

## Classification and Botanical Description of Legumes

Legumes, or pulses, are flowering plants in the Leguminosae family. The word legume is derived from the Latin verb *legere* which means to gather. The term pulse has a more direct lineage. It derives from puls or porridge, a cooked bean dish which the ancient Romans were fond of eating. (Albala 7). This family is also known as Fabaceae, and both terms can be used interchangeably to indicate the some 690 genera and 18,000 species therein (Morris 365). The Leguminosae family is classified into three sub-families: Papilionoideae, Caesalpinioideae, and Mimosoideae. Each sub-family is identified by its flowers. Edible legume crops are mainly found in the sub-family Papilionoideae. This includes the soybean, chickpea, bean, and pea, among others (Morris 365). Other lesser known members of the legume family include clover, licorice, lentils, and the peanut. The peanut is in fact, biologically though not culinarily, defined as a woody, indehiscent legume.

Unique to Fabaceae are the flowers and fruit. Like many flowers, those found on legume plants are hermaphroditic, containing both the stamen and pistil. This makes the plants self-fertile, meaning that an individual plant is able to reproduce by itself which can have the effect of limiting genetic diversity. However, hybridization occurs frequently in nature due to this characteristic, as any plant can pollinate another due to the hermaphroditic properties therein (Weaver 57). This creates difficulty in clearly defining the differences that enter between subspecies. The flower typically has five petals and an ovary with one carpel, cavity, and style (Morris 365). The distinctive nature of the flowers is not in the parts but in the shape of the parts. The general pattern of legume flowers follows that of the pea blossom. The result of this arrangement is that of a papilionaceous design, which means butterflylike (Earle 11). The petals of the legume plant are shaped into a cup. One large petal, the 'banner' or 'standard' folds over the rest for protection. In front of this petal are two narrower petals called 'wings,' between which two other petals unite. Due to their shape these petals are referred to as the keel. Within that fold are the stamens and pistil (Earle 10). After pollination the flower will die and reveal the growing ovary which becomes the pod.



Typical Bean Flower Shape  
Pic 1

The distinctive fruit is the most ready resource by which to identify members of the Leguminosae family. This fruit principally grows into a pod that contains the seeds of the plant. The legume pod is a one-celled seed container formed by two sealed parts called valves. Legume pods always split along the seam which connects the two valves. This characteristic is called dehiscent, from the Latin word meaning to gape or burst open (Earle 5). However, not all pods are shaped the same. The thickness, length, curve, and fleshy nature of the pods can vary between species. In addition, some pods are winged or indehiscent (meaning the pods do not split open at maturity) (Morris 365). Colors of flowers and seeds vary greatly from white to scarlet to blue.



A Dehiscent Pod  
Pic 2

## **BEANS**

The exact origin of the word bean is unknown, though it is reminiscent of a few sources. Germanic *bauno*, Old Saxon *bona*, the Dutch *boon*, or the Norwegian *bonne* are all related to the contemporary English word 'bean.' Beans are found in a number of genera under the Leguminosae family. The most prominently cultivated of these are the genera *Phaseolus*, *Vigna*, *Vicia*, and *Glycine* (Tobias 70). Within the genus *Phaseolus* are the species tepary bean (Latin name *acutifolius*), runner bean (*coccineus*), lima bean (*lunatus*, so called for its crescent shape), and common or pinto bean (*vulgaris*). The word *Phaseolus* comes from the Greek *phaselua*, "which refers to a canoe-like boat reminiscent of a bean pod" (Albala 7). *Vigna* species include the moth bean (*aconitifolia*), azuki bean (*angularis*), urad bean (*mungo*), mung bean (*radiata*), rice bean (*umbellatta*), and cowpea (*unguiculata*) under which label both black-eyed pea and yard long bean fall. The *Vicia* genus only contains the broad or fava bean (*faba*). The *Glycine* genus contains only the soybean (*max*).

