (the first cultivars are thought to be domesticated from the wild variety *Cicer reticulatum* found in southeastern Turkey and Syria) (Muehlbauer and Tullu, 1997). From here they spread to India and Africa and became staples in these cultural cuisines. The garbanzo bean is considered to be one of the eight founder crops of the origins of agriculture, and today is the second most widely produced legume in the world (soybeans are the first) (Anonymous, 2016).

Importance of garbanzo beans:

Garbanzo beans are known for their high nutrient content, especially protein, and for being able to store well. It also has many culinary as well as medicinal and industrial uses. In the culinary business, garbanzo beans are often used for fresh eating, put on salads, canned, prepared (via boiling, frying, parching, or roasting), fermented as a food item or as a vinegar, and dried or rehydrated. Some medicinal properties of garbanzo beans are as an anti-diarrheal agent and as a food to help control cholesterol levels. In addition, the acids extracted from the leaves are said to have several household remedial purposes (i.e. as an aphrodisiac, aid against cholera, snakebite remedy, sunburn remedy, etc.-these are not necessarily scientifically proven though). Some might be surprised to find that garbanzo beans also have industrial purposes. The leaves are known to produce an indigo-like pigment that can be used as a dye for fabrics and textiles, and the starch present in garbanzo beans can be used as a finish on textiles. The husks, stems, and leaves have been used as animal feed in developing countries, and the beans can also be ground

up and used directly for feed as well. A non-water resistant adhesive can also be produced from garbanzo beans. (Muehlbauer and Tullu, 1997)

Fun Facts:

- Today India, Pakistan, Turkey, Ethiopia, and Mexico are the highest producers of garbanzo beans (Mercola, 2013).
- During the World War I, garbanzo beans were ground up and used as a substitute for coffee (Nolte, 2010).
- It has been suggested that ‘chicken pox’ got its name from the resemblance the blisters associated with the infection had to chick peas, or garbanzo beans (Nolte, 2010).
- Garbanzo beans contain protease inhibitors that counteract the enzymes in our bodies that digest proteins (Nolte, 2010).

Breeding:

The domesticated garbanzo bean comes in two major varieties: desi and kabuli. The kabuli variety is a little larger in size, and is grown in temperate climates while the desi type is grown in the semi-arid tropics (Muehlbauer and Tullu, 1997). The garbanzo bean is a self-pollinated crop, and rarely cross pollinates with other plants



Photo Source: (Acharya, 2007)

(Muehlbauer and Tullu, 1997). Garbanzo beans are usually a pale yellow color, but are commonly found in India in reds, browns, and blacks. These darker-colored garbanzo beans are usually of the desi variety. Almost all varieties produced in the United States are kabuli type garbanzo beans (Buschena et al., 2002).

Cultivation and production:

Full sun is optimal for garbanzo beans. They can take partial shade, but the yield will be reduced. Loose, well-drained soil rich in organic matter and low in soil nitrogen are best suited for growing garbanzo beans, and potassium and phosphorus are good soil additives for this crop. Garbanzo beans germinate best when the planting beds are kept moist, but after germination it is suitable to grow it as a dry land crop. To plant garbanzo beans, one must first ensure that there is minimal residue on the soil surface in order to discourage disease. The seed bed should also be prepared in such a way that large clods of soil are broken up and the soil is not compacted. Planting can be done when the soil



Photo Source: (Zell, 2009)

temperature reaches 42-45 degrees Fahrenheit, and seeds should be planted one and a half to three inches beneath the soil surface at a density of 75 to 150 pounds per acre. Rows should be spaced six to twelve inches apart. When it is time to harvest, ensure that the crop is uniformly mature and dry (about 13% seed moisture). (Doll et al., 1990)

Harvest, processing, and marketing:

Harvest is accomplished by swathing or harvesting directly with a sickle bar header (Ball et al, 2004). Garbanzo beans are processed similarly to other dried beans. Bins, elevator legs, conveyors, air screen cleaners and secondary conditioning equipment are used prior to packaging or canning (Ball et al., 2004). To market garbanzo beans, like most crops, it is important to read

the news and see what is trending in order to play into media fads and market a product. At the moment, there is a lot of literature about garbanzo beans being a super food and providing several health benefits such as high protein content and antioxidant potential. In fact, the U.S. is currently consuming more garbanzo beans than are being produced within the country, so we are importing a percentage of our intake. Processing garbanzo beans into other products, such as hummus or flour, is another way to market them.

Recent Scientific Literature on Garbanzo Beans:

The first entire genome sequence draft was done on both desi and kabuli varieties in 2013. The sequencing found that the desi variety was slightly older than the kabuli variety, which provides some evidence for desi being the older of the two varieties. One hundred eighty-seven disease resistant homologues-significantly less genes than other legumes designated to disease resistance. This data puts some pressure on breeder to work on cultivars better-suited to disease resistance. (Bharti et al., 2013)

Conclusion:

Garbanzo beans are a historical crop with many uses that may have been overlooked in the past, but has recently made its way into the media as a nutritional ‘superfood’. There are several uses for this crop beyond human consumption, and its dry land potential paired with the cultivation and harvest techniques it shares with dry land beans grown in Colorado may spark some interest for increasing the local production of garbanzo beans in the future.

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Sweet Potato History and Production

by Marie Harveland

Sweet potatoes are considered a 'New world' plant because they were discovered in the topical regions of Central America by Christopher Columbus around the year of 1492. Sweet potato was brought back to Europe, also known as the 'Old world' and has since become a staple in the diets of people worldwide. Although they are not known to produce naturally, its believed that they were spread through the tropical Americas by means of ancient trade routes.(Swiader and Ware, pg.522)

Years later in the late 1600s on through the 1800's this sweet starchy vegetable made its way to China, Asia, Africa, and Latin America. They grow relatively well under most circumstances and are a major source of carbohydrates for underdeveloped countries because of their high concentrations of vitamins A and C, not to mention they have 50% more calories than Irish potatoes (Swiader and Ware, pg.521). It is often used as a substitute for rice and corn in these places and is ranked the 5th most important food crop based on a fresh weight basis (Valera) Currently the global leader in production of sweet potatoes is China and in the United States the lead producer is North Carolina. For scale, China produced 81% of the 2.8 billion cwt sweet potatoes harvested in 2007 whereas North Carolina only produced about 1% (Hill).

Sweet potatoes, or *Ipomea batatas*, are not actually apart of the potato family at all. They are part of the morning glory family known as Convolvulaceae (Swiader and Ware, pg.521). Sweet potatoes are also often confused with yams primarily because of marketing in the United States. Most products labeled as yams you find in the grocery are a sweeter cultivar of sweet potato with moist orange flesh. Native sweet potatoes are said to be dry fleshed and pale yellow, but sweet potatoes come in all sorts of colors from creamy white to orangish-red to reddish-purple (Varela). If you would like to know more about the different cultivars of sweet potatoes check out the link below:

<http://www.all-about-sweet-potatoes.com/popular-varieties-of-sweet-potatoes.html>

Unlike Irish potatoes, sweet potatoes can be eaten raw and are often boiled, baked, pureed and candied (Swiader and Ware, pg.521). In fact, most parts of the plant are edible including the roots, shoots and leaves. The roots can be made into a multitude of things including flour, chips, dried and canned goods, juice, bread and pie just to name a few (Varela). George Washington Carver came up with a 100 uses for sweet potatoes himself including a substitute for corn syrup. In Asia it was discovered that when fermented they could be used to make alcohol and soy sauce (Huntrods). In the United states per capita we use about 4.5 lbs of sweet potatoes a year . There is a distinct increase in utilization during winter months because it is a staple in most Thanksgiving and Christmas dinners (Swiader and Ware, pg 521).

Other markets for sweet potatoes include the livestock feed industry and the landscaping industry. Sweet potato vines and roots can be used as a base for high protein animal feeds and has also been used in domestic animal food and treats (Huntrods). As for the landscaping industry, its heat tolerance, spreading habits, and aesthetically pleasing heart shaped green or purple leaves have made it a highly used ornamental plant. Its most commonly used in hanging baskets, and patio containers. Although sweet potatoes do produce a small flower that is similar to a morning glory it's not a very showy or a prolific bloomer.

Because of its ability to spread easily due to feeder roots that form when a vine is in contact with soil, the sweet potato plant is very easy to propagate. It can also be propagated by seed or from slips. Slips are adventitious shoots that develop off of the tuberous roots themselves (the fleshy sweet potato as we know it). Most commercial production uses slips for propagation, seeds are only really used for breeding because they take longer to mature and become profitable (Swiader and Ware, pg. 524).

As a crop, sweet potatoes are considered a warm season perennial or an annual in colder climates. They prefer a lighter soil with little organic matter such as a sandy loam. Although sweet potatoes can grow in pretty harsh conditions heavier soils tend to make the edible root lumpy and misshapen. The crop requires a heaving feeding schedule, and good drainage. As I mentioned before, sweet potatoes don't produce an abundance of thick edible

roots naturally. The plant will produce a slip (or fleshy root) usually stemming from the crown that has apical dominance, but if you heat treat the plants this will reduce apical dominance and create more slips (Swiader and Ware, pg.524). Most cultivars will be ready for harvest after 4 months with the exception of some select cultivars (Varela). Growers should beware of weevils and nematodes as well as stem rot during production.

As for post harvest production, the size of your operation dictates the route you will take to get your product on the shelves. Smaller companies will sell directly to buyers, local businesses or at farmers markets. Large scale production operations usually hire a broker who will work directly with a seller or buyer to negotiate things like price, pick up points and quantity sold (Huntrods). Sweet potatoes are sold in many different forms whether they are canned, frozen or fresh. Most times you'll see single potatoes for sale stacked on top of each other or in a breathable bag and even in plastic individually wrapped. The biggest market for sweet potatoes is in Canada, but also there is a large market for fresh product in the UK and the US while the Dominican Republic has its hold on exporting the most frozen sweet potatoes than anywhere in the world (Huntrods).

Citrullus lanatus – Watermelon

Turtle Hodges 10/11/16



Fig 1. “Personal- size” watermelon (Saha,2014)

I chose watermelons because they were one of my favorite things to eat as a child. During the summertime pool parties at my cousin’s house we would have watermelon eating contests. We would each sit down with a spoon and half of a watermelon and see who could clean out all of the red flesh the fastest. I was never aware that watermelons could be different colors. The first bite of yellow-fleshed watermelon I took was quite the surprise, as I thought it was going to be pineapple. Looking back at that time, I remember obsessing about the white “seeds” in seedless watermelon. Now I know that these are the pericarp left from genetically scheduled fertilization failures. Watermelon a common summer time snack enjoyed and cultivated around the world. However, it has become a weed in open ground and roadsides in some areas.

- Identification

Watermelon are found in the Cucurbitaceae family. They are grown as an annual vine in hardiness zones 2 through 11. Plant height can reach up to a foot tall, but each vine can grow to be approximately 10 feet long. Stems are “hairy” with tendrils, for anchorage, and exhibit a trailing

vine growth pattern. The leaves are pinnately arranged and lobed. Flowers are pale green. (MBG, 2016)

Watermelon fruit can be significantly different from cultivar to cultivar. Watermelons can be spherical, as in the case of “personal-sized”, or more traditionally oval shaped. They are typically green with a darker green stripe pattern, referred to as mottling. The outer rind is firm and is edible. The inner white rind is edible and is sometimes pickled. The most desirable portion of the watermelon is the sweet, juicy flesh contained inside the rind. This flesh can be different colors, including the traditionally recognized red, orange, and yellow. Seeds are generally black or brown.



white seed shapes in “seedless” varieties are pericarps of undeveloped seeds.

Fig. 2 Watermelon can come in a variety of colors. The Photo to the left illustrates the diversity in flesh color of watermelons. (Saha,2014)

▪ Background

Watermelon are believed to originate in southwestern Africa. Particularly in the Nambia region (MBG, 2016). However, it is important to note that in the early 1600’s colonists found Indians cultivating them in the Illinois River Valley. These are thought to be citron melons. (Swiader, 2002).

There are over 1,200 accepted cultivars of watermelon. Fruits can range from less than 1 pound to the world record of 351pounds, produced by the variety ‘Carolina Cross’. Fruit weight is not

the only thing that can change between varieties. Rind thickness, mottling patterns and flesh colors can also change. For example: ‘Golden Midget’ are spherical watermelons with a golden rind, pink flesh, black seeds, which grow to 3 pounds. ‘OrangeGlo’ watermelons can range between 20-25 pounds, have a thin outer rind with green stripes, oblong-shaped, and orange flesh. ‘Moon & Stars’ watermelons are uniquely colored with a dark green rind speckled with yellow dots. ‘Moon & Stars’ are oblong-shaped, contain red flesh, and can weigh between 10- 15 pounds.

Seedless varieties of water melons are obtained through the hybridization of a diploid (2N) parent with a tetraploid (4N) parent. The chromosome number of watermelon can be doubled by applying colchicine. This results in a sterile triploid (3N) offspring. Seedless watermelons are generally smaller than seeded varieties. This is because the size of the watermelon is directly proportional to the number of seeds contained inside. This makes sense logically because more seeds inside mean that the watermelon (if not eaten) would have to support the growth of more seedlings.

Some current watermelon studies include breeding work to identify and map possible QTLs for rind patterns and lycopene production. Lycopene is the pigment which gives tomato and watermelon their red color, and is an antioxidant. (Bauer, 2002)

- Soil

Watermelon perform best in well-drained soils., When managed properly sandy and clayey soils can produce bountiful harvests. Watermelon vines will not tolerate excessively wet soil or standing water and they will not perform in compacted soil. Watermelon seeds will germinate in soil temperatures between 68°F and 95°F. At temperatures below 70°F germination will be very slow. At a soil temperature of 77°F emergence will only take 5 days. Seeds should be placed at a

depth of 1". Spacing can vary. Traditionally seeds were spaced 6'-8' apart. With irrigation the spacing can be cut down to 5'-6'. 'Personal-size' vines can be spaced 2' - 5' apart.

- Water

Evapotranspiration (ET) rates have been reported up to 0.3" per day. Individual microclimates will vary but a general watering guide ½" when the top of the soil is dry between emergence and when vines begin to run. From running to 1st bloom, ¾" every 5 days. After 1st bloom water should be applied at 1" every 4 days. Watering rates should increase if the plant exhibits signs of water stress. (Boyhan *et al*, 2014)

- Fertilization

Watermelon 120 pounds per acre is the maximum recommended amount of nitrogen, potassium, and phosphorus. Due to the long growing season, it is recommended that fertilization treatments should be broken up throughout the season.

- Pests/disease

Watermelon are susceptible to a variety of species of pests and diseases. Some common diseases include: Anthracnose, blossom end rot, fusarium wilt, bacterial wilt, downy mildew and powdery mildew. Common pests include; cucumber beetles, aphids, squash bugs, stink bugs, cutworms, pickleworm and squash vine borers, mites, and thrips.

- Harvest

The United States harvested 3.2 billion pounds of watermelon off of 120,000 acres in 2014. Approximately 24% of that came from production sites in Mexico and other Central American

countries. This placed the watermelon in the top 3 crops produced by the United States, alongside onion and lettuce. (Naeve,2015)

Harvesting the watermelon when it is ripe is extremely important, as they are non-climacteric fruits. They will develop the red color but will not get any sweeter after removal from the vine. A few indicators of maturity include, but are not limited to; The ground spot on the bottom of the fruit has turned yellow, from white. The tendrils closest to the fruit have turned brown. Thumping on a mature fruit produces a soft hollow sound, compared to the metallic ringing sound of an immature fruit. (Boyhan *et al*, 2014)

Care should be taken when removing the ripe fruit from the vine. Watermelon do not “slip” from the vine. If pulled the outer rind might rip. A Sharp knife should be used to cut the fruit from the vine. Watermelon should not be stored on either end as they may crack open.

- Marketing

Watermelon are bought and sold in the fresh marketplace. A producer can choose to sell their watermelon straight out of their field, in a farmer’s market, or directly to the store of their choosing. Marketing services can be offered by produce brokers. Large scale operations will often utilize services such as these to move their produce.

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Travis Kapetan

Mark Uchanski

Hort-450B

9.16.16

History, Care, and Contents of Santa Fe Peppers (*Capsicum annuum*)

The earliest uncovered artifacts to highlight modern humans' consumption and domestication of *Capsicum annuum* peppers was found alongside corn and squash remains in central-eastern Mexico dating back over 6,500 years (Kraig, 2014). *Capsicum annuum* lies within the Solanaceae plant family and is considered to serve as a horticultural vegetable crop because little to no processing is needed to enjoy these seed pods, also because it is consumed with dinner rather than desert. These seed pods are used in many cuisines across the globe, most people prefer to dilute the concentration of the spicy compounds contained within by chopping up and throwing the peppers into a soup or salsa. Tropical regions of North and South America are accepted to be the origin of most peppers and more specifically central-eastern Mexico is shown to have served as the cradle for *Capsicum annuum* domestication. This plant grows as perennial shrub in its native tropical habitat or greenhouse setting therefore it should come as no surprise that *Capsicum annuum* is treated as a warm season crop and has proven to produce its most nutrient-dense fruits under warm conditions within average daily temperatures above 75°F but below 90°F (Swiader, 2002).

The seed pods that these plants produce are important within a healthy diet because they contain unavoidably spicy phenolic acids and capsaicinoids which serve as successful herbivory-defense mechanisms for the plant. Not so ideal for the plant however, we humans have decided

to enjoy these spicy chemicals at low concentrations and are scientifically working towards maximizing the concentration of capsaicin in pepper production through cultivation and breeding practices with popular cultivars such as Mana, Numex, and Belrubi. Phenolic acids and capsaicinoids act as antioxidants aiding in oxidation and reduction throughout the human body giving reason as to how these organic compounds work to balance the body's pH, reduce the number of free radicals, and reduce the risk of cancer (Materska, 2005).

Capsicum annuum peppers are considered spicy at all pigmentations, moreover it has been found that red mature peppers contain higher concentrations of capsaicinoids in their pericarp than the pericarp of yellow-green immature peppers (Materska, 2005). The red ripening stage has an important impact on the carotenoids content of the peppers showing that immature green/yellow peppers sustain the highest content of polyphenols (micronutrients which fight cancer and cardiovascular diseases) while red mature peppers hold the highest content of vitamin C and provitamin A (Marin, 2004). The change in pigmentation along with concentrations of spicy chemicals is correspondent to the stage of seed maturity within the pod, each pod changes pigmentation from yellow-green to red as the seeds inside shift toward maturity (Uchanski, 2016).

Mass maturity, which is the end of the seed-maturing phase, occurs roughly 49–53 days after flowering for the first appearing fruit and indicates onset of both viability and desiccation tolerance within the seeds (Demir, 1992). However, Capsicum Annuum may continue to produce flowers and bear fruit far beyond that 53-day window as shown in *figures 1,2, and 3* which depict a Santa Fe pepper about 75-85 days after flowering, meaning that this specific cultivar has an indeterminate flowering pattern where flowers and seed pods continue to appear and bloom after the initial appearance of flowers and the plant does not mature uniformly throughout.

(Uchanski, 2016).



