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SPINACH

SCIENTIFIC CLASSIFICATION AND ENTYMOLOGY

Spinach, or “roundleaf spinage”, is a staple of the early American vegetable gardens. It is a relatively quick-growing vegetable and easy to maintain. Spinach is in the classification system Family Amaranthaceae. *spinacia oleraceae* being its official scientific classification name. Within Amaranthaceae there are about 102 genera and 1400 species world wide. It is within the family of leafy green vegetables, referred to as ‘greens’ or ‘potherbs’, because they were historically cooked before eating. Spinach ranges in color from light to dark green and comes in two general types: the crinkle leaf variety and the smooth leaf variety, although there are varieties that contain characters of both, known as “semi-Savoy Spinach”²

The word “spinach” is derived from the Persian word “*ispanai*” which means ‘green hand’, which later became ‘*spanachia*’ in late Latin, and ultimately ‘*spinage*’ and then ‘spinach’ in English.³

Scientific Classification	
Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Caryophyllales
Family	Amaranthaceae
Genus	Spinacia
Species	<i>s. oleraceae</i>
http://www.usda.gov/wps/portal/usdahome ¹	



¹ USDA, United States Department of Agriculture
<http://www.usda.gov/wps/portal/usdahome>

² Kenneth F. Kiple. Cambridge World History of Food. (United Kingdom: Cambridge, 2002) 1857 p 288

³ UGA Horticulture, Spinach

University of Georgia College of Agricultural and Environmental Sciences, Department of Horticulture. Vegetable Crops

<http://www.uga.edu/vegetable/spinach.html>

⁴ Flickr.com (Creative Commons)

HISTORICAL IMPORTANCE

Spinach is native to southwestern Asia. It reached China via Nepal during the early 7th century AD and did not reach Europe until it was recognized in Spain in the early 8th century.⁵ At the end of the Middle Ages the crop was a visible food item, and first appeared in a cookbook that was published anonymously in Nuremburg in 1485.⁶ It was first planted in England in 1568 and soon became one of the few vegetables on the tables of the wealthy. Spinach was also very appealing because it was a very short growing period relative to early vegetables, and made its appearance in early spring which appealed very much to those who were eagerly looking to consume some fresh vegetables after a long winter.⁷

Spinach was introduced to the Western hemisphere by the colonists, and it was first listed in American seed catalogs by 1806 under three different varieties.⁸ This being said, Spinach was very new to the American garden around 1812, and represented a very new and exotic crop for the American gardens of the time.

HORTICULTURE AND PLANT SPECIFICS

The choice of varieties is very important to ensure disease and insect resistance for the particular area where it is being grown, as well as one that is appropriate for the projected season of growth. There are various spinach varieties that are slow growing and slow bolting, which are preferable for the spring or summer due to the fact that there is more available time for cultivation. There are also fast growing varieties, which are more preferable for fall, winter, or early spring growing.⁹

Spinach is distinguishable by its green color as well as smooth, oblong shaped leaves that can be either crinkled or smooth. The edible part of the plant is a compact rosette shape of fleshy leaves attached to a short stem.¹⁰ When in flower, it is two to three feet high with an erect stem and branching leaves, and interestingly, the fertile and barren flowers are produced on separate plants.¹¹ The fertile flowers are produced in groups at every joint very close to the stalk, while the barren flowers can be found in long terminal bunches.¹²

Spinach has two stages in its life cycle; the vegetative, rosette stage and the bolting, seed stalk stage. It is important that the plants be maintained to avoid

⁵ Kiple 1856

⁶ Kiple 1857

⁷ Kiple 1856

⁸ Soloman H. Katz. Encyclopedia of food and culture Volume 2. (Macmillan Library Reference, 2002)

⁹ UGA horticulture, spinach

¹⁰ Katz 358

¹¹ Fearing Burr Jr. Field and Garden Vegetables of America. (Illinois: The American Botanist Booksellers, 1988(first published 1873) 299

¹² Burr 300

bolting, because once it reaches this stage it is not marketable. The first stage of growth, where the plant leaves are in rosette shapes (about 35-40 days) is relatively short, and requires close watch.¹³