Considering this large array of species it is not surprising that the growth strategy of beans vary. All wild bean species have runners, as well as some domesticated bean species. The vines climb available trees, poles, or walls, and are known to grow up to twelve feet or more. These are known as pole or garden beans (Tobias 70). Some beans grow on short plants and are known as bush or field beans. In all types, the distinctive pods typically grow to five or six inches long.



Bean Plant  
Pic 3



Purple Pea Pods  
Pic 4

Frequently gardeners will grow green or snap beans. These are also known as string beans and, although the tough valves which once had need to be cut away before consumption have been selectively undeveloped by growers, the name persists (Earle 18). Dwarf or bush beans are also grown in many gardens due to convenience although tall pole beans produce more of the purplish flowers which will later become edible pods (Earle 19). Other types of beans are grown in gardens for purely aesthetic reasons. For example, the scarlet runner bean known for its bright red flowers.

## **PEAS**

Under the Leguminosae family in the genus *Pisum*, which is Latin for pea as well as the derivation of the English word pea, the pea is the sole species. Its Latin name is *sativum*. The *Pisum sativum*, or pea, was once commonly used in the Pease pottage from the Middle Ages (Weaver 58). 'Pease' became mistakenly known as the plural meaning and was shortened to 'pea' by 1600 (Kaplan 279). In fact, peas are beans distinguishable only by linguistic accident (Albala 75).

Like beans, peas exist in different states in the wild versus garden domestication. All peas are vine plants which creep onto low bushes, rocks, or nearby poles for support as well as protection (Kaplan 276). These climbing peas can grow to be around six feet in height (Earle 12). The tendrils grasp the limbs of nearby plants in order to raise the pods out of the reach of rodents and other small animals which would find a meal in the fruit. The leaf of the pea plant is made of one or more pairs of leaflets which grow like wings opposite one another (Earle 13). The end of the stalk is a tendril which allows the plant to climb.

Peas are found in two general varieties: sweet or green peas, and field pea. Field peas, also known as cowpeas or gray peas, are the domesticated *Pisum sativum*. These are called 'gray'

due to the color of the seed and the flour they produce when ground. These are the horticulture incarnation of peas as opposed to the garden pea. Field peas are harvested on the vine and dried for use. In contrast to wild peas, field peas typically maintain shorter, stronger vines. The plants are more compact and produce a greater number of pods which contain large seeds. The distinctive Leguminosae flower is more pronounced in the field pea due to its multi-coloration (Weaver 58). Alongside this display the dry seeds are generally speckled.

Garden peas are actually a result of selective evolution. Dutch farmers in the seventeenth century began favoring dwarf plants (Weaver 58). Those plants, once the result of a rarely expressed recessive gene, became the widely grown bush types of the average kitchen garden. The dwarf peas are favored mainly because they do not require a trellis for support (Earle 12). The flowers of the garden pea are white, which is believed to be due to albinism (Weaver 59). The genetic mutation also results in light colored seeds which can be almost white or yellow. Those seeds dry wrinkled or smooth, producing different tastes for the consumer. When green, however, all the seeds contain more sugar than the field peas (Weaver 59).

## **Legumes: A Nutritional History**

*“Nearly every place on earth has its own native species and nearly every culture has depended on beans” (Albala 1).*

Beans and bean products are diet staples worldwide (Tobias 70). Throughout history, the cultivation and preservation of legumes around the world has often meant the difference between life and death. Beans are among the simplest plants to grow and are considered an excellent source of protein (Albala 1). In addition, Legumes have historically acted as a critical source of food insurance against times of famine, as they are considered virtually indestructible if properly well dried and stored (Albala 1).

Legumes have often been associated with poverty throughout history. In cultures where a portion of the population can obtain protein from animal sources, beans are seen as food only fit for peasants; the “poor man’s meat” (Albala 2). Eating beans is a cheap way of maintaining important nutritional requirements, but is also accompanied with a negative stigma associated with the lower class; those that could not afford meat had to depend on beans.