Figure 1: Sept. 28th 2016 - Pigmentation changing in peppers as seeds mature - 75 days after flower. Credit: Author

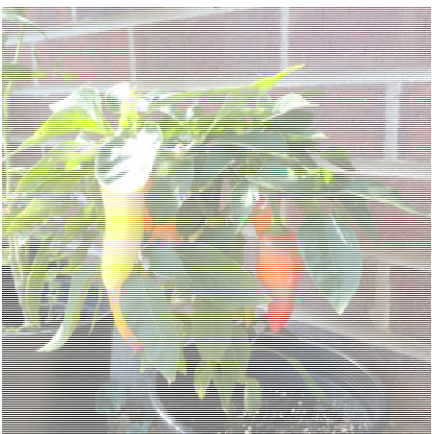


Figure 2: Oct. 2nd 2016 - Pigmentation continuing to change, the bottom-right pepper looking fully mature – 82 days after flower. Credit: Author



Figure 3: Oct. 4th 2016 - Mostly mature Santa Fe peppers - 84 days after flower. Photo credit: Author

This plant species may only set fruit after self-pollinating or out-crossing genes which is performed by insects (Dewitt, 2009). They require very little maintenance from a land management perspective, provide a variety of beneficial compounds, and have a beautiful white flower as shown in *figure 4*. Harvests may be made anytime throughout the fruiting stage as individual peppers mature, peppers for consumption may be harvested at any pigmentation of preference whereas viable seeds may only surely be harvested from a mature red pepper. Root formation frequency for *Capsicum annuum* cuttings is best achieved when using a solution containing IBA (Ahmad, 2006). However, the most common form of propagation for these warm season peppers are through seeds shown in *figure 5*. This plant may be grown in many types of soils and under varying conditions as shown in *figure 6* with a *Capsicum annuum* plant in a one-gallon bucket full of coco soil mix. The best growing practices for this crop are to allow the soil to drain and aerate well, pH irrigation water between 5.5-6.5, and provide a controlled amount of drought stress to encourage higher concentrations of capsaicin within the fruit (Uchanski, 2016). Keep in mind that these plants are not frost tolerant and cannot tolerate an average nightly

temperature below 50°F.



Figure 4: July 16th 2016 White *Capsicum annuum* flowers opening on a young plant. Photo credit: Author



Figure 5: Oct. 4th 2016, mature *Capsicum annuum* seeds from a mature red pepper. Photo credit: Author



Figure 6: Aug. 2nd 2016, immature yellow-green Santa fe peppers growing in a one-gallon bucket containing coco soil. Photo credit: Author

Concluding thoughts bring together an idea that increasing the variety of foods and colors in your diet and garden promotes many beneficial aspects. It could easily be upheld that adding *Capsicum annuum* to both your garden and soup recipe may be the change needed to spice up your love life with food! These plants require very little care, are drought tolerant, and produce a wide variety of cancer fighting compounds. The only excuse not to grow this plant is that your nightly temperatures are too low and you lack access to any type of microenvironment.

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Capsicum frutescens ‘Tabasco’

Kelsey Keith

The *Capsicum frutescens* ‘Tabasco’ plant, or more commonly known as the Tabasco pepper, is a member of the Solanaceae family most famous for its use in hot sauce (Capsicum frutescens Tabasco Pepper- 2012). This small plant produces many inch to two inch long red hot peppers with a Scoville rating (a scale used to measure how spicy certain foods are) between 30,000-70,000 (Bosland and DeWitt- 2009) and have a high capsaicin content of .1-1.5% (Capsicum frutescens Tabasco Pepper- 2012). Capsaicin is the main chemical responsible for making a food taste spicy (Potter- 2015).

Uses

The small peppers from the *Capsicum frutescens* ‘Tabasco’ plant are used mainly in Tabasco sauce because of their unique flavor and hot characteristics, but are found virtually nowhere else commercially. They are sometimes grown by backyard gardeners for their flavor and high Scoville rating that makes it good for hot sauce, salsa, and Cajun food. Although the peppers are rarely used for anything besides Tabasco sauce many people worldwide are familiar with it as it is shipped to over 180 countries and territories and is a staple on most American restaurant tables (Tomky- 2016). The McIlhenny Company at Avery Island Louisiana receives the ripe red peppers grown in Central America, mashes them into a pulp, salts them with salt mined on the island, then lets the mash age for up to three years in white oak barrels (which they will reuse for up to 50 years) After the pepper mash has been fermented it is mixed with white vinegar and stirred several times over the course of a month before being strained and bottled for sale. A little known fact about Tabasco sauce is that it’s signature red color is only from the peppers themselves and no natural or artificial color is ever added. (How We Make Original Red Sauce)

History

The origin of Tabasco peppers is largely unknown but it is believed to be from either Tabasco Mexico, as the name implies, or near the Panama area in Central America (DeWitt and

Lamson- 2013). Virtually nothing is known about the domestication of the Tabasco Chilli as the first recorded appearance of the pepper was not until 1868 when it was grown by Edmund McIlhenny in Louisiana and sold in his famous Tabasco sauce (How We Make Original Red Sauce). The original recipe for Tabasco sauce has not changed in the past 148 years but the processing of the Tabasco Chillis has evolved from aging the mash for 30 days in stoneware jars to three years in oak barrels. The pepper sauce was also originally bottled in cologne bottles fixed with sprinkler fittings on the top in order to prevent people from pouring too much of it on their food then complaining about how hot it was. Until 1967 all of the Tabasco peppers used by the McIlhenny Company were grown on Avery Island in Louisiana. However, the high demand of this condiment forced them to turn to growers in Central America. (Tomky- 2016)

Commercial Production

Since virtually all of the commercially grown *Capsicum fretenses* ‘Tabasco’ plants are grown by or for the McIlhenny Company for their pepper sauce, commercial production is relatively simple. Each year plants are grown at the Tabasco bottling and production facility on Avery Island Louisiana for seed (McIlhenny Co- 2016) (Tomky- 2016). No professional or academic breeding programs exist for Tabasco chilies, so all plant breeding research and seed production is done by the McIlhenny company itself (Tomky- 2016). It is worth noting that there was one exception to this in 1970 when Auburn University in Alabama bred the disease resistant ‘Tabasco Greenleaf’ variety of *Capsicum fretesens* and introduced it when many of the traditional Tabasco Chillies fell prey to the tobacco etch virus (DeWitt and Lamson- 2013)(How to Grow Tabasco Pepper- 2016). The best plants in the island’s production fields are selected and the seeds dried and stored for the following year; some of the seeds are stored at the Avery Island facility and some are stored in a vault at a local bank just in case something happens to future seed crops. The Latin and South American farms the McIlhenny Company manages are supplied with these seeds every year where the Tabascos are grown and handpicked to be sent back to the production facility in Louisiana. There have been several attempts to automate the harvesting process, but a machine that can precisely distinguish the correct shade of red peppers must reach has not been developed. This means that the Tabascos are harvested by hand and each worker is given a small wooden dowel, called a “le petit baton rouge,” painted the shade of red the peppers are supposed to reach as a reference point. (How We Make Original Red Sauce)

Growing

Capsicum fretesens ‘Tabasco’ can grow from four to six feet high and produces small slender pods that point distinctly upright when they grow (Database of Chilli Pepper Varieties). They are very frost tender with a hardiness of 8-11 and should be sown indoors in well-drained soil approximately one quarter of an inch deep eight weeks before the last expected frost

(*Capsicum frutescens* Tabasco Pepper- 2012). The seeds need warm temperatures to germinate and the growing medium would ideally be kept at 80-85 degrees Fahrenheit, but 60-95 degrees Fahrenheit is an acceptable range. Seedlings should emerge in six to twelve days. Even at a young age, the plants will need as much sunlight as they can get and would do well in a south window. Some artificial lighting may be required if the seedlings receive poor sunlight. (How to Grow Tabasco Pepper- 2016)

Two to three weeks after the last frost, when soil temperatures have reached at least 50 degrees Fahrenheit, transplant the seedlings outside in a very sunny location fairly close to one another at twelve to twenty four inches apart in rows spaced twenty four to thirty six inches apart in a well-drained soil. The plants will tolerate very extreme soil pHs but performs best in the range of five to seven. Peppers are somewhat temperamental about setting fruit and will set the most fruit when night temperatures range from 60-75 degrees Fahrenheit and should not be given excess nitrogen fertilizer, which encourages more leaves and vegetative growth as opposed to peppers. Unlike many peppers that prefer dry soil, these are native to humid areas and may need more water than the average chili. (How to Grow Tabasco Pepper -2016). Generally, they can be harvested 55-70 days after transplant when the small peppers turn a deep red color (Bosland and DeWitt- 2009).



Figure 1 Grown *Capsicum frutescens* 'Tabasco' (DeWitt-2009)

It should be noted that plant viruses and diseases common to tomatoes and potatoes can effect Tabasco peppers as well, so it is best to plant them where these have not been grown for several years (How to Grow Tabasco Pepper- 2016). The variety 'Greenleaf Tabasco,' or *Capsicum frutescens* 'Greenleaf Tabasco' is a cultivar more resistant to common Tabasco viruses (Bosland and DeWitt- 2009).

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Crazily Satisfying Cardoons

Spencer Lane

“What do you call a Cardoon that’s been cooked to long...Cardone.”

I wonder how many times I’ve eaten celery, and it was actually a cardoon. Well, the answer is not often. This leafy vegetable of the Asteraceae family is not commonly found on the dinner table, but at one time it was all the rage. Written about as early as 1685 in Robert May’s, *The Accomplisht Cook*, where he said the cardoon is best eaten; blanched, cut, and like Celery (Weaver 2000). This perennial vegetable has had an interesting history as well as a picky growth cycle. For centuries people have patiently cared for the cardoon so that its flavor and texture could live on. Delicately grown between 55-64 degrees Fahrenheit, the cardoon is considered a cool season crop, but one quickly learns when trying to grow these picky plants, that cardoon cannot tolerate the cold toes, so it is typically grown in warmer conditions.

Cynara cardunculus L., otherwise known as the cardoon has its roots early in human history. Although the precise location is not known, it most likely originated in southern Europe, near Spain, Portugal, and the Mediterranean where it grows wild (Rodger 1993). It spread from Crete to North Africa, and even though this may seem expansive, it did not stop there. The Cardoon was brought to the New World and written about as early as 1660’s (Weaver 39). Currently, cardoons are eaten all over the world, grown on almost every continent, domesticated and bred from its wild relatives for its moist flavorful stocks and ornamental leaves.

Although the cardoon is a perennial vegetable it is mostly grown annually. The root ball can be harvested and placed in a cool, dark, area such as a cellar or garage to be saved for the next season (Munro 1997). Despite its survival abilities, only two of the twelve species of the *Cynara* genus are commonly grown, those being *C. cardunculus* L., the cardoon, and, *C. scolymus* L., the Globe Artichoke. Interestingly enough, both of these species are infertile which means when a gardener or farmer wants to plant cardoons, they must first start with seeds in a green house (Munro 1997).

Another reason that cardoons are typically started in a greenhouse and then transplanted is because the plant grows best in temperatures between 13-18 degrees Celsius (55-64 degrees Fahrenheit) (Munro 1997). Cardoons have a very specific temperature range, and with a life cycle of 120-150 days, in order to produce a good crop they must be started during the winter (Albert 2013). After the last sign of frost the cardoons are transplanted in to a near neutral PH soil, which drains well, that is high in organic matter, and gives full sun. (Munro 1997). In the wild cardoons are known to be found in stony, dry places, with clay textured soils (Rodger 1993). As they age, cardoons can grow to be a staggering two meters tall and two meters wide (Munro 1997). When the plant is about three or four weeks from harvest, most cultivators wrap the foliage around the stocks in order to blanch them. (Albert 2013). Blanching is a process where you starve the plant cells of light, and after a time, the cells white and soft. This improves the flavor and softness of the vegetable. In order to have healthy stocks, plentiful water is required. The blanched stocks are then cut at ground level and the leaves are trimmed, as their taste is not appealing.

Cardoons can be eaten raw or uncooked like celery, and according to one of the only commercial growers in the US, Ocean Mist Farms, the best stocks are moist and heavy, blanched to a grey-green color. The cardoon is high in fiber, low in calories, and provides four to six percent of ones daily requirements of calcium and iron (Ocean Mist Farms 2016). The taste of cardoons is said to be a mix of artichoke, celery, and salsify (Munro 1997). Although you wont find a Cardoon anywhere but your local Whole Foods, some farmers grow and sell varieties at farmers markets.

The wild cardoon has stout spines on the leaves, which serve as natural biological controls for insects and other pests. As this is not fun for the harvester, cultivars have been bred to remove some of the more unpleasant qualities. For example, a variety cultivated in France, only grows small spines on the foliage, while others like the ‘Gigante de Romagna’, grown in Italy, has no thorns but requires a wintering period for best taste, this allows cultivators to harvest in December (Weaver 2000). Other cultivars include: ‘Bettencourt’, ‘Konopka’, ‘Plein Blanc’, and ‘Vert De Vaulx’ (Munro 1997 and Weaver 2000).

This crop, although often not consumed in the United States, still has great value in the rest of the world. For instance, in Spain, the dried flower is taken and made into a substance that acts as a substitute for rennet, which causes the milk to curdle when one is making cheese (Munro 1997). But this is not the only instance where it holds importance. In the past it was thought that eating copious amounts of cardoons while pregnant, would produce a male heir (Munro 1997). It was said to be a frequent on Benjamin Franklin’s dinner table, as the French mainly cultivated it and he was the United States Ambassador to France during the Revolutionary War (Weaver 2000). The Cardoon is also not

specifically only for eating either, sometimes; certain varieties are used for decoration in outdoor gardens. I chose the cardoon because it was a warm season vegetable that I had never heard of before, but I came to realize that the cardoon's history is just as crazy as its satisfying stocks. It is a warm season vegetable steeped in culinary history. What makes the cardoon important is that, it represents a source of nutrients to many cultures in the world forever solidifying its place in the story of humanity. From its origin in the Mediterranean to its travel over seas, the cardoon has been cultivated in countless location, providing a valuable source of nutrients to many cultures for generations.



Figure 1: Foliage of *Cynara cardunculus* L. (Kramer 2004).



Figure 2: The Edible Stocks of the Cardoon (Saynisch 2016).

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The Pickling Cucumber

By: Colin Velazquez Lee



Above Image: Fertilized female cucumber flowers producing cucumbers.

We all love that satisfying sound of cracking a freshly sealed jar and what a better item to be in that jar than the crispy delicious snack that is the pickle. While most vegetables and a variety of different foods can be pickled for increase in shelf life and storage the most common vegetable for this process is known as the pickle, which is, of course the cucumber and so be horticulturally specific *Cucumis sativus*. While most of us know and love all sorts of pickled cucumbers it is seldom known to the public the amount of variety there is in the cucumber community and especially for pickling. This report will be focusing in on a specific type of pickling pickle, specifically *Cucumis sativus* ‘Gherkins’, which is considered an annual warm season vegetable crop because it prefers warm weather to grow and germinate, these temperatures range between 60 to 90 degrees F, meaning it is best planted in the late spring to early summer. However before diving too deep into the logistics of this specific cucumber let us first address cucumbers in general to understand them better horticulturally and botanically.

To begin to understand a plant species one not need to go further than the Latin name itself, typically there is a good amount of information to what the plant is, how it is used and what it looks like hidden away within the etymology of the name itself. As for *Cucumis sativus*,

the naming of this crop comes directly from the crop itself and was dedicated its own word in both Greek and Latin origins. *Cucumis* can be derived from the Greek word *kykyon* or the Latin word *cucumis*, both have a direct correlation to the plant itself and literally mean cucumber and define the whole plant genus itself. The species name for this warm season crop is *sativus*, which can be derived directly for a Latin word *sativus*, meaning ‘that is sown’. This directly correlates the genus and species name directly for this crop, and when it’s all laid out it means the cucumber that is sown directly, or the type of cucumber that is preferred both horticulturally for growing, taste and of course, pickling. Now that we understand how and why the cucumber received its Latin name let’s take a look into the botanical, morphological and characteristics specifically of *Cucumis sativus* ‘Gherkins’ (Santanna).

When most people think of cucumbers they think of a long vine dramatically similar to the vines of squashes. This is a correct assumption because the cucumber and squash are actually related and all belong to a family with very similar growth and foliar characteristics but also with a wide variety of fruits and/or vegetables. The family for cucumbers, and squashes, is Cucurbitaceae, which actually has the word cucumber built right into it meaning. This family is known as the gourd family and has a wide variety of characteristics as well as very similar characteristics that are widespread throughout the family. One of the most common features to the wider known crops from this family is an herbaceous vine growth habit with yellow flowers. But this is only a general feature to the family, let us look at *Cucumis sativus* ‘Gherkins’ specifically. *Cucumis sativus* ‘Gherkins’ is an annual flowering herbaceous dicot from the Cucurbitaceae family, it is a monoecious plant, meaning it will produce both male and female flowers on the same plant. In other words, it will produce both pollen (male) and ovaries (female) sex organs. Cucumber plant typically flowers between the months of July through September and male or staminate flowers will open prior to the female or pistillate flowers. Now we have an idea of what a cucumber is botanically speaking let us dive into some of its usage and history.

The cucumber originated in ancient India over 4000 years ago and has since travel the world making many places its home where it is cultivated for human consumption. It was the Romans who actually took the cucumber to new heights in culinary practices and moved it physically around the world globally during the Roman Empire’s reign (“History of Cucumbers”). Since then they had become a staple in many cultures around the world including

our own American culture. As stated by CSU, “In 2012, top cucumber producing states, as reported by the United States Department of Agriculture, were Georgia and Florida with 283.5 and 280.8 million pounds, respectively” and when talking about importing cucumber to the US, CSU reports that “The top three countries that imported cucumbers to the United States in 2013 were Mexico (1,144,458,000 lbs) Canada (215,028,000 lbs) and Honduras (65,244,000 lbs)” (Brewton). When you add all those numbers up it shows that the US is a major consumer of cucumbers and you can even see them in supermarkets year round as they are consistently in demand. When thinking about cucumbers we typically think of eating them raw in salads or as a side in dishes and of course pickling which is a home stead treatment of many types of crops around the world that has been key to surviving winter. The reason I chose to write about the cucumber is because it is such a widely used, loved and heavily grown crop worldwide, and personally I love and use these crop weekly which has lead me to my selection of this crop.

As we now know some brief botanical and historical aspects to *Cucumis sativus* ‘Gherkins’ let’s look at how this crop is harvested and handled to make it way to our supermarkets and into our mouths as fresh as possible. Cucumbers in general are all harvested similarly; it can be done mechanically or also by hand to preserve their skin. Typically for pickling it doesn’t matter as much and mechanical is becoming increasingly used for ‘Gherkin’ cucumbers. As for post-harvest it is very important to keep them cool and away from sunlight, with heavy humidity. Ideal conditions are 90% humidity between 50-55 degrees F. Also cucumbers are highly sensitive to ethylene which is abundant in the atmosphere meaning they continue to ripen with off the vine. So it is important to keep these away from ethylene or in a contained environment while transporting and shipping cucumbers globally. Cooling cucumbers from out in the field is also critical in keeping them crisp and full of moisture. There are many cooling methods that include hydro cooling, forced air cooling and room cooling. These ensure that the proper environmental conditions are met speedily and can be maintained until they hit supermarket and reality shelves or food processors like picklers (Semco).