The different varieties of spinach have distinct uses. The savoy varieties are primarily used for fresh market produce and are preferable for long transportation because they have a longer shelf life. The semi-savoy and smooth leaf varieties are easier to clean and are primarily used for processing.¹⁴



15

CULTIVATION

Climate:

Spinach is always raised from seeds and grow better when planted in drills rather than broadcast.¹⁶ This green does best in rich soil and partial shade. Full sun will cause the plant to run to seed prematurely, so the amount of sunlight available to the plant is very important, and as a result, spinach is always grown as a spring or fall crop. This is unique, given that generally speaking, very few vegetables will grow satisfactorily in partial shade.¹⁷ Spinach will also do better in areas where the soil temperatures will be lower, such as on the North slope of the garden. Spinach is a cool season annual herb, and can survive severe frosts in the winter.¹⁸ This makes it a very practical and useful crop because of its versatility depending on varietal.

Soil:

Vegetable plants are generally consistent, and it is not usually necessary to make the soil extremely acidic or extremely alkaline, as is the case with other types of plants. Generally, a pH of between 6.0 and 6.5 is satisfactory for a vegetable

¹³ UGA horticulture, Spinach

¹⁴ UGA horticulture, spinach

¹⁵ Flickr.com (Creative License)

¹⁶ Burr 300

¹⁷ John C. Wister. "Woman's Home Companion Garden Book". (Doubleday and Company, 1947) 710

¹⁸ UGA horticulture , spinach

garden, which is slightly acidic.¹⁹ However, it is necessary to take into consideration what our own soil's condition is in Clinton and alter it (or not). In the case of Spinach, the soil should be fertile and well prepared to a depth of six inches. Spinach will not grow in acidic soils.

Within the cultivation of seeds, the quantity per 100 feet of row, how far apart to place the plants, how deeply to plant the seed, and the length of the growing season are all very important to keep in mind. One source suggests ½ oz. of seeds for 100' row, 4" distance apart between plants, planting ½" deep, and a growing time of approximately 40 days from planting to harvest.²⁰ According to one source, the land should be sowed monthly through the growing season 12 inches apart.²¹ The seeds themselves are round or prickly depending on the variety, and take about one week to germinate in adequate conditions.



22

PATHOGENS AND PESTS

Pest and disease management is especially important in leafy greens such as spinach because they are much more susceptible due to their fragility and above-surface growth. For this reason, pesticides are generally highly used in conventionally and industrially grown spinach. However, there are also ways to manage these potential pests through natural methods as well.

Two common pests to spinach are the green peach aphid and the spinach leafminer.²³ The green peach aphid is a small, yellowish insect that primarily leaves on the undersides of the leaves. The most detrimental aspect of this pest is not that it eats the crop, but that it helps to spread disease and wipe out large portions of the crop. The spinach leafminer is the other primary pest threat. It is a small black fly type insect, and the larvae pose a problem by creating white tunnels within the leaves.²⁴ There are also

¹⁹ Wister, 711

²⁰ Wister, 720

²¹ Stephanie Donaldson. "The Shaker Garden: Beauty Through Utility". (Vermont: Trafalgar Square, 2000) 140

²² Flickr.com

²³ UGA horticulture, spinach

²⁴ NSF CIPM

more minor threats from cabbage loopers, cucumber beetles, and cutworms, although these do not tend to pose as much of a threat.²⁵

Disease presents a relatively large problem for spinach due to the fact that even a small amount of defect can have major affects on the quality and marketability of the crop. Some of the biggest threats include downy mildew, bacterial soft rot, fusarium wilt, and white rust.²⁶

Downy Mildew (aka Blue Mold)–

Fungus that is highly mobile, and spreads very fast in high humidity. Spores spread and cause unsightly white spots on leaves. This fungal disease can cause huge crop loss in a very short time, and the best control method is to use resistant varieties.²⁷

Bacterial Soft Rot-

This is a bacterial disease that enters the plant from the soil in through punctures or lesions in the plant. It causes a greasy appearance of the leaves, and ultimately leads to the leaves becoming mushy and water saturated.²⁸

Fusarium Wilt-

This is a fungal disease that is transferred through contaminated seed and soil The fungus causes the plant to turn pale green, and then proceed to wilt and ultimately die.²⁹

NUTRITION

Spinach contains large amounts of minerals and vitamins, especially vitamin A, calcium, phosphorus, iron and potassium. Spinach also has high levels of protein.