## **Human Consumption**

Legumes are consumed by humans in several forms. Although the word bean seems to imply the actual seeds of the bean plant, one can also consume the entire bean pod if picked before the pods are fully ripened and dry out. The actual seeds found inside the pods can also be consumed cooked or raw, dried or boiled, ground into flour, or used as spices or condiments. Beans can also be processed into foods such as soymilk, tofu or vegetable oil (Albala 2). Dried beans alone, however, contain toxic lectins and the seeds must be boiled before consuming. One of the most toxic of the lectins found in beans is known as ricin. Undercooked or partially cooked beans cause vomiting, diarrhea, and can irritate the intestinal tract. The toxic lectins are easily inactivated by boiling the seeds of the family for approximately 10 minutes (Bender 2005).

The most popular and most widely used beans include; French beans, kidney beans, runner beans, snap beans, and string beans (Morris 369). These bean varieties are considered primary protein food in Latin America and parts of Africa. And in Europe and the US, the

immature pods of these bean varieties are consumed fresh, canned or frozen. When combined with tomato sauce any of these whole dried beans can also be cooked together to create the classic American dish, baked beans. The bean dish "succotash" common of the South, is made by boiling down and combining Lima beans and corn (Tobias 71). Additionally, the bean dishes that most represent American cuisine are various foods from different cultures that have been fused together. A perfect example of this is the Tex-Mex style of cuisine. This cuisine utilizes beans as an integral ingredient for burritos, tacos, and enchiladas (Tobias 72).



Yellow French Beans  
Pic 5

Dried Kidney Beans  
Pic 6

Scarlett Runner Beans  
Pic 7

Peas on the other hand, can be divided into two categories based on dietary characteristics; sweet or green peas and field peas. Sweet or green peas can be eaten raw or cooked, while field peas are primarily dried for storage and require long periods of simmering to cook them thoroughly (Smith 251). Peas were also among one of the first vegetables to be canned commercially. Beginning in the 1920's, peas, along with other vegetables began to be frozen as a means of preservation, but did not become popular until the 1950's with the advent of the refrigerator freezer (Smith 251).

### **Unique Dietary Features**

Interestingly, beans are often referred to as incomplete proteins as they are in fact missing two of the eight essential amino acids needed from food for building protein in the body. Various grains such as corn or wheat provide the other two essential amino acids needed and when consumed together provide a valuable source of protein ("Beans: Powerful Nutrition").

Table 1 illustrates a breakdown of percent water, protein, fat, carbohydrate and fiber for a variety of dried legume seeds. Legumes contain no cholesterol, are composed of lots of complex carbohydrates and contain little fat. More complex carbohydrates mean less of a drastic spike in blood sugar levels and marks a longer period of satiety- which means more energy for longer. Beans are also a source of vitamin B, folic acid, potassium selenium, magnesium and fiber, which aids in maintaining digestive health ("Beans: Powerful Nutrition").

Additionally, various species of legumes have historically been cultivated for the use of animal forage. Various legume species used for animal forage include: *Aeschynomene*, *Desmodium*, *Leucaena*, *Macroptilium*, *Neonotonia*, *Desmanthus*, *Sesbania*, *Trifolium*. Other legume species have been used as cover crops, ornamentals, and green manure (especially with their unique nitrogen fixation principles) (Morris 371).

## **Legumes: Nitrogen Fixation**

Most food crops rely on 3 essential micronutrients found in the soil for optimum plant growth; nitrogen, phosphorus and potassium. However the family of plants is unique in that they naturally fix nitrogen in the soil. This natural process of nitrogen fixation proves to be one of the most unique characteristics of legumes (Morris 365).

Legumes convert atmospheric nitrogen into nitrogenous compounds useful to plants. Root nodules containing the bacteria *Rhizobium* fix free nitrogen for the plants. And in return, the legumes then supply the bacteria with valuable carbon produced by photosynthesis. Thus this symbiotic relationship between plant and bacteria facilitates the unique process of nitrogen fixation in legumes (Morris 365).