In the end we have explored *Cucumis sativus* ‘Gherkins’ in many aspects that I hope have given you a new insight and a new respect to the cucumber both as a consumer and to the farmers who produce them. This crop has been in human culture for a long time and at the rate it is being produced and eaten today I do not see it going anywhere in the future as long as we can grow it. So next time you’re looking for thing to plant in your home garden choose the mighty

cucumber, but be careful a vine or two will do you good and you have plenty of extra cucumbers for making your own pickles and *Cucumis sativus* 'Gherkins' will make a easily grown nice short stout pickle perfect for you pickling needs. Lastly you have to try these local Colorado (image below) pickles, they are delicious.



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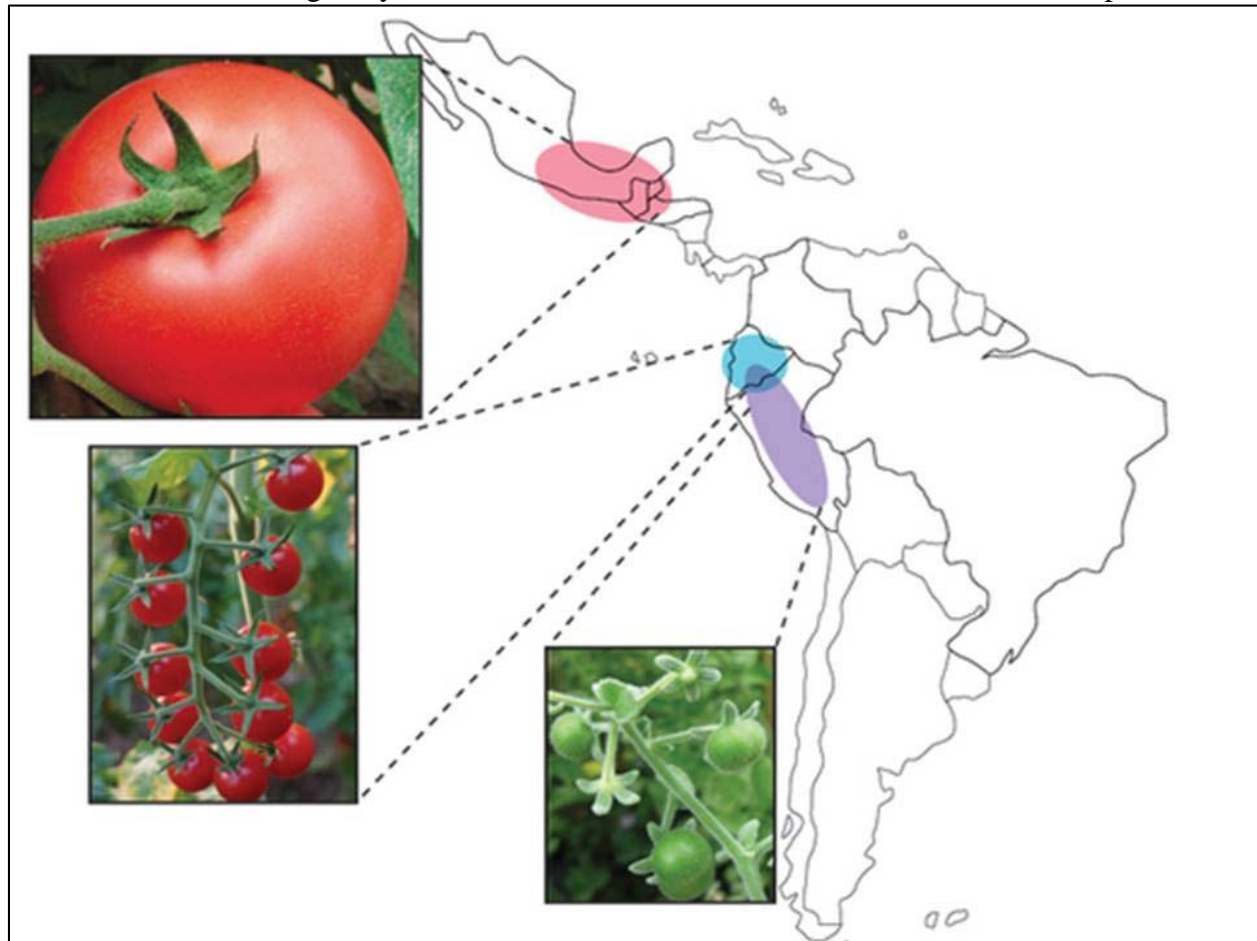
Tomatoes: A Saucy Solanum

David W. McKinney

Almost no other vegetable can boast the relationship that the tomato has developed with American society. This beloved classic is not only one of the most cultivated vegetables in the home garden but is also the largest contributor among vegetable crops of nutrients to the per capita U.S. diet. Tomatoes can be baked, stewed, fried, juiced, pickled, pureed, processed, or even just enjoyed raw (Swaider and Ware, 2002). This makes the tomato extremely versatile from a culinary stand point. From pizza sauce, to catsup, to fresh on the salad bar, it's no wonder that the tomato is an American favorite. One of the reasons the tomato is such a popular plant among gardeners is its wide adaptability and love of the heat. Thriving in the mid 60 to high 80 degrees Fahrenheit, the tomato is the perfect summer vegetable, and if started early enough, it can even bear fruit in the shortest of growing seasons. There is nothing quite like eating fresh tomatoes right off the vine and that makes it a favorite for the whole family.

The tomato comes from humble origins in the Andes of western South America, where it has been cultivated alongside potatoes, peppers, and other members of the Solanaceae family for thousands of years. Tomatoes are considered one of the most diverse crops because in Peru alone, tomatoes were cultivated at sea-level and up to 3,300 feet up in elevation. That includes mountain valleys, coastal lowlands, and isolated microclimates that tomatoes adapted to. The earliest domesticated tomatoes were grown by Native Americans throughout South America and Central America using terraces along the Andes and in open fields where they could find valleys (Figure 1). It is said that each terrace had its own microclimate, and that each microclimate had its own cultivated variety of tomato. That shows that there could have been thousands of tomato varieties. (Razdan and Mattoo, 2006)

Figure 1. (Kay and Remigereau, 2015)
Tomatoes were originally domesticated in South America from native *Solanum* species.



One might ask, what kind of impact does the tomato market make on the United States economy? According to the most recent USDA information, United States farms alone generate \$2 billion in annual farm cash receipts from tomatoes. One thing that sets them apart is that tomatoes are grown commercially in all 50 states. However, 94% of the United States processed tomato production is in California as well as 75% of fresh tomatoes. Marketing of all these tomatoes tends to go through dealers who help growers sell to produce sellers. In the processed tomato industry, firms purchase tomatoes directly from growers, process them into cubes or paste, which is then sold again to another firm that may add a spice blend or continue processing. The final product in a can or jar is then sold to the seller. (Wells, 2016)

Harvesting of tomatoes varies significantly depending on what the tomato will be used for. Market fresh tomatoes are almost entirely hand-picked. This ensures that there are no punctures or bruises which make the tomato impossible to sell. Meanwhile processed tomatoes are picked by machinery, where it doesn't matter the condition of the tomato when the final product is put on the shelf. (Swaider and Ware, 2002)

One of the great things about tomatoes is that they are able to widely adapt to almost any condition. Hundreds of years of selective breeding and global distribution has yielded an amazing diversity of tomato shapes, colors, and preferred growing conditions (Figure 2). Just by doing some research, one can find a cultivar that has perfectly adapted to a grower's region. Tomatoes have also adapted wonderfully to greenhouse hydroponic production, especially in those states with a short growing season and cooler temperatures. Soil wise, tomatoes are not picky as long as the soil is properly supplemented with plenty of available nitrogen and moisture. Depending on organic material content of the soil and type of fertilizer, applications can range from daily to once every two weeks. Soil around tomatoes needs to be kept moist, but not wet. One way to ensure early success is to transplant tomatoes into the field or garden in the spring when the threat of frost is gone, and then to fertilize the transplant in the ground to give a nice boost (Swaider and Wade, 2002). One interesting cultural practice is that some growers graft a tomato to a potato rootstock, creating a fries and catsup plant. Tomatoes and potatoes are genetically similar enough that a single grafted plant can produce both tomatoes above the surface and potatoes below. One important characteristic of production, whether in a home garden or in a field, is support. Tomatoes have the tendency to grow up, and then lodge as the fruit develops, making harvest difficult. Solutions include cages, staking, or pruning tomatoes

into a sturdier bush. Each choice brings the fruit off the ground and gives the plant better shape for harvest.

While tomatoes may be adaptable, it does not keep them safe from a whole group of pests and diseases. Tomatoes are a favorite to aphids, cutworms, and mites but especially hornworms and fruitworms. Control methods should begin immediately at any sign of damage. There are several organic and non-organic options for however someone decides to control a tomato pest. There are too many diseases to count that target tomatoes, including fungi, bacteria, viruses, and nematodes. However, most if not all can be prevented by providing proper growing conditions for the tomato to begin with. (Swaider and Wade, 2002)

Figure 2 (Westphal)

Here you can see tomatoes come in all shapes, sizes, colors, and are an extremely diverse crop.



One final interesting fact is that depending on the balance of sugars and acids in the fruit itself, tomatoes can have varying degrees of intensity, sweetness, and meatiness (Bennett, 2012). Depending on the health of the plant during the growth season and the cultivar, tomatoes can be sour, sweet, or even beefy. Most consumers are turned off to the idea of eating a raw tomato;

however, many heirlooms have a tomato flavor that most store-bought tomatoes can't even dream of competing with.

Tomatoes are a popular and relatively easy plant to grow in the home garden or even in the field. While also being America's number one vegetable, tomatoes have maintained diversity almost unmatched by any other vegetable. As seen in Figure 2, tomatoes come in a rainbow of colors, shapes, and sizes. While they are a host to numerous pests and diseases, tomatoes are a hardy and adaptable plant capable of producing fruit just about anywhere. Harvest can be simple as hand picking when ripe or even letting machinery do the work. If someone is looking for a wonderful vegetable that can be used in a variety of ways, turn no further than to the tomato.

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Ipomea batatas - Sweet Potato

Kai Metcalfe

Background

Ipomea batatas is commonly called sweet potato. Sometimes they are mistakenly called yams, but yams are in another family and thus distinctly different. Sweet potatoes are in the family Convolvulaceae. The plant has a perennial life cycle but is grown as an annual in cultivation. They have a prostrate, vining growth habit and often form feeder roots where the vines touch the soil. The leaves are heart shaped and can come in a range of colors depending on the cultivar and intended use. Some ornamental varieties have very distinctive, interesting foliage. It's not common to see flowers forming in cultivation but when they do grow they resemble that of a morning glory. The root system is adventitious and can reach depths of 6ft (Swiader & Ware, 2002). Each plant forms 4-10 fleshy, tuberous, fusiform (tapered at both ends) roots depending on the cultivar and environment. The part of the sweet potato that is eaten is a true root, not an or enlarged stem. The roots have different color possibilities for the skin and the flesh. Skin can be white, red, orange purple or brown and be smooth or ridged. Flesh can be white, yellow, orange or reddish-purple. Different colors and combinations are popular in different localized markets.

Because the plants are very sensitive to chilling they are most easily grown in tropical and subtropical regions, but the ancestry of sweet potatoes is not well known. The center of origin encompasses the warm, general region of Central and South America (Swiader & Ware, 2002). Based on analysis of chloroplast genetics, there seem to be at least two distinct domestication events, one in the north and one in the south (Roullier *et al*, 2013). The root was brought back to Europe with Columbus' return and quickly spread across the continental land mass.

Sweet potatoes are a good source of carbohydrates, dietary fiber, vitamins C and A, calcium and iron (Swiader & Ware, 2002). They are an important tool in ending malnutrition in some countries, especially in Africa. The high concentration of vitamin A and calorie-dense composition, in addition to being tolerant of a wide range of soil types, makes it a staple food in many developing countries in Africa and Asia (Schafleitner *et al*, 2010). The United States only produces 883,099 metric tons per year according to the USDA 2010 census (Table 37) and per capita consumption is only 4.1lbs (Swiader & Ware, 2002). Acres in production and yield per acre have began to rebound in the 1980s after the steady decline following the Great Depression (Lucier *et al*, 2008) and has been growing 6.1% per year on average since 2000 (Johnson *et al*, 2015). Colorado does not commercially produce enough sweet potatoes to be statistically significant but there are short season cultivars that can be successful for the determined, cool climate gardener.

The crop can be cooked and consumed in a variety of ways and there are cultivars bred to be ideal for different methods (e.g. frying, freezing or boiling). These cultivars intended for human use can be further divided into two groups: soft- and firm-fleshed potatoes. Soft-fleshed potatoes usually have darker orange colored flesh and are intended for baking. Firm-fleshed potatoes are best for boiling and have lighter colored flesh (Swiader &



Figure 1 Shows a variety of skin colors and the cultivar associated with the color. <http://www.farm-fresh-produce.com/images/sp/all.jpg>

Ware, 2002). There are also cultivars bred specifically as animal feed. Use in animal feed is becoming increasingly common, especially in China, where approximately 40% of their production is dedicated to feeding pigs (World Sweet Potato Atlas, 2007). These cultivars tend to be very high yielding, high in starch and easy to store.

New cultivars are still being developed. Universities in North Carolina and Louisiana, major production states, have active breeding programs running and have released important large-scale commercial cultivars, such as Covington. They are breeding for typical agronomic traits such as high yield, uniformity and stand establishment but mainly they are searching for disease and pest resistance by returning to genetics found in the center of origin.. There are genetic markers available for use for some traits and a substantial amount of the sweet potato genome has been sequenced. Other breeding possibilities could involve making the crop even more nutrient dense or to create high yielding, cold hardy cultivars to prepare for climate change.

Cultivation

Pre-Planting

Sweet potatoes are very tender and suffer chilling injury at 50°F and growth will be slowed or arrested at even 59°F. They need three to four months of frost free days to be fully mature and of a good saleable size so cold climates like Colorado are not ideal. Significant consideration should be out towards what cultivar, if any, is good for the region you're attempting to grow in.

While sweet potatoes may be sensitive to temperature, they are more tolerant of adverse soil conditions. The crop will grow in a wide range of soils, although they will not necessarily

thrive on all soils. The plants produce the highest quality crop in soils of intermediate texture, with slightly acidic pH (5.5-6.2), and that contain a low percentage of organic matter (Swaidar & Ware, 2002). Heavy soils produce rough, misshapen roots with a high risk of cracking. Too light of soils will result in long, smooth, very slender roots. A high percentage of organic matter in the soil can have the same consequences. Drainage is another key factor in producing beautiful sweet potatoes. Soils with poor drainage can also cause the roots to be misshapen and cracked. This requirement manifests as cultivating the plants in mounded rows, similar to strawberries. This way drainage can be more actively controlled.

Finally fertilizers and pre-plant soil based treatments for diseases, insects and nematodes must be applied. If there is a history of soil-borne funguses in the area a fungicide should be applied before planting. A soil test will be needed in order to determine how much of what type of fertilizer to apply. Contact your local extension office for application rates.

Planting

Most commercial farms plant “slips” instead of direct seeding or seed potatoes but fields can also be planted with stem cuttings. The plant’s vigor is variable depending on where on the parent vine the cutting was taken from. Stem cuttings are less expensive and less likely to spread disease or pests but they require a longer growing season than slips (Swiader & Ware, 2002). The slips are adventitious shoots that form their own roots and become separate, self sustaining plants. Mother plants can be held in specific conditions to encourage the growth of

slips. The slips should be planted after the fear of frost has gone and the soil has warmed to around 65°F or warmer. In-row and between-row spacing is highly variable depending on cultivar. For more spreading cultivars larger spaces are needed between plants. The size and uniformity of the harvested root is more dependent on consistent in-row spacing than between-row spacing.

Planting from slips can speed up the growing process but can also be a big source of headache if not properly sourced. Sweet potatoes are notorious for having many mutations on vegetative clones so it’s very possible to end up with off-types in your stand. Buying certified slips assures you that they were carefully selected based on the foundation seeds definition of the cultivar and, possibly more importantly, that they are free of diseases, viruses and pests. Because sweet potatoes are planted from vegetative propagules, planting isn’t very automated. Fields are often planted by hand or with the aid of precision planters.

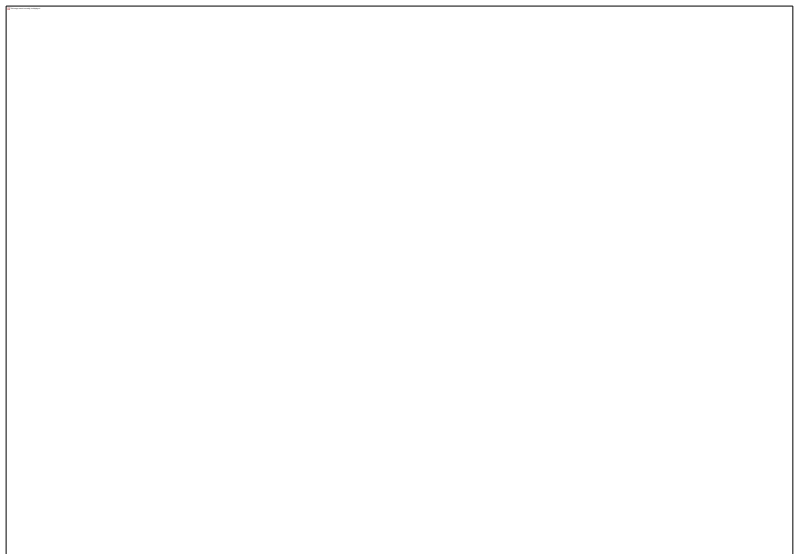


Figure 2 - sweet potatoes growing slips (Morris, 1995)

Care

The plants have noticeable drought tolerance because of an extensive root system. They need only 1-1.5" of water every 7-10 days (Swiader & Ware, 2002) if it's hot and may need even less than that depending on local temperatures and precipitation (about an inch every three weeks according to Kemble *et al*, 2006). Water can be given through drip tape and other surface delivery methods or overhead sprinklers. Most large scale farmers prefer surface watering because watering in a limited area also limits weed seed germination. Overhead sprinklers can also increase the risk of foliar diseases with excess water on the leaves. Overwatering can be supremely detrimental to the roots, causing cracking, roughness and unmarketable shapes/sizes. The last month to 40 days are the most critical to forming a saleable crop. Giving the plants less water at maturity keeps the roots from cracking and helps to condition them before being harvested. In addition to water the plants may need more nutrients. Sweet potatoes are moderate feeders and fertilizer applications will vary depending on region and soil type.

Diseases, Pests & Weeds

Many of the major diseases that sweet potatoes suffer from have resistant cultivars. Most insect pests do more damage to the foliar, above ground parts of the plant than the root. Weeds aren't much of an issue once the vines establish themselves and shade the weeds out. Overall, sweet potatoes need minimal management if the site is prepared well before planting.