Ninety-one percent of spinach weight is water. A serving of spinach contains 3.2 grams of protein, 4.3 grams of carbohydrates, and 0.3 grams of fat. It also contains vitamin A, and C, thiamin, riboflavin, and niacin. Calcium, phosphorus, iron, sodium, and potassium are also found in spinach greens.³⁰

²⁵ UGA horticulture, spinach

²⁶ National Science Foundation Center for Integrated Pest Management.

<http://pestdata.ncsu.edu/cropprofiles/docs/caspinach.html>

²⁷ University of Arkansas, DA

University of Arkansas Division of Agriculture;

<http://www.uark.edu/ua/jcorrell/spinach%20diseases.html>

²⁸ NSF CIPM

²⁹ UGA horticulture, spinach

³⁰ UGA horticulture, spinach

MUSTARD

SCIENTIFIC CLASSIFICATION AND ETYMOLOGY

The Brassicaceae family (formerly Cruciferae) contains about 300 genera and 3000 species, most being herbs found in the temperate regions. The name "mustard" is thought to have originated from the Latin *mustum-ardens*.³¹ The ground seed was often added to unfermented grape juice, called "must", and the second part of the word is derived from the Latin *ardere*, meaning "to burn", hence, "burning must".³² Over time this spelling evolved to become "mustard" as we know it today.

Scientific Classification	
Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Capparales
Family	Brassicaceae
Genus	Brassica L.
Species	<i>Sinapis hirta</i>

Mustard plants are primarily characterized by leaves with deep notches, small yellow flowers, and leaf formations with four leaves together (similar to the Greek cross). This is typical of the Cruciferae family, which is where the name comes from, the Latin for "cross".³³ Three of the most common mustard varieties that are commercially grown are Black Mustard (*Brassica nigra*), Brown or Indian Mustard (*Brassica juncea*), and White or Yellow Mustard (*Brassica hirta*, formerly classified as *Brassica alba* and *Sinapis alba*)³⁴



Brown Mustard



White Mustard



Black Mustard³⁵

³¹ E.A. Weiss. *Spice Crops*. (New York: CABI Publishing, 2002) 28 - 36

³² UCLA

UCLA History and Special Collections, Louise M. Darling Biomedical Library.

<http://unitproj1.library.ucla.edu/biomed/spice/index.cfm?displayID=18>

³³ Kiple 288

³⁴ J.E. Simon. *Herbs: An Indexed Bibliography*. (Connecticut: Archon Books, 1984) 770

(<http://www.hort.purdue.edu/newcrop/med-aro/factsheets/MUSTARD.html>).

³⁵ Saskatchewan Mustard Development Commission

(<http://www.saskmustard.ca/mustard/index.html>)

HISTORICAL IMPORTANCE

The mustard plant is indigenous to China and Asia.³⁶ It is one of the world's most important spice crops. It has evolved to hold much historical and cultural significance and has various uses outside of culinary uses. Some varieties offer insecticidal and biological properties, and various industries are currently attempting to harness the energy of mustard and its oils for biodiesel and other industrial purposes.³⁷ However, the primary significance of this plant lies in its pungent and distinct taste and color.