In addition to the unique process of nitrogen fixation characteristic of legumes, specific varieties of the family are also cultivated as valuable phytochemicals (Table 2). Phytochemicals are known as plant or fruit derived chemical compounds that have been medically studied to help reduce the risks of cancer and other diseases. Soy beans as well as beans, peas, and lentils are especially high in phytochemicals (Morris 370).

**Table 1**

<b>Dried Seed Variety</b>	<b>% Water</b>	<b>% Protein</b>	<b>% Fat</b>	<b>% Carbohydrates</b>	<b>% Fiber</b>
Field Peas	10.6	22.5	1	58.8	4.4
Fresh Green Peas	74.3	6.7	0.4	15.5	2.2
Lima Beans - Central America	12.6	20.7	1.3	57.3	4.3
Green Beans - Central America	66.5	7.5	0.8	33	1.5
Chickpea - India	9.8	17.1	5.3	61.2	3.9
Field Bean - India (Mung)	9.7	23.6	1.2	58.2	3.3
Black Grams - India	9.7	23.4	1	57.3	3.8

\*Data taken from Morris, Brad. "Legumes." The Encyclopedia of Food and Culture. 2003 ed.

**Table 2**

<b>Legumes with Phytochemical Properties</b>	<b>Use of Phytochemical for Pharmacological Purposes</b>	<b>Bioactive Uses (when applicable)</b>
Jack Bean ( <i>Canavalia</i> )	Concanavalin-A (used in medical)	Pesticide

<i>ensiformis</i> )	diagnostics)	
Red Kidney Beans ( <i>Phaseolus vulgaris</i> )	Lectins extracted aid in medical diagnostics	
Sunn Hemp ( <i>Crotalaria juncea</i> )	Lectins extracted aid in medical diagnostics	Bactericide, pesticide
Field Peas ( <i>Pisum sativum</i> )	Lectins extracted aid in medical diagnostics Produces isoflavins used in nutraceuticals for natural estrogen therapy	
Kudzu ( <i>Pueraria</i> )	Marketed as an antiparkinsonian herbal supplement or nutraceutical	Bactericide, pesticide, viricide
Velvet Bean ( <i>Mucuna pruriens</i> )		
*Data taken from Morris, Brad. "Legumes." <u>The Encyclopedia of Food and Culture</u> . 2003 ed.		

## The Cultivation of Legumes

Legumes can be divided into two categories according to their cultivation growth techniques: dwarf or bush varieties (which do not require climbing support and mature early), and the climbing varieties (which take longer to mature and require support, yet are characteristic of a longer bearing season) (Duffus & Slaughter 13). As dwarf varieties of peas do not bear as heavily as the climbing peas, one or two dwarf sorts should be planted every two weeks to maintain a constant supply throughout the spring and summer seasons (Rockwell & Peterkin 203).

The Shakers Gardener's Manual (1996) clearly illustrates the planting techniques for both the bush and climbing legume varieties:

*The bush or dwarf bean may be sown in drills, 20 inches apart, 2 inches deep, 2 inches apart, and 6 inches apart in the row. The Running or Pole Bean should be planted in hills, three and a half feet distant each way. We prefer setting the poles before planting...then dig and loosen the earth, and drop five or six beans in a circle around the pole, about 3 inches from it, and cover with mellow dirt (Buchanan 72).*



Dwarf Beans  
Pic 8

The series of events that occur after seed germination are similar in all legume varieties. Duffus and Slaughter describe the events of the seed germination well in their book *Seeds and Their Uses*:

*After water has been taken up by the seed, the coat bursts and the root starts downward growth into the soil. The hypocotyls then elongate and bend, forming a hook which is forced upwards through the soil. The cotyledons and shoot apex are then raised above the ground by a gradual straightening of the hypocotyls (Duffus & Slaughter 13).*



Seed Germination  
Pic 9

Bush legume varieties reach a height of about 20-60 cm tall and contain anywhere from 4-8 nodes, while climbing varieties typically reach a height of 2-3 m tall and contain between 11-30 longer nodes (Duffus & Slaughter 14). Beans and peas are classified as an annual garden vegetable and fresh seeds must be planted every spring (Earle 14).