Some of the major known diseases that have above- and below-ground symptoms include black rot (*Ceratocystis fimbriata*) and stem rot/*Fusarium* wilt (*Fusarium axysporum* f. *Batatas*). Some diseases don't have above ground symptoms such as scurf (*Monilochaetes infuscans*) and root rot (*Phymatotrichum omnivorum*). There are no known methods of controlling root rot, but a hard freeze will kill it (Swiader & Ware, 2002). There are some diseases that are specific to storage and handling like soft rot (*Rhizopus stolonifer*), Java black rot (*Diplodia gossyina*) and charcoal rot (*Macrophomina phaseoli*) (Kembel *et al.*, 2006). Disease management should include careful cultivar selection and clean up at the end of each season. If a cultivar is selected based on resistance to common diseases in the area, there are bound to be fewer problems during the growing season. Plant matter left in the field to decay serves as an overwintering location for many of the above fungi so cleaning it up at the end of the season prevents it from lingering into the following. A three to four season crop rotation system can help prevent accumulation on plant matter in fields. Additionally, fungicides can be applied to the soil before planting. Diseases that primarily happen in storage and handling can be managed and reduced by using proper techniques aimed at not damaging or puncturing the skin in any way and keeping sanitary facilities (Stoddard *et al.*, 2013). Nematodes can also be an important pest. Management is similar to that of other soil-borne pests but there are no known resistant cultivars.

Most insects are nothing more than a nuisance for sweet potato farmers but the sweetpotato beetle (*Cylas formicarius elegantulus*) is one that causes the most damage (Kemble *et al*, 2006). Sweetpotato beetles feed just below the skin of the root and lay eggs, hatch and mature in the tunnels. The larvae overwinter in decaying plant matter. Other pests, like wireworms, white grubs, larvae that feed on the roots also overwinter on decaying plant matter which makes clean up doubly important for insect and disease management. There are insecticides that can be applied depending on the insect present and the situation. Although insects are typically not very damaging, monitoring the population and percentage of defoliation is important and should be controlled before it reaches 30% defoliation (Stoddard *et al.*, 2013).

Current research hasn't turned up any known associations between specific weed species and *I. batatas*. Weed management is important in the beginning when the slips are young and no vines have set to help them out compete the weeds. Herbicide may be used at that point to allow the slips to begin growing. Mechanical methods are used as well. Management should be dependant on the species of weed present. Once the vines have set or established themselves they reduce most weed competition by creating a shady canopy over the soil.

Harvest to Market

Harvest

The roots should be harvested once the majority of the crop is of the desired size (usually US No. 1). This takes three to five months or 130-150 days (Swiader & Ware, 2002). Harvest should begin after the vines have begun to decline, since roots will no longer be receiving photosynthates, but before they are already dead since dead and decaying vines are a vector for disease. Special care should be taken to be sure the crop is out before the soil gets cold because the roots are very sensitive and will crack or sustain other injuries from even short exposure to cold temperatures. Check with extension offices for local frost dates. Vines should be cut and removed before harvest to prevent them from getting in the way. Once the vines are cut a moldboard turnplow or middlebuster can be used to turn the potatoes up from the soil to be collected later by hand. There are more automated systems but the risk of puncturing or otherwise damaging the thin skin and risking infections requires human involvement.

Individual roots are usually graded into the following categories: US Extra No. 1, US No. 1, US Commercial and US No. 2 (Kemble *et al*, 2006). The requirements become less stringent on the way down from Extra No. 1 to No. 2. In general the roots should be between 3-9" in length with a diameter of 1.75-3.5" and weigh less than 20oz.

Post-Harvest

If cured and handled appropriately, some sweet potato cultivars can be stored for up to a year. Their long storage life also means they can be marketed and sold easily year round. To

cure the potatoes they should be held at 80-85°F at 85-90% relative humidity for four to seven days. This period of time encourages callous formation to heal wounds, reduces shrinkage and weight loss and improves the cooking quality. Temperatures above 86°F encourage sprouting which renders the crop unmarketable. After the curing period is over the crop should be stored at 55-60°F and 85-90% humidity (Swiader & Ware, 2002). The temperature should not be allowed to drop below 55°F or risk of chilling injury increases. Potatoes can be packed into large crates, still being handled gently to prevent punctures and other damage, for long term storage. Only about 25% of the US crop of sweet potatoes is processed further, the majority is sold fresh.

Marketing

Sweet potato production was valued at \$478 million in 2010 (USDA 2010 Census, Table 22). Come market time there are an abundance of packaging options but the roots almost always come washed. Packaging options range from 15lbs mesh bags to individually wrapped sweet potatoes. Some companies package them in microwave safe bags to be cooked in their packaging (Stoddard *et al.*, 2013). The bulk of sweet potato sales happen in November and December in the US, around the holiday season. Sweet potatoes are heavy so transportation can get expensive. They should not be transported with ripening fruits because the ethylene gas given off will cause a darkening and pithiness inside the root.

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Photos

Figure 1 <http://www.farm-fresh-produce.com/spvarieties.html>

Figure 2 <http://www.motherearthnews.com/organic-gardening/sweet-potato-slips-zmaz85mjzraw>

Cayenne Peppers

Rachael Morris

Cayenne chili peppers, also known as Guinea peppers or red hot chili peppers, belong to the plant family Solanaceae, known as nightshades, which also includes tomatoes, potatoes, and eggplant. (Hot - 2016, Swaider and Ware – 2002). They are a member of the genus and species *Capsicum annuum*, and are a subgroup of the *Anaheim chile* group.



Figure 1: 'Joe's Long Cayenne' cultivar (Heirloom – 2016).

Enjoyed fresh, in salsa or hot sauce, or dried and ground as a spice, cayenne peppers can be a mainstay for delicious meals, classifying them as a vegetable in horticultural terms. Although many people traditionally think of cayenne peppers as red, they are edible as green fruit, which eventually ripen to red. In addition to their tasty nature and colorful appearance, cayenne peppers are considered easy to grow, so it's no surprise that the CSU Extension states that peppers are second only to tomatoes as one of the most abundantly home-grown vegetables (Aegerter – 2010).

Origins

A "New World" crop, cayenne peppers claim their origin in South America, where they have been used by native Americans for both dietary and medicinal purposes. Only being globally dispersed after the discovery of the Americas by Europeans in the 15th century, hot peppers such as cayenne gained popularity in Europe quickly, and soon were used widely in fresh and

dehydrated form as a spice. This trend continues today, as cayenne is one of the most commonly used chiles for dehydration (Swaider and Ware – 2002).

Cultivar Specifics

Although a member of the *Anaheim chile* group, cayenne fruits “are more slender and rounder, characteristically wrinkled and irregularly shaped, thin-walled, and highly pungent” (Swaider and Ware – 2002). Many different cultivars exist, with four separate examples – ‘Cheyenne’, ‘Red Flame’, ‘Red Rocket’, and ‘Bankok’ – being listed in one seed catalog alone (Hot - 2016). Most are high yielding, with about 80 average days to red ripe fruits. See Figure 2 for images.



Figure 2: Three cultivars from Johnny's Selected Seeds 2016 Catalog. From left to right: 'Red Rocket', 'Bankok', 'Cheyenne' (Hot – 2016).

A warm season crop, cayenne peppers have tropical origins and perform best when air temperatures average above 75°F. Planting should not be done in early spring, but instead when constant warm evening temperatures stay above 70°F. Warm evenings are of significant importance to chili pepper varieties, which are extremely chill sensitive (Swaider and Ware – 2002).

For Colorado production specifically, planting transplants or utilizing plastic much with direct seeding is preferred to keep soil temperatures sufficiently warm (Aegerter – 2010). Transplants

should be set about 24 inches apart, fertilizing at planting and again a month later. Treatment of the plants throughout the growing season can alter their hotness – minimal irrigation and fertilizer, in combination with hot dry weather promotes capsaicin production in the fruits (Cox – 2010). Although these conditions are available in Colorado only during the mid-summer months, there is plenty of time in the growing season to produce an abundant harvest!

Harvest and Storage



Figure 3: 'Red Flame' cultivar (Hot – 2016).

Harvest fruits when desired color and size have been achieved. This will vary between cultivars, but red chiles should be ready in Colorado around September (Cox – 2010). Peppers destined to be sold fresh at the market or in the home garden are harvested by hand, using a sharp knife to prevent plant damage (Aegerter – 2010). Cayenne peppers that will go for

further processing are mechanically harvested, sometimes with a “once-over destructive harvest” (Swaider and Ware – 2002).

Fresh cayenne peppers should be stored at refrigerated temperatures, around 45°F, as they are subject to chilling injury if subjected to lower temperatures (Swaider and Ware – 2002). To dry cayenne, stems are tied together with wire. This bundle, called a “ristra” can be hung outdoors in full sun, where the peppers are allowed to dry (Cox – 2010). Dried chiles can then be ground into a powder to be used a spice.



Health and Marketing

Capsaicinoids are the alkaloid compounds responsible for the spicy and pungent flavor complex of peppers. Two major capsaicinoids have been isolated, with capsaicin being the more researched and marketed compound. Research has led to the output of many health claims surrounding the consumption of capsaicin, including anti-carcinogenic and anti-inflammatory affects, improved metabolism, antimicrobial use, and protection of gut mucosa (Barbero, et. al – 2014). Of these, the marketing of capsaicin as a metabolic and weight loss aid may be the most widespread. In fact, so well accepted is cayenne pepper's effect on heightened metabolism that millions of people have voluntarily forgone food for weeks in favor cleansing methods consisting of only lemonade and cayenne pepper, which promise dramatic weight loss results (Olaski)!

How Hot is Hot?



Invented in 1912 by pharmacist Wilbur Scoville, the Scoville scale is used to rank the heat index of hot peppers. Peppers' relative hotness is measured in Scoville heat units, or SHUs, which is based on how much solvent it takes to dilute a pepper's taste to a human tongue (Greenway – 2013). The range goes upwards of 2 million units, with the average cayenne coming in around 30,000 to 120,000 SHUs (Reschke).

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Fact Sheet: Tomatillo

Erika Peirce



Introduction:

The tomatillo is a very fascinating and underestimated warm season vegetable. It needs warm air and soil temperatures in order to produce high yields, making it a warm season vegetable. Its center of origin is in Mexico. A center of origin is where it originally came from and was cultivated. The tomatillo was originally domesticated by the Aztecs (Staff, 2015). It is often also called Mexican husk tomato. Even though it is also in the Solanaceae family it is not a tomato.

Growing Tomatillos:

Tomatillos need full sun and well drained soil. Tomatillos are very sensitive to frost damage so be sure not to plant them in any low lying areas that are subject to early or late frosts. In addition to frost



Figure 1: Tomatillo plant.
<http://www.cellerdelaspic.com/upload/img/ayfTvYiGFd-max.jpg>

damage tomatillos are subject to heat damage as well. If it is too hot during flowering it could result in poor fruit set.

Tomatillos main pests include aphids, European corn borer and various types of fruit worms.

Overall tomatillos have proven to be very disease and pest tolerant (University of Kentucky, 2012).

Storing, Preparing and Using a Tomatillo:

To ensure your tomatillo lasts

long it can be stored at

temperatures above 41°F, any

colder than that will result in

chilling damage (University of

Kentucky, 2012). In addition to

keeping the tomatillo cold be

sure to keep it away from any

sources of ethylene as exposure

can result in undesirable color change.

To prepare a tomatillo one must first remove the outer husk and rinse the tomatillo inside.

After a tomatillo is prepared it can be used in various different ways. It is typically made in

to a salsa verde, which can be made spicy or mild. Tomatillos are often fried with cornmeal,

eggs and olive oil. As well as this they are used in stews, sauces for meat, jams and

marmalades.



Figure 2: Salsa Verde
<http://shewearsmanyhats.com/wp-content/uploads/2013/06/tomatillo-salsa-14new.jpg>
grious

Fun Facts:

It is believed the reason for the confusion between tomatoes and tomatillos is not just in appearance but the names the Aztecs had for them. The Aztecs called tomatoes xitomatl and tomatillos miltomatl. The Europeans would often shorten both names to tomatl. This is where the confusion is thought to have arisen.

The Aztecs cultivated two species that are still in cultivation today. The two species are *Physalis ixocarpa* and *Physalis philadelphica*. *P. ixocarpa* is the one typically seen in the supermarkets and has fruits around 2 ½ inches in diameter. *P. philadelphica* has fruits that are marble sized (Staff, 2015).

There are not nearly as many cultivars of tomatillo as there are tomatoes but there are still several varieties commonly grown mainly from the *Physalis ixocarpa* species. Cultivars include the 'Cisneros Grande Tomatillo', 'De Milpa Tomatillo', 'Dr. Wyche's Yellow Tomatillo', 'Everona Large Green Tomatillo', 'Plaza Latina Giant Tomatillo', 'Purple Tomatillo', and the 'Tomate Verde Tomatillo' (Southern Exposure Seed Exchange, 2016).

An interesting fact about tomatillos is that they are not self-pollinating like tomatoes are. There must always be more than one tomatillo plant in order for the plants to set fruit. This would make it difficult to grow in a greenhouse unless there are pollinators present. It is difficult to tell when a tomatillo is ripe because they are always green. The ripest tomatillos are the ones that have burst through their husk and show no signs of disease or insect damage.

Health Benefits:

In Mexico the flowers are often used in a concoction to treat diabetes. In addition to this there are many other health benefits of tomatillos. They are packed full of dietary fiber so they are good for digestive help. Fiber can bulk up food to help them through the digestive tract. This eliminates constipation, excess gases and other serious conditions such as colon cancer. Tomatillos contain a distinctive antioxidant phytochemical called withanolides. When colon cancer cells were treated directly with an isolate of withanolides it showed a cell cycle arrest when in the G2/M phase (Choi, Murillo, Su, et. al. 2006). Tomatillos have vitamin C which helps boost the immune system by up regulating the production of white blood cells (Organic Facts, 2016). If you are trying to loss weight tomatillos are a preferred vegetable as they have high-nutrient content, low-calories and low-fat content.

Although there are many health benefits it is good to be aware of the high alkaloid levels in not just tomatillos but all the nightshade vegetables. Eating high levels of alkaloids can cause inflammation in the joints.

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Introduction

With the popularity of biochar (a type of charcoal resulting from pyrolysed biomass (Verheijen et al)) increasing and an entire commercial industry developing from its rediscovery, researchers are examining whether it is the miracle many have been hoping for or if it is too good to be true. There are many theories as well as studies to explain what biochar does to and for the soil.

The ancient addition of biochar to tropical soils in the Amazon Basin has been named “Terra Preta” which is Portuguese for “black soil”. There has been a second, less publicized, area in Northern Germany named “Nordic Dark Earth” that shows very similar soil properties (Wiedner). The soils in these locations were formed thousands of years ago and are more fertile than the surrounding soils. It is clear that the biochar irreversibly changes the soil properties for potentially thousands of years. What is not clear is whether incorporating biochar as a soil amendment has the effects that it is being marketed for. Biochar is being marketed as nutrient storage, beneficial microbe sanctuary, water retainer for sandy soils, aeration for clay soils, and also as a means to sequester carbon from the atmosphere.

Changing the physical properties of the soil may be one of the reasons that the addition of biochar can lead to increased crop yield. In sandy soils, the higher organic matter and increased surface area will lead to increased water retention. In clay soils, the lower bulk density will help with penetration depth in the root zone.

Like high additions of organic matter, the addition of biochar helps clay soils with the problem of too much water and not enough aeration (Lehmann). If the smaller particles of biochar fill the voids around the current soil particles, it will have a negative affect on bulk density and water infiltration (Verheijen et al).

The high surface area, porosity, and PH of biochar have an affect on the cation exchange capacity and therefor-nutrient availability of the soil. The higher surface area increases the available places for cations to bind to. The PH of biochar has a liming effect on the soil and could be the reason for increased fertility in acidic soils since lower PH soils have a reduced cation exchange capacity (Verheijen et al). In basic soils, this PH increase could be detrimental to nutrient availability.

The effect that biochar amendments have on soil microbes has been largely unstudied. The large internal surface area of the biochar particles is believed to serve as a sanctuary for microbes. Lehmann et al found that in most cases, microbial biomass increased with biochar. The exception to this is that mycorrhizae decreased in instances of excess nutrients.

The microbes in the soil play an important role in the carbon cycle by breaking down organic matter. The respiration rate of the microbes releases large amounts of CO₂ back into the atmosphere. Biochar is being marketed as a means to reverse climate change by sequestering carbon in the soil for hundreds to thousands of years. Since it is slow to break down, it will offset the respiration of the soil microbes. Multiple tests in Minnesota showed decreased CO₂ respiration and decreased N₂O production at all concentrations of biochar applications. Only above 20% by weight applications were the reductions substantial (Jha).

A red leaf lettuce and sweet peppers will be grown in treatments consisting of biochar and bloodmeal, biochar, and just bloodmeal. It is hypothesized that the treatment of biochar and bloodmeal will have the highest yield due to the biochar acting as a reservoir for the bloodmeal and slowly releasing it over the growing season.

Materials & Methods

In preparing the beds for this experiment, drip irrigation was turned on before planting to moisten the soil and break up large dirt clods. Each bed was measured and divided into three equal sections.

For each of the first sections, 1.25 cubic feet of medium size biochar from Biochar Now and 10.2 ounces of bloodmeal (12-0-0) were obtained and mixed together in a large container. The biochar and bloodmeal mixture were spread evenly over the top of the beds. A rake was used to flatten the top of the bed, incorporate the biochar mixture to 2 inches, and break up the large dirt clods. This will be referred to as Treatment A.

For the second sections of each bed, 1.25 cubic feet of medium size biochar from Biochar Now was applied evenly without bloodmeal. These sections were then raked to flatten the top, incorporate the biochar to 2 inches, and break up the large dirt clods. This will be referred to as Treatment B.

The third section had 10.2 ounces of bloodmeal (12-0-0) applied evenly to it with no biochar. A rake was then used to flatten the top of the bed, incorporate the bloodmeal, and break up the large dirt clods. This will be referred to as Treatment C.

Lunchbox Snack Pepper mix seeds were obtained from Johnny's Selected Seeds and 100 seeds were planted into flats approximately 1/4 " in OMRI approved soilless potting mix in 72 trays on June 14th. The flats were then watered and left to germinate in the greenhouse.

New Red Fire leaf lettuce seeds were also obtained from Johnny's Selected Seeds. Only 204 seeds were planted at 1/8" deep in flats, due to running out of OMRI approved soilless potting mix on June 22nd. The flats were watered and left in the greenhouse to germinate. For comparison and demonstration purposes, an adjacent bed was direct seeded at approximately 6" apart for the length of the bed. This bed received 30.6 ounces of bloodmeal (12-0-0) prior to planting.

By June 22nd, approximately 75% of the peppers had germinated. By June 28th, the cotyledons of the majority of the lettuce had emerged (see Image 1), both in the greenhouse and out in the field. On July 5th, the lettuce from the greenhouse was transplanted into the bed at approximately 6" spacing. The peppers were transplanted into their bed at approximately 18" spacing. Weeding was accomplished weekly and drip irrigation was accomplished twice a week. On July 17th and 18th, a rogue flock of Canadian Geese ate nearly all of the lettuce down to approximately 1/2" above the soil surface. On July 19th, fish emulsion (5-1-1) was applied at a rate of 2 Tbsp./Gal of water. Each treatment received 1 gallon of fish emulsion solution for a total of 3 gallons per bed. Bird netting was also installed on this day to prevent further theft. Harvest and data



Image 1: Lettuce Cotyledons emerged

collection was conducted on August 4th (see Image 2 and Image 3 for lettuce prior to harvest).