The plant evolved from wild weeds growing in Asia and was primarily used as a spice for meats. Its earliest uses were not so much as flavor enhancers as flavor disguisers and was added to meat because its pungent flavor made the meat taste better considering that there were no methods for refrigeration at the time, and meat was often a bit tainted. Some of the earliest known documentation of mustard's use can be found in texts as far back as 3000BC in Ancient Sumerian and Sanskrit texts.³⁸ One of the first accurate references from Sumerian texts is a contemporary proverb:

“When a poor man has died, do not try to revive him!
For while he had bread he had no salt
And when he had salt he had no bread.
When he had meat he had no mustard.
And when he had mustard he had no meat.”³⁹

References to mustard have also been found in ancient Egyptian writings from 2000BC and also from China in about 1000BC. Mustard is also prominently references in the Bible, and is describedAs it became more popular as a spice, its use expanded into China and Japan, Africa, Asia minor, and Europe.⁴⁰ Currently, the primary varieties in commercial cultivation are brown, black, cress, and white mustards, and the largest exporters of the crop are Canada, Austria, England, France, Germany, Holland, Italy, India, Northern Africa and the Western United States.⁴¹ Once it reached Europe, mustard was originally used for its medicinal purposes by the Greeks and Romans.

³⁶ Walter E. Splittstoesser, PH. D. Vegetable Growing Handbook:Organic and Traditional Methods. (New York: AVi, 1990) 314

³⁷ Saskatchewan Mustard Development Commission

³⁸ Saskatchewan Mustard Development Commission

³⁹ Weiss 30

⁴⁰ Kiple 1856

⁴¹ Kiple 1857

HORTICULTURE AND PLANT SPECIFICS

Black mustard is the most common varietal used in table mustards. Brown mustard, also commonly known as Indian mustard, is the most common varietal used for mustard greens, and is the varietal used in the making of Dijon style mustards. This type is also commonly used for mustards and cooking oils in Asia.⁴² White mustard is a varietal characterized by its hairy seedpods. Also used for table mustard and salad greens, it is the varietal used for the common American yellow table mustard.⁴³

Brassica and *Sinapis* genera are very closely related, but they have some differences that allow for recognition. Plants within the *Sinapis* genera have pale green leaves and fruits that have claws, while members of the *Brassica* genera often have grey-green leaves and smooth fruits.⁴⁴ These two genera contain the most popular commercially available and used varieties.



Table mustard and other condiments are made by first processing the mustard seeds into mustard powder, and then adding ingredients such as vinegar and seasonings. Powdered dry mustard, powder, paste, and seed forms are also commercially available and used for various different uses. White, Brown, and Black mustards are often mixed in particular blends to create certain aromas and or flavors. Mustards are also used in other condiments such as mayonnaise as emulsion stabilizers and antifungal agents.⁴⁶

Mustard has a few particularly unique characteristics. The pungent and hot taste of mustard is a result of "glucosinolates".

⁴² Splittstoesser 315

⁴³ Saskatchewan Mustard Development Commission

⁴⁴ Weiss 32

⁴⁵ Saskatchewan Mustard Development Commission

⁴⁶ Saskatchewan Mustard Development Commission

"An enzyme, active in the presence of water, hydrolyses glucosinolates to give rise to subsidiary compounds that actually impart mustard's characteristic flavour. The compounds, isothiocyanates, are different depending on the type of mustard. Yellow mustard contains hydroxybenzyl isothiocyanate (derived from sinalbin), while oriental and brown contain allyl isothiocyanate (derived from sinigrin). The hydroxybenzyl form is much hotter than the allyl form and is responsible for the hot taste of Dijon style mustard."⁴⁷

Another important characteristic of mustard seeds is called "mucilage". This is the outermost coating of yellow mustard seeds. It is a polysaccharide that gives the mustard its properties as a thickening agents, and remains a very important ingredient in the making of salad dressings and mayonnaise.⁴⁸



49

CULTIVATION:

Mustard is grown in conditions similar to spinach and has the ability to be grown anywhere in the United States. In the North the most optimum time for growth is the early Spring or Fall, while in the South the optimum time is late fall and winter. Long, warm summer days will allow for a seed stalk to form, and this optimum temperature is usually around 60 - 65F.⁵⁰ Interestingly, the pungency and spiciness of mustard leaves increase with the daily temperature. Therefore, plants

⁴⁷ Saskatchewan Mustard Development Commission

⁴⁸ Saskatchewan Mustard Development Commission

⁴⁹ Saskatchewan Mustard Development Commission

⁵⁰ Splittstoesser 314

that and grown at the beginning of the summer throughout the extent of the summer will procure a more peppery taste than counterparts that are grown a little later or earlier.