## **CULTIVATION of PEAS**

Field peas are typically grown as winter annuals in temperate regions receiving 450 -500 millimeters of annual rainfall. Field peas also grow best in well-drained soils with a pH between 6.0 and 7.5 (Morris 367). The heirloom varieties of field peas today are primarily grown as fodder or as green manure, which is known as the act of plowing a field of peas under to enrich the soil (Weaver 58). Among the first ground peas to sprout in the spring are little white peas, referred to in England as the *May-Pea*, and followed by the *Early Charleton*, the *Hotspur*, the *Blue Pea*, the *Dwarf*, and *Tall Marrowfats*. These various varieties of American peas may be grown without the aid of sticks or climbing props (Cobbett 137). For best results cultivating ground peas, one can consult the following planting instructions as written by William Cobbett, an early 19<sup>th</sup> century journalist-turned farmer in his book *The American Gardener*.

*I ploughed the ground into ridges, the tops of which (for the dwarf sorts) were four feet apart. I then put a good parcel of yard-dung in to the furrows; and ploughed the earth back upon the dung. I then leveled the top of the ridge a little, and drew two drills along upon it at six inches distant from each other. In these I sowed the peas (Cobbett 137).*

The early pea may be sown in the fall but as Cobbett points out, “care must be taken to guard against mice...when the frost sets in, all is safe till winter breaks up” and may sprout up to



ten or fifteen days earlier than if one were to sow peas in the spring (Cobbett 138). Peas can germinate while the soil is still cool and were historically planted in late fall, but were also among the first crops planted in the spring (Buchanan 72).

## **CULTIVATION of BEANS**

In the US, the common dwarf field bean is primarily grown in New York, Michigan and areas west of the Mississippi River. Beans are characteristic of a warm-season annual crop and flourish in a variety of soil types, while the optimal temperature for growth should be between 63 – 77° F and need about 120 – 130 days of growth without frost (Morris 367). Planting dates vary from early April to early July but can vary due to geographic location and the threat of frost in more Northerly regions. Field bean crops require an added source of phosphorus, potassium and zinc as fertilizer for best growth results (Morris 367). Cobbett points out an alternative planting technique – similar to peas:

*The bean is difficult to raise here. It does not like dry and hot weather; and it likes moist and stiff land. If attempted to be raised in America, it should be sown in the fall by all means but, still it is useless to sow, unless you guard against mice (Cobbett 95).*

**Chart 2** Illustrates various cultivation parameters for both beans and peas.

<u>Vegetable</u>	<u>Sow In Open Ground</u>	<u>Distance Between Plants</u>		<u>Days to Sprout</u>	<u>Weeks to Mature</u>
		<i>Plants</i>	<i>Rows</i>		
Beans, bush	Early May	3 inches	2 feet	6 to 10	6 to 11
Beans, climbing	Mid May	3 feet	4 feet 2 to 4	6 to 10	9 to 14
Peas, climbing	Mid March	2 inches	feet	5 to 10	7 to 9

\*(Chart compiled with information generated from Tabor's *Garden Primer*)

## **A Brief History of Origins: Migration, Use, and Religious Significance**

### **LEGUMES**

In his 1886 edition of *Origin of Cultivated Plants*, Alphonse de Candolle first alerted botanists to the archeological record that contains nature's records of the geography of plant domestication (Kaplan 273). N.I. Vavilov spent decades researching geographical botany, and by 1926 had created a morphology chart of domesticated papilionaceous legumes. The four main genera of beans are *Phaseolus*, *Vicia*, *Vigna*, and *Glycine*. Each of these genera is relegated almost entirely to beans from specific geographic areas, listed as follows (Albala 6 and Kaplan 273):

*Phaseolus*- the New World- the Americas. Basic kidney beans, pinto, lima, tepary and navy beans.