Results

On August 4th, 10 heads of lettuce were harvested from the center of each treatment. The root ball was left intact and they were rinsed thoroughly. Excess water was shaken off of the heads and they were kept in a refrigerator at 40 degrees Fahrenheit when not being weighed and measured. Height measurements were taken from where the soil surface originally was to the top of the highest leaf as it sits naturally. Leaves

were not bunched up towards the center to get the height measurement. Refer to Table 1, Table 2, and Table 3 for height and weight data for each treatment. No data was collected on the peppers due to the fact that no peppers were produced by August 4th

Treatment A		
Head Number	Weight (lbs)	Height (inches)
1	.09	4.5
2	.19	5.25
3	.09	4.75
4	.16	5.75
5	.10	4.5
6	.15	5.5
7	.17	5.75
8	.15	5.5
9	.13	5.0
10	.19	6.0
Average	.14	5.25

Table 1: Treatment A height and weight data

Treatment B		
Head Number	Weight (lbs)	Height (inches)
1	.06	4.0
2	.02	3.75
3	.06	3.5
4	.04	4.0
5	.05	4.0
6	.09	4.75
7	.03	3.75
8	.05	4.25
9	.03	3.0
10	.04	3.5
Average	.047	3.85

Table 2: Treatment B height and weight data

Treatment C		
Head Number	Weight (lbs)	Height (inches)
1	.12	5.0
2	.12	4.75
3	.11	5.0
4	.06	4.0
5	.08	4.5
6	.05	4.75
7	.10	4.0
8	.08	4.25
9	.09	5.0
10	.08	4.5

Average .089 4.575

Table 2: Treatment C height and weight data

Discussion

Due to the low vigor of the pepper seeds, very few plants survived. The growth of the ones that did was not acceptable. No peppers were harvested for data collection. This cultivar is not a good choice for growers. From a visual inspection, there seemed to be little difference in the size of the heads of lettuce between each treatment. After weighing and measuring heads from each treatment, it became clear that the average heights and weights from the treatments were drastically different. The average weight of each head in Treatment A was .14 lbs while it was only .047 lbs for treatment B and .089 lbs for treatment C. Treatment A had an

average height of 5.25 inches while treatment B was 3.85 inches and treatment C was 4.475 inches. Treatment A was over 10% greater than treatment B and C in both height and weight. This shows that there is a significant difference. If the microbial communities in and around the biochar were responsible for the yield increase, yield increases would've shown up in Treatment B as well as Treatment A. This was not the case, however. If the bloodmeal fertilizer had been solely responsible for the increased growth, the growth from Treatment A and Treatment C should've been closer. Since Treatment A had the highest growth, it is most likely that the biochar acted as a nutrient and water reservoir to slowly release nutrients and provide water to the plants on hot days when irrigation wasn't applied.



Image 2: New Red Fire Lettuce before harvest



Image 3: New Red Fire Lettuce beds 2 days before harvest

Globe Artichoke

Brandon Rowe

Introduction

Although most people know it only as an artichoke, the actual common name is

Globe Artichoke (Figure 1). Globe Artichoke's

scientific name is *Cynara scolymus* and it

belongs to the Asteraceae family (USDA, n.d.).

It is grown as a warm season annual vegetable

but it is a perennial in USDA zones 7 and above.



Figure 1. Globe Artichoke

Background

The origin of the Globe Artichoke is believed to be around the Mediterranean region,

most likely Northern Africa. It was introduced to the United States by French

settlers in Louisiana and then taken to California by Italian immigrants in the 1920s

(History, n.d.). Artichokes are a relative of thistle and have been artificially selected



Figure 2: Cardoon Flower & Bracts

from cardoons (*Cynara cardunculus*)

(Figure 2). It is larger and less prickly than

cardoons, which are grown for their stems

and roots (Ravenscroft, n.d.). Currently,

artichokes are named as California's state

vegetable since 99.99% of the United

States' commercially grown artichokes are

grown there (Welcome, 2016). Castroville, CA is the center of the production with the only processing plant in the United States located there (History, n.d.)



Figure 3: Castroville, CA Welcome Sign

Cultivation

In USDA zones 7 and above, artichokes are grown as perennials but they can be grown as annuals in lower

USDA zones. They can be grown from seed, with high variability, but are typically commercially grown from root division so that they are genetically identical.

Compost, manure, or other organic matter should be incorporated into the soil prior to planting. Plenty of space should be

left at planting since artichoke can spread to six feet in diameter when

mature. Artichokes should be

fertilized annually with

approximately 1/10 lb. of Nitrogen

per plant in a side-dressed manner

(California n.d.). They should be



Figure 4: Commercial artichoke cultivation

irrigated at a rate of 3-4 acre-feet of water per season (Swiader, Ware 2002). Apical buds and axillary buds are harvested when immature to ensure tender, non-fibrous tissue. The immature flower buds can be store for three to four weeks at 32 degrees F and 90% humidity (Swiader, Ware 2002)

Consumption

Not only do the apical buds get consumed but the axillary buds do as well, although the axillary buds are smaller. The portion of the immature bud that is typically

consumed is the bract (labeled as leaves in figure...) of the flower. It is also common for the heart of the

artichoke to be consumed. Once the flower begins to bloom, the bracts

become fibrous and unpalatable. In a

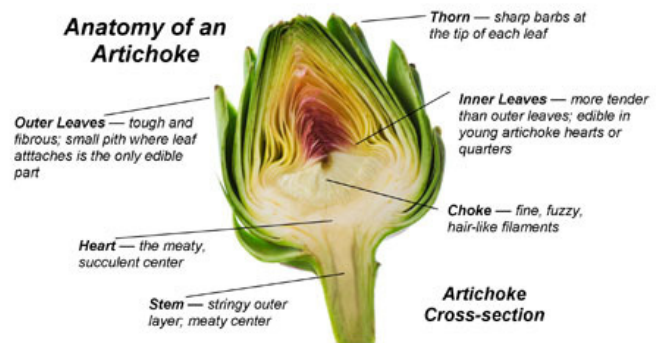


Figure 5: Cutaway view of an Artichoke

single growing season, it is not abnormal to harvest 40 buds per plant (Swiader, Ware 2002).

Fun Fact

In 1935, New York's Mayor Fiorello Enrico La Guardia, temporarily banned

artichoke in an effort to stop racketeering by the

mafia. The underboss from the Morello crime family,

Ciro "The Artichoke King" Terranova, was buying

cases from California for \$6 and pressuring and

intimidating vegetable vendors to buy them in New

York for a 30-40% profit. He even had entire fields cut down in the middle of the night to convince growers to

lower prices. The ban was lifted in 1936 when prices

returned to normal (History n.d.).



Figure 6: Ciro "The Artichoke King" Terranova

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Figure 1:

<http://foodblogga.blogspot.com/2008/04/how-to-clean-cook-and-eat-artichoke.html>

Figure 2:

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Figure 3:

http://www.waymarking.com/waymarks/WM7PA2_Castroville_CA_Artichoke_Center_of_the_World

Figure 4:

<https://ferrebeekeeper.wordpress.com/2013/08/>

Figure 5:

<https://goodnessgreeness.co/tag/anatomy-of-an-artichoke/>

Figure 6:

<http://www.onewal.com/cagedwolves/cw-mugshots.html>

Cantaloupe

Courtnei Shafer

When walking around a farmer's market in the summer, one will see a variety of fruits and vegetables. Some that are familiar, and some that are not. One of the most iconic vegetables seen is a cantaloupe. *Cucumis melo* is an incredibly popular fruit/vegetable in the warmer months. Whether cantaloupe is a fruit or a vegetable has been a debate for years. It is botanically a fruit but grows like a vegetable. This odd piece of produce is in the family Cucurbitaceae which includes squash, cucumbers, pumpkins, etc (nutrition-and-you.com, 2016).

Like these other vegetables, cantaloupes grow on a vine on the ground. Because of its growth habits, cantaloupe is indeed considered a vegetable. Bonnie plants, a website dedicated to growing food, says cantaloupe and honeydew melons usually thrive in warm soil. They say don't plant until the ground temperature is above 70 degrees F (bonnieplants.com, 2012). Cantaloupe thrives in warm conditions and will yield the most in hotter parts of the world. Because of this, cantaloupe is considered a warm season vegetable crop.

Another name for cantaloupe is muskmelon and is often referred to as such. Nutrition-and-you.com states that cantaloupe is thought to have originated either from India or ancient Persia or Africa. Muskmelons have several varieties that are grown all over the planet. But according to the same reference as above, there are 2 main varieties cultivated. These cultivars are the European Cantaloupe and the North American Cantaloupe. These two varieties are very different in shape and appearance.

The cantaloupe is a very tasty and refreshing treat in the summer and one of my personal favorites. One very interesting fact is that no one knows exactly where the crop was first derived. I mentioned earlier its origin but that's just a guess. The cantaloupe has a very mysterious history and no one can pinpoint exactly where it came from. Another fun fact is that it is one of the most popular—and healthy—fruits consumed in the US. According to The Humble Gardener, Cantaloupe is packed with Vitamin A and antioxidants such as beta-carotene, lutein, zeaxanthin and cryptoxanthin. That means protection against colon, prostate, breast, endometrial, lung, and pancreatic cancers. Cantaloupe is full of vitamins and is only 100 calories per melon! (Humble Gardener, 2016).

Although an amazing crop, there are some things to know before growing. Cantaloupes need a lot of water and are very sensitive to drought. Also, it is best to put something up that the vines of the cantaloupe can run on so they can get more oxygen. While running on the ground, the vines don't have much airflow and could possibly die. So some fencing or a stake in the ground should suffice. Another thing to think about before planting is the weeds in your field. It is a good idea to eradicate weeds before planting because with the prostrate vines, it could be very hard to maneuver around them to pull weeds. Cantaloupe has two flower types, male flowers and complete flowers (having both male and female parts). Cantaloupe flowers have a pollination window of one day. Pollen must be transferred from the male flower to the female flower on this day for seed set and fruit development (Karl Ford and Jill Mackenzie, 2009). Bees are a massive aspect of pollination for cantaloupes and are almost a necessity.

After the season is over, cantaloupe will tell you when it is ready to be harvested. Bonnie Plants states at the stem, a crack appears that encircles the base of the stem. A ripe melon should detach from the vine itself. This means that as soon as you see the crack start to appear, the melon is ready to harvest. Muskmelons don't take a long period of time to ripen. Most of the time, it will only take about 3 to 4 weeks and once one ripens, the others shouldn't be far behind it. After harvest, Nutrition-and-you.com explains that at home, place them in cool, well-ventilated place. Cut sections, however, should be kept inside the refrigerator. (Anonymous, 2011).

Cantaloupe has been enjoyed for generations but since 2011, cantaloupe consumption has greatly decreased. In 2011, many of Colorado's own Rock Ford cantaloupes had been infected with the Listeria Bacteria. This caused many people to get sick and it made new worldwide. According to the CDC, the total number of outbreak-associated illnesses was 147 people and 33 deaths were reported to the CDC. Listeria is a type of bacteria that can be spread with the consumption of infected foods. The CDC also states that people with Listeria usually has fever and muscle aches, sometimes preceded by diarrhea or other gastrointestinal symptoms. Listeria can also be detrimental to pregnant women. It can lead to miscarriages and stillbirths. (CDC, 2016) This infectious outbreak ended in October of 2011 and the cantaloupes were recalled. Figure 1 on the next page shows the number of people affected by the outbreak. After this incident, many people were very skeptical about eating cantaloupe and sales went way down for this melon.

Cantaloupe is slowing back on the rise in sales and people are more likely to eat this fruit now than they were a few years ago. This melon is still one of my favorites and will always be a great snack in the summer. All in all, the Muskmelon is one of the most interesting crops and it has so many aspects to discover.

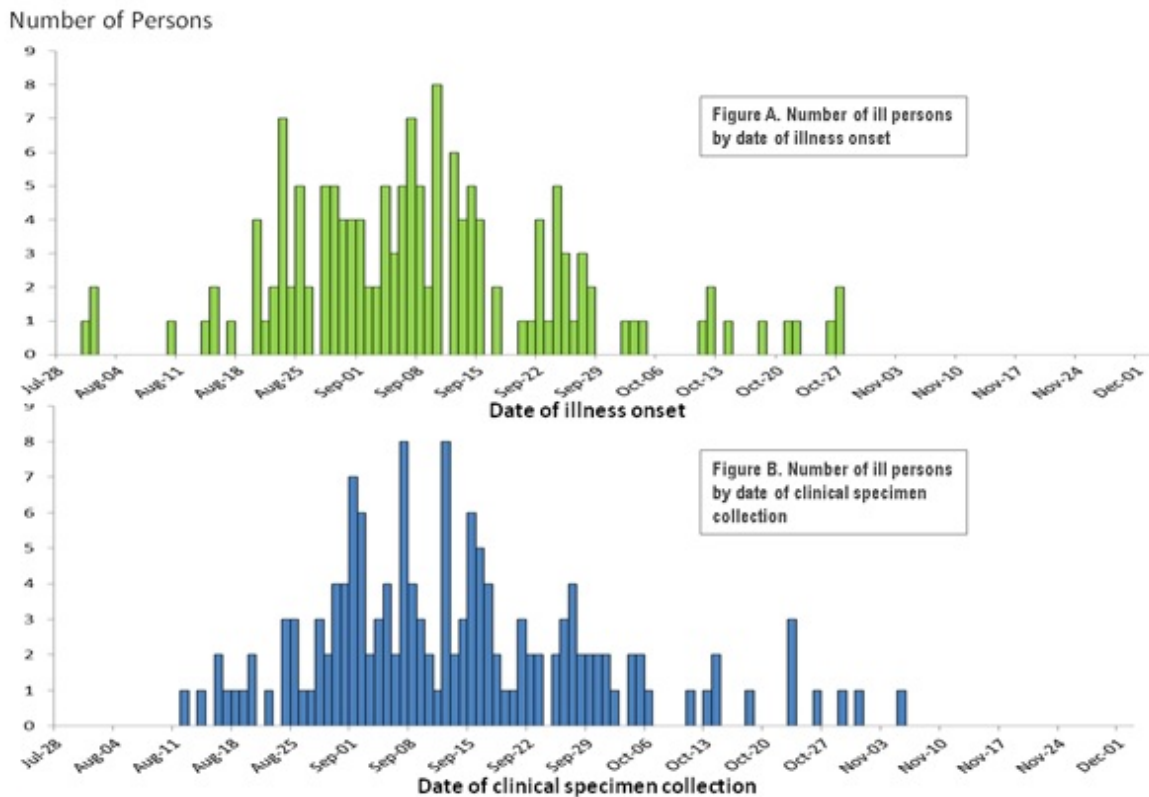


Figure 1 : Listeria outbreak info courtesy of the CDC (Anonymous 2012)



Image 1 : *Cucumis melo* courtesy of Google Images (Caitlin Covington 2016)

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TYPE:	SCOVILLE HEAT UNITS:
Habanero	200,000 - 300,000
Chiltecpin (round)	70,000
Tabasco	30,000 - 50,000
Chiltecpin (long)	40,000
Cayenne	35,000
Serrano	7,000 - 25,000
Jalapeno	3,500 - 4,500
Poblano	2,500 - 3,000
TAM Mild Jalapeno-1	1,100 - 1,500
Anaheim	1,000 - 1,400
Bells, Pimientos	0



Figure#2: The 'Carolina Reaper' Hottest pepper on earth (@Crazyhotseeds,2016)

of peppers (Armstrong, 2012)

Figure#1: Different Scoville Heat Units of certain types



Figure#3: Peppers in a garden bed, about ready to be harvested. Spaced evenly and staked (Martin, 2015).

Pepper Fact Sheet

By Matthew Sisneros

When people think about fruits and vegetables, there are many that come to mind, but none better than peppers. Peppers (e.g figure#3) are a warm season crop that can only thrive in a temperature that is greater than 65 degrees and less than 86 degrees (Bird, 2015). However, is a pepper really a vegetable? This applies to a culinary approach, a fruit is more sweet, and a vegetable is more savory and less sweet. Therefore, peppers are vegetables, based on flavor. The placement of the seeds (inside the pod) of a pepper is why scientists consider peppers to be a fruit, but as consumers, we use them as a diverse and delicious vegetable that can compliment almost any plate of food. In this fact sheet we will be discussing a few variables of this highly valued fruit, the pepper. There are a number of different varieties; and levels of spice that each type of pepper can bring to the table, this is important to know since everyone who cooks needs to know what type of pepper to use to properly compliment their meal. Also, this paper will include the different medicinal values, as different species are able to provide different benefits than the others. This is important to know for anyone looking to have their own greenhouse or just wants to grow the plant, this way none of the pepper will go to waste if it is not able to be eaten in time. Lastly, it is essential to have knowledge of where our food comes from and how it is being processed. The type of food that we are allowing to become a part of our daily diets can make a big difference on our every

day health and well-being. After this fact sheet people will look deeper into the Solanaceae family, which peppers are apart of, and understand why they are so involved in our everyday lives.

The *Capsicum annuum*, or what we all know as the pepper, was discovered 500 years ago and are widely used World Wide (Eshbaugh, 1993). Everyone uses peppers to some extent, and after much debate it seems as though the origin of the pepper came from Latin America (Eshbaugh, 1993) It has also been hypothesized to originate from Bolivia, but there is not enough information to support this idea. Since we cant determine, for sure, where peppers came from, there are a number of varieties. Every pepper is categorized into two different types. There are the sweet peppers, and hot peppers. An example of each are the typical bell pepper, which is a sweet pepper, and a jalapeño, which is a hot pepper. These two are the most commonly known and used pepper in the kitchen today (Albert, 2013). However, what a lot of Americans do not know is the number of different varieties, and cultivars, that are able to add that extra flavor that these two peppers are not always able to give. Sweet peppers have many cultivars, there are the 'California Wonder', 'Corn di Toro' or 'Yellow Bulls Horn', and then there is the 'Early Pimiento'. Each of these peppers have different flavors or are just heavy yielders in the garden. For example, the 'California Wonder' is a pepper that is tender, and provides a juicy sweet with a hint of pungency, so it is great for cooking, or adding more flavor to a dull meal. The Yellow Bulls Horn is a spicy flavor, but not very hot or even very sweet, so it may be considered to be an extra vegetable just to add to a meal as a filler just to have your daily servings of vegetables. Next, we have the 'Early

Pimiento', which is not much of a kitchen favorite, but is great for the garden, it has higher yields, and is resistant to most diseases (Albert, 2013). Hot peppers are usually sought out more by consumers since most people seem to want to see how far they can push the limit on the level of heat their bodies can withstand. A few peppers that stand out are the 'Anaheim' pepper, the 'Cayenne Long Slim' pepper, and the extra hot pepper, the 'Carolina Reaper'. The 'Anaheim' pepper is more of a moderately hot pepper that is used in canning, drying and frying, it is a pepper that is grown mainly in California and the southwest US, which is widely used for extra spice. Next, we have the 'Cayenne Long Slim' pepper, this is not for the faint hearted since it is considered to be very hot. It is very popular throughout the United States and many other countries. Lastly, we have the reaper, or 'Carolina Reaper' (e.g. figure#2). This is a pepper that was bred for heat and surprisingly good taste (@Crazyhotseeds, 2016). It is a cross between a Pakastani Naga and red habanero pepper which are both very hot on their own. To put this unforgiving pepper into perspective, the 'Carolina Reaper' sits at an astounding 2,200,000 SHUs, which are measured in Scoville Heat Units (@Crazyhotseeds, 2016). Comparatively, a 'Jalapeño' (e.g. Figure#1) only sits at a 10,000 SHUs (Martin, 2015). This is astounding to know that a pepper can be this hot, if grown properly.