The reported life zone for mustard is 5 to 27 degrees centigrade with an annual precipitation of 0.3 to 4.2 meters and a soil pH of 4.2 to 8.3. The mustards are best adapted to sandy loam soils with limited rainfall.⁵¹

During harvesting time, there are particular traits that will show that the mustard is mature and ready to be harvested. The plant is mature when the stem and seed pods become yellow. When the seeds are dark, and when the seeds rattle in their pod when shaken.⁵²

PATHOGENS AND PESTS:

Cabbage Looper:

The cabbage looper is a moth larva that is green with white stripes down its back, and about an inch long. The bugs create large holes in the leaves, and usually stay on the undersides of leaves, making them harder to detect. The bugs are difficult to kill, and can persist until killed by a frost or freeze. The life cycle of the looper is just over a month, so there can be various generations of bugs over one growing season.⁵³

Nematodes:

Nematodes, or roundworms, are one of the most common phyla of animals. Various types are pests for mustard, including the root-knot nematode, root-lesion nematodes, and stem nematodes.⁵⁴ Infestation can be recognized through a group of dead or stunted plants. While there are various types of detrimental varieties, nematodes have also been used as a form of natural pesticide by some farmers, because some types of nematodes will keep other types of pests under control as a natural predator.

Blackleg (*Leptosphaeria maculans*):

Blackleg is one of the most pertinent diseases for mustard plants. Symptoms are grey and black spots on the leaves and or grey and black lesions on the stems near the base.⁵⁵ This disease is especially taxing because the spores can survive on stems and leaves of future generations for up to five years.⁵⁶ Crop rotation and burning is often necessary.

MEDICINAL USES:

As far as is recorded, some of the first societies to utilize mustard as a medicinal substance were the early Greeks and Romans. The mustard seeds were crushed into an

⁵¹ Simon 770

⁵² Weiss, 39

⁵³ Insect Identification Laboratory, Dept. of Entomology, Virginia Tech, Blacksburg Virginia <http://everest.ento.vt.edu/~idlab/vegpests/vegfs/cabbagelooper.html>)

⁵⁴ Weiss 35

⁵⁵ splittstoesser 315

⁵⁶ weiss 35

ointment and applied to cure sore muscles.⁵⁷ The first century Roman writer Pliny the Elder noted that mustard was very useful as a medicine to cure “epilepsy, lethargy, and all deep seated pains in any part of the body.”⁵⁸

By the time of the middle Ages, mustard’s medicinal properties were secondary to its use as a food-enhancer and spice, however, it was also still being used for some medical issues including a treatment for gout, sciatica, and as a blood thinner.. At this time, mustard was also being utilized for psychological, or social reasons, as an “effective cure for hysterical women.”⁵⁹

As the plant spread, it became a very significant medicinal plant for Native American medicinal uses when it reached North America. Mustard, particularly white mustard was noted to be an “excellent household remedy”, when ingested in large quantities it could be used to induce vomiting in the case of poisoning, yet at the same time was recommended as a daily remedy for bowel troubles.⁶⁰ In the Mohegan, Iroquois, and Meskwaki tribes Black mustard (*Brassica nigra*) was used to cure head colds, headaches, and toothaches.⁶¹

In contemporary Western medical practices, mustard is not a particularly prominent substance. However, some derivatives of mustard such as nitrogen mustard (mechlorethamine) have been used as an ingredient in some antineoplastic drugs, which are used in chemotherapy to kill cancer cells.⁶²

⁵⁷ Kiple 1857

⁵⁸ Kiple 1857

⁵⁹ Kiple 1857

⁶⁰ medicinal and other uses of north American plants: A Historical Survey with Special Reference to the Eastern Indian Tribes. Charlotte Erichsen - Brown, 463

⁶¹ Erichsen- Brown 463

⁶² UCLA

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University of Arkansas Division of Agriculture.
<http://www.uark.edu/ua/jcorrell/spinach%20diseases.html>

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