*Vicia*- the Old World- Eurasia. Fava beans.

*Vigna*- Africa and India. Black-eyed peas, lentils and mung bean types.

*Glycine*- East Asia. Soybeans.

As can be seen by this simple chart, the majority of common legume varieties have origins in “Southwest Asia and East Asia to the Mediterranean, Peru, Mexico, and Guatemala” (Morris 365). These include the garden and field peas, winged pea, green bean, runner bean, lima bean, soybean, lentil, and fava bean. These origins cover a diverse range of temperate climates from humid to semiarid. Tropical climates such as South America, India, Japan, and West Africa are the origins of legumes such as the chickpea, winged bean, black-eyed pea, and peanut (Morris 365).

Unlike other staple foods which vary from place to place around the world, nearly every culture has depended on the ubiquitous bean for sustenance. Archaeological research has led scientists to believe that beans first began to be cultivated somewhere between 7000 and 3000 B.C. which places them among the world’s first domesticated plants (Tobias 71). Beans have been traded and planted to and from all corners of the globe through the centuries. This has made the exact origins of native species difficult for scientists to sort. Through their culinary history beans have been developed into a wide range of uses. “Some are dried and boiled, others are eaten fresh and immature; some are ground into flour; some are processed into food only vaguely reminiscent of beans such as soy milk, tofu or vegetable oil” (Albala 2).

Peas are thought to have originated in southwest Asia, near Afghanistan. Though the ancestral pea is extinct, consequent wild pea varieties still exist in the Middle East (Weaver 57). Peas are “associated with the spread of Neolithic agriculture into Europe” in combination with wheat and barley crops (Kaplan 279). Evidence of the plants has been found in pre-ceramic farming villages which date from 7,500 to 6,000 B.C. By 4,400 to 4,200 B.C. peas with seed coats intact had been deposited into the archaeological record of central Germany (Kaplan 279). The seed coats show evidence of domestication. Peas had reached Eastern Europe and Switzerland by the late Neolithic period. By 2000 B.C. the plant had reached India (Albala 76). Until 1066 peas were in England though not widely used. After Norman conquest in 1066 pea soup or 'gruel', common in Greece in ancient times, became a staple dish for the lower class of England (Smith 251). Pea soup also found its way into Buddhist texts as a simple but healthy dish suitable for monastic life (Weaver 58).



Pea Soup  
Pic 10

Explorers brought the dried peas to America in the seventeenth century at the same time traders introduced sugar peas to China and Japan. The Chinese are credited for taking these tender-podded peas and creating new varieties such as snow peas (Weaver 59). Until this time peas and beans alike were typically eaten after they had been dried. Gardeners in Europe began to offer the food fresh, which was a popular development, and garden peas became an addition to middle-class gardens (Albala 76). The Dutch had been breeding varieties for some time, but the French King Louis XIV “made green peas fashionable” (Weaver 59). However dried beans remained practical as stored food. Dried navy beans have been part of sea fare for some time, and Lewis and Clark were known to travel with a supply of the beans (Albala 171). By the nineteenth century fresh peas were a typical side dish and were among the first canned vegetables in the 1920s (Smith 251).



Some Canned Varieties  
Pic 11

Legumes have been employed in a variety of activities other than cooking. Dried beans served as ballots in ancient Greek and Roman tradition. White beans for acceptance, black beans for rejection of a motion (Morris 371). Native Americans developed a veritable catalogue of medical applications for different types of beans. Each tribe found uses for different varieties which ranged from skin care to snake bites. Tepary beans were important to Native American culture due to heavy reliance on the species. To them, “eating teparies is a way to recover health and identity” (Albala 205). In mythology, Coyote once spilled a bag of the beans into the sky which resulted in the Milky Way (Albala 206). In America the city of Boston earned the nickname "Beantown" due to the gusto with which locals enjoyed baked beans. This dish was an adaptation of the Native American preparation, and was typically eaten on the Sabbath (Tobias 71). Despite these auspicious origins beans today are used in practical applications such as animal feed, cover crops, ornamentals, or green manure. Beans are found in songs which depict stories about the lower class, such as Louis Jordan’s “Beans and Cornbread.”