Gardeners should know that we get out of our plants, what we put into the plant, and proper care is an essential part of the development and growth of these fruits. When planting peppers, there is not a big difference between planting hot peppers or sweet peppers. Each needs full sun, they need to be planted early spring or late winter to harvest midsummer or early fall. They do not need much spacing since they mostly

grow vertically. Once they are ready to grow bigger, peppers can be spaced into their own pots with a prepared soil, that grow in an area that gets no hotter than 70 degrees during the day and 60 degrees during the night (Newman, 2014). The only difference between the hot pepper and the sweet pepper is that the hot peppers tend to be a little bit smaller, so they can be spaced even closer to one another without causing any sort of interruption in growth to either of the plants. When developed properly, peppers have properties to help people certain medicinally (Swiader, Whittaker, 2002). Peppers are built with a bitter alkaloid called capsaicin, this is what gives peppers there hot taste, as well as provide humans with a powerful painkiller. It works by depleting the nerve cells of the chemical neurotransmitter which sends pain messages to the brain(Swiader, Whittaker, 2002). Along with that, these powerful fruits provide people with vitamins A, C, and mineral salts which aid in providing us with daily nutrition and vitamins we need to keep our immune systems functioning at a strong rate. As a bonus, peppers can also stimulate the appetite and help with digestion. Many people in the world need this knowledge to know that they do not need to use medicines, just use peppers as a productive and healthy alternative. For these medicinal values alone, people need to learn how to grow these plants properly to sustain a healthy lifestyle and use natural medicines to aid in regenerating our bodies on a daily basis. That is why it is a good idea to know where your food comes from and how it is being grown as well.

Regardless of what people may think of the superstores like Walmart, some are not all bad. Honduras and Walmart recently implemented a farm-to-market value chain approach in the year 2000 (Painter, 2009). It enables 100 farmers to provide Walmart

and Honduras, and other regional stores, with more than 60 percent of their produce, which includes peppers. These sales generate more than \$780,000 in new farmer revenue each year. This approach has enabled farmers to respond to market demand, as well as diversifying their product offerings, in turn, improving the quality and supply dependability (Painter, 2009). By doing it this way farmers are able to lower unit production costs as well as using low-cost technologies and sustainable farming practices. Also, Walmart has come up with another approach which is finding a lead farmer that is willing to take charge of the practices in the type of farming that Walmart is willing to pay top dollar. Walmart even pays this farmer more money to use a safe and effective agricultural practice to improve yields and sales with using as little conventional methods as possible. According to this article, as consumers we can trust Walmart to pay extra money for high quality foods. Walmart is showing how to lead by example. It is comforting to know that such a superstore, like Walmart is trying to lead by example in an unselfish way. Overseeing consumers products and the way they are being grown. Widely used products, like peppers, especially since they have been used by almost every person, WorldWide.

From garden to retail to your table, peppers are very important, and can provide many of your needs, as long as they are grown properly. There has always been a big demand for peppers in restaurants and at home, in 2014 american consumed 10.6 pounds of bell peppers and 7.2 pounds per person (Naeve, 2015). If people need to get high yields there are numerous things that they need to know. The benefits can be very large if a person grows them properly. These facts can help you very much to aid in what cultivars you want to grow, since you need to know why you are going to use

them. It is always a good thing to use a natural type of remedy without any known side effect within a proper usage, like anything else. Also, people need to understand where their food is coming from, how they are growing the produce and who is benefiting from the money the consumer is spending to provide daily nutrition. These are just a few things that can help people to know what they are getting involved in when they look to buy or grow peppers for any of their needs.

This fact sheet should be used to provide a future filled with a crop that is very rewarding when done right. For that reason I chose peppers, and hope that anyone that reads this feels the same way that I do after learning the many benefits.

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Cassava, the Carbohydrate Dynamo

By Deborah M. Stewart

Dr. Mark E. Uchanski

Hort 455-B

Fall 2016



Figure 1: Cassava, complete plant.

Introduction

Cassava, as seen in Figure 1, is a major food source, providing one third of the carbohydrates consumed in the human diet, worldwide (Coleby-Williams, 2010). Cassava is member of the Euphorbiaceae, or Spurge Family, *Manihot esculenta*, and classified as a warm season plant (Swiader & Ware, 2002). In 1982 a wild population, morphologically identical to *Manihot esculenta*, was discovered in Brazil (Hillocks & Thresh 2001) (Swiader & Ware, 2002). Thus Cassava officially became a “New World” crop.

Cassava is winter drought tolerant, while having the ability to withstand strong summer rains. Cassava is however frost sensitive and therefore it is not generally grown in the northern hemisphere. Cassava is a major crop in sub-tropical regions. I became interested in Cassava when a community in Haiti, Croix due Bouquet, which I've had the privilege to work with for almost 30 years, developed an interest in Cassava. This community indicated their desire to grow Cassava as a cash, and food crop in land that we are developing there. They have food production on only a small portion for their five (5) acres, (they use "acres" and not "hectares" in Haiti). We have a program in development to fully utilize the entire acreage. This program will incorporate Cassava.

Methods & Materials



Stock image
Figure 2: Propagation

Growing: Cassava is grown through propagation. Stems are generally cut in 30cm lengths and either planted where adequate nodes are above the soil surface, figure 2, or laid upon the ground, lightly covered with soil, then sprouted parts are separated and planted in the soil (Hillocks & Thresh 2001) (Coleby-Williams, 2010). Because Cassava is tolerant of poor soils, it is generally

not planted in the richer soils. The richer soils are most often saved for cash crops that are less tolerant of these poor soils.

Yields are about 5 to 20 tons in poor soils and can increase to over 60 tons per hectare in more fertile soils. Cassava prefers light sandy loams, with proper attention to best cultivation practices, as seen in Figures 3 and 4, (FAO Agricultural Services Bulletin no 8, 1977).



Stock images

Figure 3: Cassava plants in field



Stock images

Figure 4: Cassava root harvest

Disease and Pests

Viral: Mosaic, brown streak and leaf curl.

Bacterial: Bacteria such as *Phytophthora manihoti* may attack roots, stems and or leaves.

Insects: Direct attacks by locusts, beetles and ants or indirectly by the transfer of virus by aphids,

Animals: Predation by rats, goats and wild pigs (FAO Agricultural Services Bulletin no.8, 1977).

Preparation



Stock image

Figure 5: woman preparing Cassava roots

Great care is required in preparation. All parts of the Cassava are high in Prussic acid and at the highest levels can be lethal. These levels can be especially high due to drought stress (FAO Agricultural Services Bulletin no.8, 1977).

The tuber is boiled, drained and then prepared for consumption, as seen in figure 5. The leaves contain a high amount of protein but also require boiling or steaming prior to ingestion (FAO Agricultural Services Bulletin no.8, 1977). Unfortunately this may preclude the above ground biomass from being used for animal forage.

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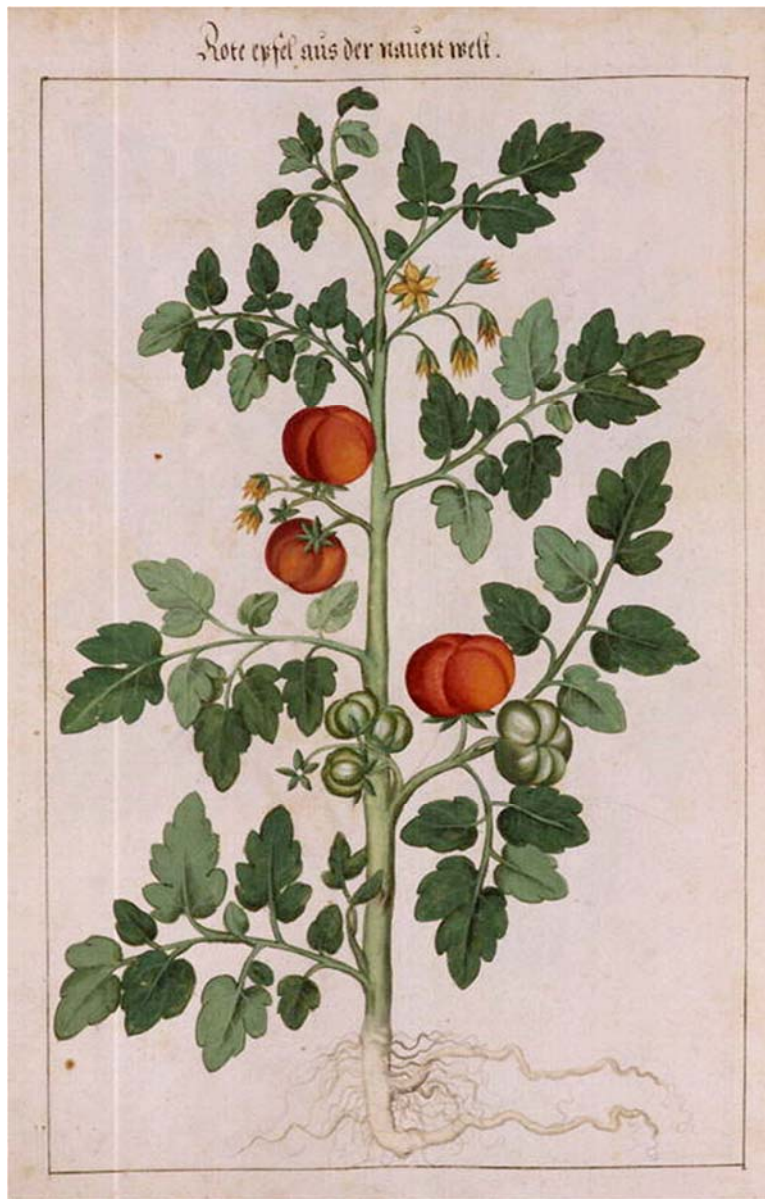
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The Tomato: Vegetable. Fruit. Annual. Perennial. Boundary Breaker.

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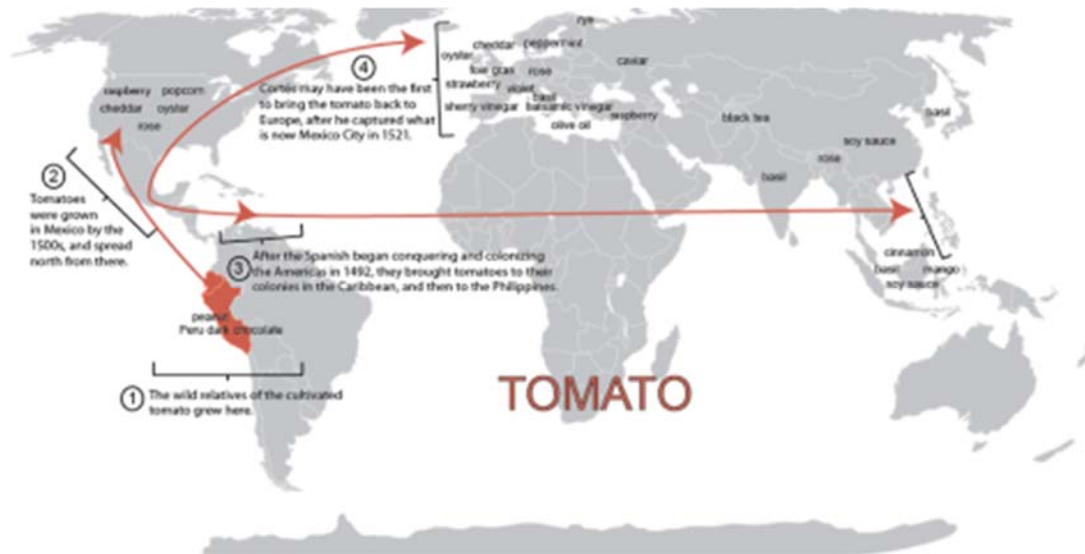
(<http://www.loc.gov/exhibits/dres/dres1.html>)

Botanically, Solanaceae *Lycopersicon lycopersicum*, also known by its common name the tomato, is classified as a fruit due to its development from the plants ovary. However, commercially and legally this plant is treated as a vegetable crop, as well as in culinary settings (Swiader, 539). The tomato is a herbaceous perennial when it is grown in its native habitat, but is grown as an annual in the United States and other places where the plant has to contend with frost conditions (Swiader, 542). Tomatoes are warm-season plants, meaning they require temperatures of between 77 and 86 degrees Fahrenheit during the day and nightly temperatures of around 60 to 65 degrees Fahrenheit, as well as an 80 day long frost-free period at the least. If tomato plants are in an environment with prolonged temperatures below 50 degrees Fahrenheit the plant may not survive, as growth stops at a minimum temperature of 53 degrees Fahrenheit or cooler. (Swiader 545)

Solanum includes annual and perennial plants from diverse habitats and is one of the largest angiosperm genera (The Tomato Genome Consortium). The tomato plant is apart of the nightshade family, along with peppers, eggplant, and potatoes. It is native to tropical America, specifically the Andes Mountains region in Peru and Bolivia (Swiader, 539). There are over 2,000 cultivars of tomatoes grown worldwide and made available for use by commercial growers as well as home gardeners which vary widely in fruit shape, color, plant type, maturity, disease resistance, use, and marketability (Swiader, 539). These varieties can be grouped into two types of tomato vines: Indeterminate and determinate. Indeterminate plants tend to be more popular for home gardens and smaller crop cultivation, while determinate plants are more common in commercial and

agricultural production on mass scale because vine growth stops when flowering begins. (Whiting, 491).

The tomato is one of the most versatile vegetables used in culinary arts. It is baked, fried, stewed, juiced, pickled, processed, pureed in addition to being consumed fresh. As far as it's nutritional value, the tomato is ranked 16th among vegetables in relative concentration of vitamins and minerals, however, it is the largest contributor of nutrients to the per capita diet in the United States compared to other vegetable crops simply because of the quantities it is consumed in. Growing up, tomatoes were a staple in my mother's garden, and many others, as tomatoes are one of the most common homegrown vegetables. (Swiader, 540)



(<https://testtubekitchen.wordpress.com/2012/01/20/the-science-of-flavor-pairing/>)

Tomatoes didn't become ingredients in "Old World" cuisines, such as Italian food, until the 'discovery' of the "New World", where tomatoes were originally found in South America and cultivated in Mexico (Simpson, 78). The tomato was called the fruit

xtomatl or *tomatl* by the Mayans prior to the Spanish conquest in America, where the name evolved into *tomate*. When tomatoes were brought back to Europe, the French called them *pommes d'amour*, or love apples. Most Europeans didn't have quite as a romantic view of tomatoes initially however, considering them to be poisonous like their other nightshade relatives. In Germany, the tomato was even believed to have the power to evoke werewolves and was given the name "wolf-peach". (Simpson, 78)

Tomatoes are unique in that their flower clusters occur along the stems, rather than at the node of leaf axils like most other plants. Because of the way the stigma is an enclosed structure and pollen is shed from the middle of the tube toward the stigma, tomatoes are also primarily a self-pollinating crop (Swiader, 543). Wild tomato varieties tend to bear smaller fruit, similar to that of cherry cultivars. Larger fruited varieties were developed by pre-Colombian Aztecs and Incas, but domestication of these plants seems to have taken place in what is now Mexico. Eventually, these domesticated seed varieties were taken back to Italy and moved to northern Europe, eventually finding their way back to America and into what is now the United States by the late 1700's. Despite the popularity of the tomato today, it wasn't a popular crop until 1835, and was not produced in an extensive commercial sense until later in the 19th century. (Swiader, 539)

In the current market, the United States harvests an estimated total acreage of about 424,000, almost 12 million tons, of tomatoes, a nearly \$1.65 billion. As far as fresh market producing states, Florida and California top the list—Florida primarily producing in the fall, winter and spring, and California producing in the summer and fall (Swiader, 540). Processing of tomatoes is heavily concentrated in California, making up about 94% of processing in the United States. Tomatoes can be planted directly from seed in the

field, or transplanted. Direct seeded crops are usually mechanically harvested and used for tomato crops that go directly for processing after harvest (Swiader, 546). Fresh market tomatoes are grown as either bush-type on the ground or supported to hold fruits off the ground. Those grown on the ground are generally for mature-green harvest, and those with fruits supported off the ground are marketed as “vine-ripe” (Swiader, 549).

‘Early Girl’ is a popular variety with mid-sized fruits, favored for early production or in areas where the growing season is short. ‘Celebrity’, ‘Big Boy’ and ‘Better Boy’ are popular varieties for main season production. Many gardeners favor rich flavored heirloom varieties such as ‘Brandywine’ or other large beefsteak types. Varieties that are pear-shaped and yellow varieties are beginning to

gain popularity as well. Cherry tomatoes are popular as well and often used in salads and as snacks. ‘Roma’ tomatoes are preferred for salsa, chili sauce and other tomato products because they require less time to cook down. (Whiting, 492)



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Anna Thibodeaux

Dr. Mark Uchanski

Warm season vegetables

09/10/2016

Curcubita pepo

Curcubita pepo, more commonly known today as the pumpkin, is a warm season vegetable that is grown and harvested all over the world. They are a member of the curcubitaceae (gourd) family, which also includes cucumbers melons, watermelon, and squash. They vary widely in size, color, and texture. They can be green, yellow, red, white, blue, or more typically orange. They can be bumpy, wrinkly, scaly or smooth. They can be 4 lbs. or 100+ lbs. Depending on the variety, which there are more than 30 of. The most common thing pumpkin is used for in America is pumpkin pie. But they are eaten in thousands of different ways. They can be roasted whole, used in soup, or to flavor coffee. They are also grown for their appearance and used as a decoration. Pumpkins are hollowed out and carved with triangle eyes and a smile for Halloween. They are a fall staple and well known by millions of Americans.

Pumpkins are a warm season vegetable which means they need warm weather to germinate, grow and thrive. They prefer temperatures of 65°-86° and do not do well when the weather becomes less than that. Which means that in the late fall, when the first frost comes, warm season vegetables don't last. Pumpkins are an annual and take 80-140 days to reach maturity. They grow on a vine that can get up to 50 ft. long. The leaves are alternate and cordate shaped, which is fancy for heart shaped, with a rugged and pubescent texture. The vine itself also has fine hairs and tendrils that reach out and curl. The flowers are monoecious and pollinated mainly by bees. Some other insects can also aid in pollination but if the blossoms aren't pollinated at all they dry up and fall off.

It is best to plant in full sun with a lot of space for the vines to spread out. They prefer nutrient-rich well drained soil. So one should add organic matter such as compost or manure before planting. I personally prefer compost or a goat manure. Goat manure is different from other manure because it doesn't have to age before you put it in the soil. So it is very hard to burn your plants with it.

The easiest way to start pumpkins is from seed in soil that is at least 70°. Although it is optimal for the soil to be 95° because pumpkins are very sensitive to the cold.(B) They like a lot of water but the soil should dry out between watering, never becoming soggy. The plants are very prone to powdery mildew, squash bugs and aphids. In order to prevent powdery mildew water during the evening to prevent leaves from overheating. Overhead watering should also be avoided. When pumpkins develop on the vine they should be turned regularly to avoid odd shapes and rot. Harvest them when they are mature by using a tool, rather than tearing them from the vine. This will also help avoid disease.

The market for pumpkin is seasonal and limited. This is because it is a warm season vegetable and it is not easy to grow in greenhouse. Not only because pumpkins are so big and heavy but because the vines are very long and therefore they need a lot of space to grow. "In 2014 Over 90,000 acres of pumpkins were grown in the U.S. which totaled to over 1.5 billion lbs. of pumpkin."(C) That is the same as twelve cruise ships Which Is obviously a lot of pumpkin. Pumpkin lovers everywhere, including myself Curcubita mos is the most commonly grown species. Mainly because the pumpkins are larger in size and have a higher yield then other varieties. But pumpkin lovers everywhere, including myself prefer a variety of several different species. I personally love new England pie or baby pam pumpkins. Both varieties are

about 4-6 lbs, orange and deliciously sweet. They are all around the preferred variety for making pumpkin puree.

Pumpkin puree is fairly easy to make on your own. You start off with a pie pumpkin there are several varieties that you can use, but like I already stated, New England pie or baby pam are the favorites. You cut the pumpkins in half and scoop out the seeds and the stringy innards. It doesn't have to be perfect. The seeds can and should be rinsed and toasted in the oven for later. They are delicious on salads, avocado slices, or just covered in salt and devoured while watching a movie. Then you quarter the pumpkin slices and place on a baking sheet. You then roast them in a 350° oven for about 45 minutes. Until the pumpkin slices are fork tender. Then peel off the skin and place the delicious sweet chunks into a food processor. It's that easy.

You can use pumpkin puree to make any amazing fall dish. Such as pumpkin pie, pumpkin bread, soup, pumpkin ravioli, pumpkin spice coffee or anything that tastes amazing and is a reminder of fall. I couldn't have fall without pumpkins. In my book they are fall. Pumpkins are the reason fall is my favorite season and why I look forward to it every year. They taste like the leaves changing, and a chill in the air, the sound of leaves crunching under your feet and the smell of pot roast dinners wafting into the street. They are delicious and you cannot go wrong.

Pumpkins have been around for hundreds of years. "They were originally called, pumpions by the English. Shakespear even mentioned "pumpions" in one of his plays"(A). Pumpkins have been in classic tales such as sleepy hollow and cinderella. They have been in America for quite some time. The native Americans used to cut them into strips and weave them into mats. They would also roast them over the fire and eat them. Pumpkin pie was enjoyed by the pilgrims. Originally they would cut off the tops, remove the seeds and pour milk, honey and spices inside then roast them on the fire. This eventually led to pumpkin pie.(A)

Today we enjoy pumpkins not only as a food but also as a decoration. On Halloween we carve them into “jack o’ lanterns.” Basically, pumpkin faces with a tealight candle on the inside. They have triangle eyes and noses with crooked smiles. We eat pumpkins pie every year on thanksgiving. And several other pumpkin treats when the season is here. Pumpkins are American staple that will always be loved and enjoyed.

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Ghost Pepper: William Tills

Taxonomy and Environment

The Bhut Jolokia, more commonly known as the ghost pepper, is considered the hottest pepper known to man, breaking one million by the Scoville Heat Unit system (SHU). Coming from the *Capsicum* genus, this hot pepper is a cross between *Capsicum chinense* and *Capsicum frutescens* and was obtained by the original cross of the two and eventual back-crossing until stable genetics were produced (7). The *Capsicum* genus belongs to the Solanaceae family, the deadly nightshades, and contains about 200 known species. Chili peppers are indigenous to the northeast region of India, where a pool of biodiversity can be found due to the region's high temperatures and humidity (Roy, Anupam 2016). Archaeological evidence shows that eventually the chili peppers were spread and domesticated in various parts of Asia roughly 8,000 years ago, where their heat would in time characterize many sauces and dishes still served today (Baruah et al. 2014). Its origins can be held responsible for extreme environmental conditions required by the ghost pepper, where an optimal temperature of 65-90 degrees Fahrenheit and relative humidity of 70-80% make this warm season crop an extremely environmentally-sensitive one (Baruah et al. 2014) (Juanitos 2016). Although challenging to produce in many regions of the United States, one can use this guide to understand how to create a pepper production site under many circumstances.

Identification

By definition, the pepper is a fruit, where a fruiting body encapsulates reproductive seed. However, when considering the pepper from a market standpoint, it can be served raw or accompany many dishes served around the world. Ghost peppers can be grown in three different

ripened colors-dark red, light red, and orange, which can be identified by the initial fruit color (dark-light green, respectively). The fruit appears shriveled, as does the seed, which the fruit bears roughly 25-35 of within 4-5 locules (Baruah et al. 2014). The plant grows similarly crinkled leaves held to a green stem which contains dark anthocyanin pigments near the nodes (Juanitos 2016). The ultimate size of the plant can vary greatly, between about 57-129 cm within 6 months depending greatly on environmental conditions. A typical ghost pepper is 5-7 cm in length and 2.5-3 cm in diameter, and a plant will produce around 25-34 per year.

Production

The harsh environments which the Bhut jolokia thrives in make this pepper plausible only to those in the 5b-11b zones (PexPeppers 2016). It is important to avoid exposure to freeze as temperatures below 50 degrees Fahrenheit are likely to kill the plant (Juanitos 2016). However, manipulating one's environment can make this an accessible plant to grow just about anywhere where it is economically favorable to do so. This can be done in a greenhouse, where a specific section or entire house can be heated and humidified to satisfy the ghost pepper for optimal conditions and ultimately optimal growth (Juanitos 2016). Indoor production would be an option as well. However, additional lighting may be required, and a Colorado producer may find it more viable to choose outdoor production.

The ghost pepper prefers a loamy soil, so a Colorado grower should consider applying gypsum or sand to break up our naturally clay-ridden soil. For container production, this means a peat moss base may be ideal (PexPeppers 2016). Most importantly, a ghost pepper prefers a warm soil, most accomplishable by a raised bed or large container (Juanitos 2016). The pH should be between 6.0-6.8 at all times to avoid nutrient lock-out, and can be amended by liming

in an outdoor system.

Germination of seed can be an extremely daunting task with Bhut jolokia. The seeds must be germinated in soil temperatures between 80 and 90 degrees Fahrenheit, and can sprout as early as a week or as long as 40 days (PexPeppers 2016). These seeds can be initially planted in a seed tray (1 per cube) or in separate small containers (4-5 seedlings in a 1 gallon pot), which can be placed on a heating mat if soil temperature is below requirement (Juanitos 2016). When sowing seeds directly into a plot, one must consider the production time of the ghost pepper, which takes an estimated 160 days until fruit production begins (unreachable in Colorado). Using a fine-mixed seedling starter is recommended, and the soil should be kept moist and never allowed to dry prior to germination (Swaidner, John & Whitaker, George 2002). It is recommended to start one's seeds 7-10 weeks before final frost, so a Colorado cultivator may want to start their seeds indoors around early March to work with our 160-day growing season. Finally, it is important to acclimate your seedlings if/when they are planted outside. Hardening off consists of repetitive daily exposure in increasing amounts, in order for the plant to adjust to the outside environment, as ghost peppers are easily stunted (PexPeppers 2016).

The ghost pepper is not particularly demanding in vegetative growth. One may employ a typical organic fertilization program of soil amendments and compost teas when growing directly in the field (PexPeppers 2016). Indoor, greenhouse and container production may require the addition of liquid nutrients, which can be applied from either organic or conventional sources in compliment to the watering program. Pruning and training is likely unnecessary, but one may consider pruning some foliage in order to allow light to the expanding buds and eventually stretch the plant out to a bushy structure (Juanitos 2016). However, this may not be necessary as the pepper plant branches dichotomously and will eventually branch its canopy naturally

(Swaider, John & Whitaker, George 2002).

Pepper plants are determinate and will begin producing flowers at a certain size, and continue flowering throughout the growing season (Swaider, John & Whitaker, George 2002). Flowers will grow in clusters primarily towards the canopy (Roy, Anupam 2016). The ghost pepper is an interspecific hybrid, as mentioned earlier, so it will likely experience a minimal amount of natural self-pollination. This means one should consider pollinating by hand or with a soft paint brush when producing indoors or in a greenhouse. Growing near habanero may help success as well (Chili Pepper Institute 2016). Plants growing outside may pollinate satisfactorily from the wind alone, given they are provided proper air circulation and spacing. Others may need the help of a pollinator, where planting near many flowers in the garden may increase populations (PexPeppers 2016). Pollinators can also be directly introduced into greenhouses with some success. Pollinators in high populations have shown to increase pollination by 10% (Roy, Anupam 2016). Peppers production is over the course of the season and continuous in that fruits may not begin production at the same time. On average, a pepper plant will produce 15-20 full size fruits in a season, as well as 10-14 smaller fruits (Roy, Anupam 2016). In Colorado outdoor production at a home garden, one may consider full-season container production as it gives the cultivator the option to bring pepper plants indoors if frost provides reason to. When ready to be harvested, be sure to wear gloves and to avoid skin contact with the peppers as handling can be dangerous (PexPeppers 2016).

Marketability

In recent years, the bhut jolokia has been spiking in popularity, particularly due to its recognition as the hottest pepper in the world by Guinness World Book of Records in 2007 (Roy,

Anupam 2016). Although since then it has been topped, this pepper is still internationally recognized and marketed as novelty, where the production of ghost pepper hot sauces and salsas appeal to those seeking a spicy thrill. It is most commonly used in its indigenous and surrounding regions in the east, where one can find it as a spice or curry flavoring, because it is known to contribute color, pungency and flavor to food (Baruah et al. 2014). In the US, it is becoming increasingly common find ghost pepper products such as chips and even french fries. The notable spiciness of the ghost can be measured by the Scoville Heat Unit (SHU), where Wilbur Scoville created a test in the early 1900s measuring the heat content of peppers by alcohol extracting from the pepper, and then diluting with amounts of sugar-water until heat is undetectable (Roy, Anupam 2016). To put things into perspective, the bhut jolokia has a rating of over one million SHU, putting it more than 40 times hotter than normal Tabasco sauce and 18 times hotter than the jalepeno (Y, Liu & MG, Nair 2016). It has been researched that the chili peppers of the east get their hot flavor from a group of compounds called capsaicinoids, likely produced as deterrents to nature's threats. There are five of these compounds found in *Capsicum*, and capsaicin is the most prominent in contribution to overall pepper heat (Baruah et al. 2014). These capsaicinoids are researched for their medicinal values as well, and the ghost pepper boasts to be at least 3-5% higher in capsaicin content than any other Indian chili, making it a valuable crop choice and an important target of research (Baruah et al. 2014). The medicinal benefits are vast, where even in history humans have used the pepper's leaves to relieve arthritis and other pain and inflammation (Roy, Anupam 2016). This information suggested about capsaicin has now been researched and confirmed, and medical professionals are also looking into its anti-cancer activity (Baruah et al. 2014). Capsaicin introduced to cultured cells seemed to block the migration of breast cancer cells and destroy the prostate cancer cells, providing a

possible future in a formal medical setting. Other benefits that are targeted by research include gastrointestinal benefits, bactericidal effects, cardiovascular activity and antioxidant effects (Roy, Anupam 2016). One particularly interesting benefit is the bactericidal effects mentioned, where in vitro capsaicin has been shown to fight particular strains of bacteria, posing a possible benefit to destroying antibiotic-resistant bacteria strains (Baruah et al. 2014). These medical benefits, as well as the increasing interest for its extreme heat content, make this a high-value specialty crop that, with successful cultivation, will have no trouble in marketability in the many parts of the world it is enjoyed in.

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A Colorado-focused *Capsicum annuum* Factsheet for the ‘Jane or John Doe’

Sean Taylor Vanous

Capsicum annuum is a popular dicot warm season vegetable that people consume and often see daily. Belonging to the Solanaceae family also known as the nightshade family. *C. annuum*, is native to Mesoamerica and has been selected by humans for its edible mature fruit of different sizes, colors, shapes and flavors (sweet or chili) (Swiader and Ware, 2002). This has led to many cultivated varieties also known as cultivars that are now grown and marketed worldwide (habanero, jalapeño, bell, sweet etc.) (see Figure 1). Peppers are a warm season crop because they are very tender in terms of frost tolerance and injury to cool temperatures (Swiader and Ware, 2002). Peppers are also partially classified by their lifecycle and number of cotyledons, peppers fall under a perennial classification and are dicotyledonous plant meaning they have two leaves when the seedling first emerges from the seed (Swiader and Ware, 2002).

I chose to provide this factsheet because ever since I was a child I have loved colorful food, and peppers come in so many colors these days. There are so many choices and varieties when it comes to consuming peppers so picking or trying new ones is always easy. I also like how they are not just limited to being hot or spicy, but there are varieties that are sweet and mild, allowing for subtler dishes, but still packed with vitamins. I also remember a time when an optometrist told my dad that the carotenoids and other compounds related to fruit and vegetable color are very good for eye sight and overall eye health. I love being able to see well and so knocking out two birds with one stone of flavor, nutrition and overall health is a real plus too.

Peppers are an important food crop worldwide and used not just in food production but by law enforcement, hikers and campers even by gardeners to deter unwanted garden visitors.

Peppers produce chemicals called lachrymatory agents which when sprayed in the face can irritate the eyes and nose, causing tears and temporary blindness which as you can guess is used to control crowds, riots, or wild animals or even other humans trying to cause harm to another. So peppers to me are not just a season, a delicious afternoon or morning snack, but a tool used for survival, and protection of things or people we care about.

Peppers are a perennial herbaceous plant in its native regions of Mesoamerica, but in more temperate locations such as Colorado behaves like an annual (EOL, 2012). Peppers are a warm season crop according to a classification of temperature requirements and hardiness (frost tolerance) (Swiader and Ware, 2002). Peppers are very tender which means they do not tolerate even very light frosts well. This makes sense because these plants do their best growth during warm time of the season (summer) temperature ranging from 65 to 86°. Also consider where they originated, Mesoamerica, near the equator which year round is relatively warm. Extended exposure to temperatures below 50° will cause serious metabolic disruptions (Swiader and Ware, 2002). Fluke storms or drops in temperature have large impacts on quality of the peppers, as do post-harvest handling methods such as chilling or cooling. But proper management of these practices and understanding the peppers habits can reduce these losses.

C. annuum are distributed and native according to the USDA in the lower forty-eight states and in Central and South America (USDA NRCS, 2016). Their center of origin is the Mesoamerican area, which has allowed breeding regimens to begin favoring traits of certain genes and selecting for others. This gave rise to new cultivars and breeding lines for the varieties and flavors of today. But sometimes we lose traits that were once within a cultivar but due to certain selections we lost that trait. This means we need old distant relative's genetic material to bring that trait back. Old traits from native wild types can be re-incorporated to modern cultivars

with proper breeding and much care in ensuring specific genes are carried over while not losing others that are currently favorable. Peppers are propagated sexually via perfect flowers (all plant parts present), and are self-fertile with 24 chromosomes (Swiader and Ware, 2002). In the wild or open fields pollination occurs via insect vectors visiting flowers and mixing pollen, giving them the moderate ability to outcross, creating new varieties and genetic combinations (Swiader and Ware, 2002).

Most breeding programs focus on the non-pungent cultivars of *C. annuum* and this lead to five species being domesticated in the American tropics (Pickersgill, 1997). Domestication occurred in highland Mexico of *C. annuum*, and its closely related species of *C. chinense* and *C. frutescens* (Pickersgill, 1997).

Peppers prefer soil with a pH of 5.5 to 6.8 (Swiader and Ware, 2002), and when night temperatures do not drop below 65° (Walker, 2013). Seed germination temperatures range from 60° to 95° and optimal is about 85° (Swiader and Ware, 2002). Days to emergence though between groups of peppers will vary if in similar soil temperature ranges (Swiader and Ware, 2002). When pH is below 5.5 blossom-end rot and manganese and aluminum toxicities can occur and lead to yield losses (Swiader and Ware, 2002). Also when temperatures exceed 100° F the pepper pollination rate decreases as does the fruit set and overall yield also are hindered (Walker, 2013). Ample humidity (60-80%) should be present for pollination to occur without issue as well (Walker, 2013). Direct-field sowing should be avoided if temperatures are cool (60° to 65°) due to slow germination and damping-off risks (Swiader and Ware, 2002).

Soil amendments of manure or other organic materials should be added before transplanting plants, but make sure it is not too active or ‘hot’ to prevent burning your plants. Peppers like well-draining soils and when in fruit production plenty of water should be available

but do not over water or under water, as this will cause stress and lead to inconsistent fruit development (Walker, 2013).

Peppers are susceptible to many diseases and pathogens, some of which are easily managed and well known, while others are not. Many modes of spread and reproduction and different types of disease (fungi, bacteria, nematodes, etc.) all call for different management techniques. Diseases include but are not limited to; Bacterial Soft Rot, Bacterial wilt, Anthracnose, Powdery mildew, Root-knot (nematodes), alfalfa mosaic, beet curly top, tobacco mosaic (Black et. al, 1991) (Swiader and Ware, 2002). Some of these diseases can be mechanically transmitted like Tobacco Mosaic Virus (TMV), by leafhoppers as in Beet Curly Top, or by aphids as in Alfalfa Mosaic (Black et. al, 1991). Each of these different vectors of infection have different means of control. They also can cause similar symptoms in plants leading to incorrect diagnosis of disease and improper controls may be taken.

To alleviate some worries about peppers care, let's nutritional content and physical makeup of peppers particularly green ones. Coming from Swiader and Ware 2002, in Table A.4, Peppers (green) have a mineral content 6mg of Calcium, 22mg of Phosphorus, 1.3mg of Iron, 195mg of Potassium, 3mg of Sodium, and lastly 14mg of Magnesium. Table A.5 contains the vitamin contents and they are as follows 530 international units IU of vitamin A, 0.09 mg of Thiamin, 0.05 mg of Riboflavin, 0.60 mg of Niacin, 0.16 mg of B₆ and lastly 128mg of Ascorbic Acid. The international units (IU) state one IU of vitamin A is equivalent to 0.3 micrograms of Vitamin A alcohol. Peppers in their raw state consist of 93% Water, contain 25kcal, 0.9 g of protein, 0.5 g of fat, 5.3 g of carbohydrates, 1.2 g of fiber and 0.6 g of ash. (Swiader and Ware, 2002)

An interesting fact about peppers, particularly of the hotter varieties is that the capsaicin compound (alkaloid) which gives them their heat is concentrated in the membrane and seeds, or sometimes in the stem end of the fruit or chili. The heat rating of peppers is in terms of Scoville heat units, non-pungent bell peppers are rated 0, tabasco grouped peppers are rated at 40,000. (Swiader and Ware, 2002)

This capsaicin chemical however is not recognized by the olfactory organs of avian species (birds, chickens etc.). Due to this adaptation; birds are the primary source of seed dispersal for these plants. The capsaicin chemical would deter other mammals from consuming the fruit but the birds are able to neglect that, eat the seeds and carry them to new locations. To tag along with the birds and their ability to not be affected by capsaicin, you can test this experiment on your chickens if you have any. For a duration of time give your chickens one specific color of peppers for their feed such as red peppers. Collect their eggs, cook them, and see what color the yolk is. Yes, the color of the yolk changes to the color of the pepper that predominate the diet of the chicken.

Another fun fact is that although many believe peppers to be vegetables, they are actually fruit when you consider their botanical growth habit. Botanists define fruit as “part of the plant that develops from a flower.” (Nelson et. al, 2012). While a vegetable is derived from other parts of the plant such as the stem, leaves and roots (Nelson et. al, 2012). But in a culinary aspect vegetable are thought to be less sweet and more savory and served with the main meal. Fruit are usually sweeter and served either as a snack or at dessert, but not many like to eat peppers for dessert (Nelson et. al, 2012).



Figure 1 above: Displays a variety of shapes and sizes of *C. annuum*, (Feiertag S, 2014)

From: <http://www.ethno-botanik.org/Capsicum/Capsicum-literature-scientific-publications.html>

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An Overview of the Cayenne Pepper

By: Jesse Vincent

Introduction:

Cayenne pepper, or *Capsicum annuum*, are in a subgroup of the horticultural group, the Anaheim chilies. These are pungent, slender, and wrinkled peppers. Peppers have become a staple product for many countries around the equator so it's very much a warm season crop. It originated in South and Central America where the temperatures tend to be quite warm. Because of this, it's very sensitive to frost. In fact, hot peppers like the Cayenne grow best at an average temperature above 75 degrees Fahrenheit and will likely altogether not produce anything if the temperature drops below 50 for an extended period of time. If grown in a place like here, in Colorado, there will be many precautions to take to ensure a productive crop. But I believe it's worth the extra effort to grow a crop with the uses, health benefits, and fantastic heat of the Cayenne pepper.



Origin:

Cayenne peppers are in the Solanaceae family so they are closely related to others in the nightshade family like tomatoes. This is an important consideration before planting or planning a garden. If the planting area has many pests and diseases that affect tomatoes, the Cayenne peppers may also be targeted. But the Cayenne pepper has an important place in history as well. It's actually named after the city Cayenne in French Guiana. It's believed that Columbus brought chilies back from the West Indies in the 1400's and it's spread like wildfire ever since. And now peppers containing high amounts of capsaicin, like the Cayenne, are in the cuisine of most countries near the equator today. In countries like these, Cayenne grows as a perennial because of the constantly high temperatures. If grown in a temperate climate, it's usually treated as an annual. But if one takes the time to protect the pepper from frost, it can be overwintered successfully.

Domestication:

The first evidence of the domestication of chile peppers was around 6,000 years ago. This was found by analyzing the starches on the seed milling devices of our ancient ancestors. After all, capsaicin degrades quickly and needs to be kept somewhere cool and dark. On the other hand, the starches contained within it can be evaluated for thousands of years. The milling might suggest that it was being used similarly as it is today. That is, more as a spice than regularly consumed whole. It's primarily consumed as a ground spice or as a dried powder.

Soil:

As previously stated, growing Cayenne peppers in a climate like Colorado presents many challenges. Of the chilies grown in North America, the Anaheim chile group makes up 15% of the total chile production. The importance of avoiding cooler temperatures is key to producing chile peppers. Peppers are relatively sensitive to excess moisture but the soils type they're grown in is of lesser importance. Of all the soils textures, a heavy clay is the only one that is incapable of growing peppers. The acidity should be between the pHs of 5.5 and 6.8. If your soil happens to be below the 5.5 pH, blossom-end rot becomes a real concern. Fertilizing rates could be as high as 250 pounds of nitrogen, 150 pounds of phosphorus, and 50 pounds of potash per acre (Swiader, 2002). Side dressing is an option but because the roots are so thin and sensitive, it must be done carefully and at the right time to be effective. Nitrogen utilization seems to be greatly increases when fertilizing with a mulch rather than without a mulch.

Planting:

The seeding rate is about 2 pounds of seed per acre. If pests are a concern, I would recommend planting in a single row with plants spaced one foot apart. This will reduce the plant density which will increase yields on the pepper plants. But the real benefit to this is that this reduces water accumulation on the plant. This will greatly reduce the chances the peppers will harbor diseases (Swiader, 2002). If you happen to live up north, transplants seem to be the most viable option as pepper seedlings are very sensitive to temperature. The closer one gets to the equator, the more likely they will benefit from direct seeding. But it's also possible to direct seed

with pre-germinated plug-mix or fluid-drilled seeders if field conditions aren't to the growing standards (Swiader, 2002). When it comes to transplants vs. direct seeding, it's important to look at the climate of the growing environment. It could take over 100 days for a Cayenne pepper to go from planting to fruiting. If this isn't an option due to climate, transplanting will speed up the process a bit.

Importance:

Not only are there many health benefits supported by scientific journals, but the general uses for peppers are expansive. The primary reason is the compound capsaicin, which is what makes a pepper hot. Studies have been done on how it might affect appetite and weight loss. It was shown that those who consumed the pepper had increased blood flow and metabolism. But

Nutrition Facts	
Serving Size 5 g	
Amount Per Serving	
Calories 17	Calories from Fat 5
% Daily Value*	
Total Fat 1g	1%
Saturated Fat 0g	1%
Trans Fat	
Cholesterol 0mg	0%
Sodium 2mg	0%
Total Carbohydrate 3g	1%
Dietary Fiber 1g	6%
Sugars 1g	
Protein 1g	
Vitamin A 44%	Vitamin C 7%
Calcium 1%	Iron 2%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.	
NutritionData.com	

this was only for those who actually ate the pepper and had to deal with the heat (Ludy et al, 2011). Those who took capsaicin capsules didn't receive the mouth heat or any of the beneficial results. There are also studies showing that a topical capsaicin cream can be used to alleviate pain and the symptoms of psoriasis. But this doesn't mean to go start rubbing chilies on yourself as this will surely result in some discomfort. Self-defense mace used to incapacitate individuals is effective because of the pain-inducing capsaicin it contains. This leads us to some health concerns associated with the Cayenne. ACE inhibitors have been shown to be amplified by capsaicin. This can be dangerous as it will reduce blood clotting and increase the likelihood of uncontrollable bleeding. If

one loves to eat peppers but takes a lot of aspirin, the effect is similar. Sadly, it appears pseudo-science is interfering with continued research on the benefits of hot peppers. There seems to be a lot more information on how it can reduce a persons' weight or stop heart attacks rather than real scientific studies (Lejeune, 2003). With all this in mind, I think the addition of the Cayenne to most gardens will bring joy, and a little pain, to any dedicated grower.

Fun Facts:

Capsaicin and why we eat it is actually a topic still debated today. One theory is that we are a bunch of masochists that enjoy experiencing pain. But I think another theory has more evidence to back up its claims. And that is the fact that birds have no capsaicin receptors. This is relevant because very plant strives to propagate and survive as far away and as best as it can. That means that mammals eating peppers will experience pain and avoid it while birds, who travel much farther than mammals, aren't affected at all. So this theory might explain why it's spicy to us but not why we still eat them. Some believe it's because of the strong anti-microbial properties hot peppers have been proven to contain. That's why they say they're found in high amounts in places that are hot and wet. This is where microbial diseases would thrive. A problem with this is that prior to modern farming technology, the only places hot peppers could grow was around the equator. But it is hot and wet around the equator, so you can see that we're still a pit where we don't fully understand hot peppers like the Cayenne.

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Pepper image url: <http://www.thehealthylifecompany.com/cayenne-pepper/>

Nutrition image url: <http://vitalitydirectory.com/fresh-peppers-and-nutrition-facts/>

Scallop Summer Squash Secrets

By: Abigail Zlotnick

Introduction

Cucurbita pepo var. *patissonia*, more commonly known as scallop squash or patty pan squash belongs to the family of summer squashes. Scallop squash is a commonly grown annual and found in Colorado. The fruit from a scallop squash plant are typically small, rounded, and have different skin colors (Kolota, 2015). Image 1 below shows the various skin colors and variance in size among scallop squash.



Image 1: Diversity of size and color of scallop squash (Ettington, 2016).

Vegetable crops can be divided based on their ideal growing conditions into cool-season and warm-season crops. Warm season vegetables include vegetables that have ideal growing temperatures between 65 and 85 degrees Fahrenheit (Swaider, 2002).

Summer squashes are members of *Cucurbitaceae* family that consists of multiple warm season vegetables (Boyhan 2009). Summer squash seeds require warm temperatures; planting should occur once air temperatures have reached at least 70 degrees Fahrenheit, a long warm growing season of at least 50 to 65 days is needed, and summer squash are very sensitive to frost (Summer Squash).

History

Curcubita pepo is known to be native to the Americas with evidence showing domestication of this crop as early as 4,000 years ago (Paris, 2008). Domestication of *Curcubita pepo* dates back 10,000 years in southern Mexico. The cultivation of squash in Europe is accredited to transoceanic voyages occurring post-Columbian.

Evidence of cultivation in North America dates back to the 16th century from European explorers records of the word, “asquash” , a word used for a an immature fruit. Today this word is better known as squash (Paris, 2008). Native Americans consumed scallop squash when it was immature; where as other Cucurbita varieties at this time would be used or stored when mature (Paris, 1996).

The scallop squash originates from the order Violales, family Cucurbitaceae, genus *Cucurbita*, and species *Cucurbita pepo*. The scallop squash is a particular variety *passionia*. Within the genus *Curcubita pepo* many commonly consumed species exist: squashes, zucchini, and pumpkin. These species have similar origins but can vary greatly in taste, shape, color, and size. Summer squash is bred for fruit quality, minimal foliage, and increased productivity (Paris, 1996). Today popular cultivars include Butter Scallop, Peter Pan, and Sunburst. However, the original 16th popular varieties of Yellow Bush Scallop, White Bush Scallop, and Golden Bush Scallop can occasionally still be found (Paris, 1996).

Production

When growing scallop squash one should ensure this crop has adequate space and full sun. Summer squash will perform best in well-drained soils with high soil fertility and a pH between 5.8 and 6.8. Summer squash requires consistent moisture from planting to fruiting. Summer squash will grow well in Colorado at elevations below 5,500 feet (Whiting, 2016). Irregular watering will cause poor fruit quality. In addition to preference of warm temperatures this crop is quite frost sensitive and should not be planted when temperatures are still close to frost (Anonymous, 2016).

Summer squash should be seeded 0.5 to 1 inch deep into hills. Hills are ideal for vine crops as they allow water to drain properly (Whiting, 2016). Hills or mounds should be spaced 3 to 4 feet apart. If planting in rows, sow 4 inches apart in rows 4 to 5 feet from each other. Once plants are 2 to 3 inches tall they should be thinned to 2-3 plants per hill and one plant every 1-2 feet in rows (Anonymous, 2016).

Harvest should occur 60-70 days after planting and provide a yield of 10-15 fruit per vine (Brush, 2016). It is likely that fruit production will follow within days of flowering. Fruits should be harvested when small usually between 2-4 inches. Scallop squash will grow larger if allowed but smaller fruits tend to have the best taste (Grant, 2016). To hasten harvest time one might cover the soil by mulching to increase soil temperatures (McLaurin, 2009).

Squash contains both male and female flowers on a single vine. Pollination occurs typically by wind or pollinator assistance. Today’s most common hybrid cultivars are bred to ensure pollination will produce the same cultivar where as, older varieties were open pollinated and pollination did not always lead to scallop squash production (McLaurin, 2009).

For commercial summer squash production, adequate nutrient inputs should be applied. Nitrogen is the most limiting nutrient and will likely be needed in the greatest quantity. Phosphorus and potassium should also be applied if a soil sample shows these nutrients to be needed. Table 1, 2, and 3 below are taken from Colorado State University Extension and show fertilizer recommendations for nitrogen, phosphorus, and potassium respectively.

Table 1: Nitrogen fertilizer recommendations (Swift, 2016)

Soil Test Levels (ppm)	Percentage of Organic Matter Present		
NO ₃ -N (nitrate nitrogen) ¹	0 – 1 %	1.1 – 2.0 %	> 2.1 %
1 ppm = 0.08 lb. N/1000 sq. ft.	Lbs. Nitrogen to add per 1000 sq. ft. area		
0 – 9 parts per million (ppm)	5.5	4.4	3.3
10 – 19	4.4	3.3	2.0
20 – 29	3.3	2.1	1
30 – 39	2.1	1	0
40 – 49	1	0	0
>50	0	0	0

Table 2: Phosphorus fertilizer recommendations (Swift, 2016)

P (phosphorus) ² 1 ppm P = 0.1 lb. P ₂ O ₅ /1000 sq. ft.	Level of sufficiency	Lb. P ₂ O ₅ /1000 sq. ft.
0 – 3 ppm	very low	5
4 – 7	low	4
8 – 11	medium low	3
12 – 14	moderate	1
Greater than 14	sufficient	0

Table 3: Potassium fertilizer recommendations (Swift, 2016).

K (potassium) ³	Level of sufficiency	Lb. K ₂ O/1000 sq. ft.
1 ppm K = 0.06 lb. K ₂ O/1000 sq. ft.		
0-60 ppm	very low	3
61-120	low	2
121-181	medium low	1
Greater than 181	sufficient	0

Some common pests and diseases associated with summer squash include powdery mildew, downy mildew, aphids, and squash bugs (McLaurin, 2009).

Companion Planting

Companion planting is a type of gardening or farming that has been used historically to improve production. It is based on the concept that certain plants are capable of benefiting others when planted within certain proximities. Native Americans would use companion planting with squash in the well-known “three sisters” combination of corn, beans, and squash (Kuepper, 2001). Traditionally, the corn would provide structure for beans to climb, the beans fix nitrogen in the soil, and the large vines of squash acted as a ground cover that would conserve water and provide weed control (Kuepper, 2001). While this is no longer a widespread practice the benefits of companion planting are still applicable. Image 2 below includes a garden layout with spacing for those interested in planting a “three-sisters” garden in their own backyard.

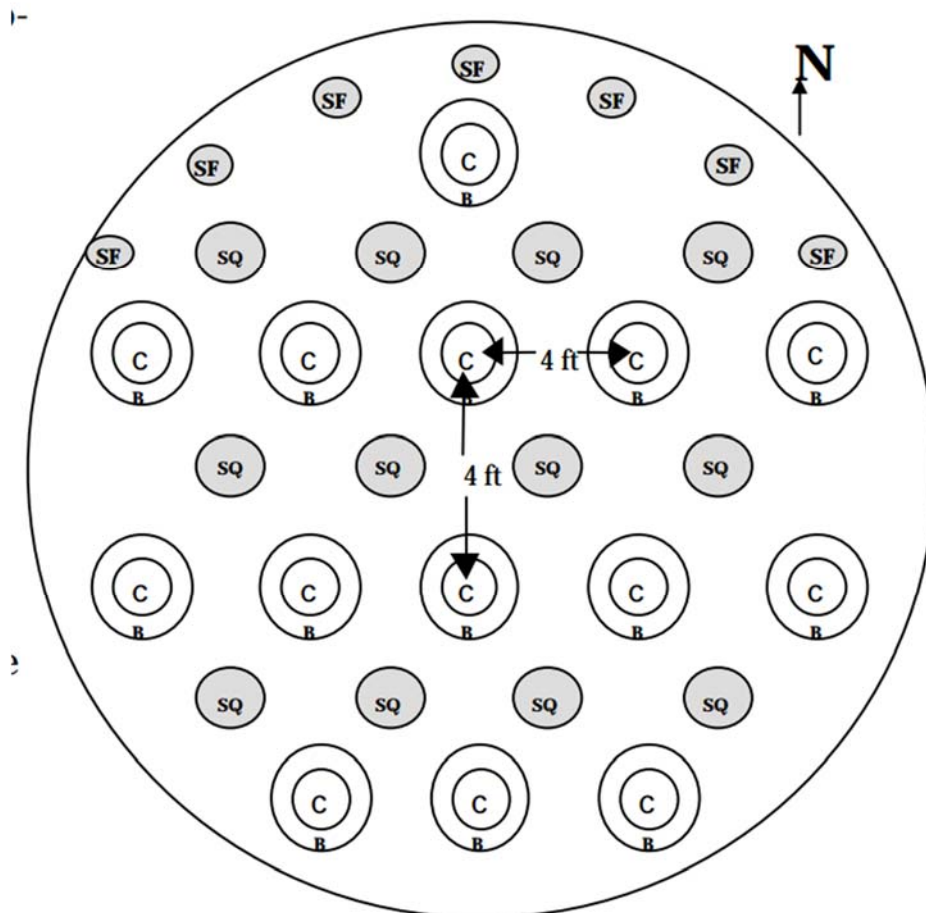


Image 2: Three-sisters planting guide with c representing corn, sq squash, and b representing beans (Kuepper, 2001).

Marketing

Scallop squash are smaller and rounder than the typical longer oval summer squash. While these squash are shaped differently they are still profitable and favorable among consumers. In fact, some have suggested the small size may make them more favorable among children. Karen Stickler did a study in 2008 at a farmer's market to see if it was more profitable to wait until scallop squash were larger in size or to sell at a smaller size. Her conclusion found that the smaller squash sold at 94% compared to the larger patty pan squash selling at 72%, and traditional medium zucchini squash selling at 84% (Strickler, 2016).

Preparation

Scallop squash are a delicious food and can be prepared in a multitude of ways. Try slicing off the stem and grilling them, roasting them at 400 degrees Fahrenheit in the oven for 15 minutes, or slice and sauté them in a pan with a tablespoon of oil and your choice of spices until golden.

Still wanting more? Here is a delicious recipe for baked summer squash. Enjoy!

Recipe taken directly from Sara Kate Gillingham via *The Kithn*

Baked Summer Squash

Serves 6

2 pounds summer squash (zucchini, pattypan squash, yellow crookneck squash)

1/4 cup olive oil

1/2 cup grated Parmesan cheese

1/3 cup bread crumbs

1/2 teaspoon flaked salt

1/4 teaspoon freshly ground pepper

“Preheat the oven to 350°F. Remove the stem ends and slice the squash cross-wise in 1/4-inch-thick rounds. Toss with the olive oil.

In a small bowl, combine the bread crumbs, Parmesan, salt, and pepper. Arrange the squash rounds in a 9x12-inch rectangular baking dish, or 10-inch pie plate. Sprinkle the bread crumb mixture over.

Cover the baking dish with foil and bake in the oven for 30 minutes. Remove foil and bake another five minutes until the top is bubbling and crispy.”

(Gillingham, 2015).

Conclusion

Since before our country was born, the pattypan squash has been cultivated and enjoyed on this land. It has roots in the three-sisters cultivation and has since been

developed for improved qualities. For those who live in Colorado, try planting this vegetable next season and enjoy the bounty. Otherwise, try looking for this cultivar at the farmers' market or grocery store where it can be recognized for its small round shape depicted in Image 1. This warm season vegetable is grown widely and is available to enhance any dinner plate.

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