Despite this wide geographical, cultural and culinary range of origin and usage, many cultures perceive beans as a food consumed by those who are socially and ethnically inferior. Historically, upper class households which are able to afford more expensive luxuries were able to depend on meat for protein rather than the inexpensive beans which therefore became known in Europe as the “poor man’s meat” (Albala 2). Perceptions of class and racial inferiority are still attached to the bean today. For example, the racial slur ‘beaners,’ which refers to Mexicans, speaks to the ethnic bias migrants face. The food of a culture, being foreign and central to that culture’s way of life, will always face scrutiny. In addition to being culinarily relevant, beans also

carry religious significance for some groups, either as a dish to be avoided or enjoyed in some specific preparation on holidays.

## **THE NEW WORLD**

Domesticated *Phaseolus* species show similar changes of structure and physiology which are common to Old World grain legumes (Kaplan 273). These evolutionary changes take the form of “gigantism (increased size of seed and other plant parts); suppression of seed dispersal mechanisms (decreased tendency of pods to twist and discharge seeds); changed growth form (especially the loss of rampant vining); loss of seed dormancy; and other physiological and biochemical changes” (Kaplan 274).

The common bean, which is the blanket name for the white navy bean, red kidney bean, black bean, pinto bean, and string bean which are all of the same species, is of unknown origins until the late nineteenth century. Archaeological excavation on the coast of Peru unearthed proof that *Phaseolus vulgaris* and *P. lunatus* were cultivated in the Americas since pre-Columbian times (Kaplan 274). As in other parts of the world the food served as an alternative source of protein which was responsible for the large population the area could support. However further research has shown that “common beans were domesticated independently in at least two distinct areas: Mesoamerica and Andean America” (Kaplan 274). Written records had already established that varieties of the common bean were grown by Native Americans from Chile to the upper Missouri rivers since before European contact. *P. vulgaris* beans exist in such a range of shapes and colors in so many diverse regions of the world that it becomes difficult to realize they belong to one common ancestor. The year 1492 was the beginning of species exchange between the New World and the Old. It was not until 1566 when the Old World realized that the beans which were migrating from the New World were not the same as the beans already in the Old World, however. The botanist Rembert Dodoens published a book arguing that beans must be distinguished from fava beans (Albala 138). Until then the beans from the New World had been assumed to be nothing more than another sort of fava.

The written records of explorers also describe the Iroquois practice of planting maize, beans, and squash together. The beans were typically common or tepary varieties, which though rare today were once the staple of Native American beans (Albala 207). This arrangement benefits each of the plants, though for the Iroquois it held mythological significance. The arrangement was referred to as the three sisters (Tobias 71). The maize provided a stalk for the runners to climb for support while the beans provided nitrogen fixation for the soil and the squash monopolizes the ground area to prevent weeds from growing. Two harvests a year were typical for the crop, and the work was typically done by women who dried the plants and threshed them for storage (Kaplan 274). Baked beans were a common dish, which settlers were taught to make. Bostonians in particular favored this dish. Because husbandry was so important to tribes such as the Iroquois and Hopi, it was typical for the crops to be worshipped “in ceremonial bean dances or festivals” (Tobias 71). Another favorite dish which the natives brought to the attention of colonists was succotash. This dish is still common in the South, and is made of lima beans and corn although the original recipe resembled a pot-luck stew (Tobias 71).

Lima beans themselves were important to the Incan diet. Ceramics and woven textiles from ancient Peruvians are known to depict the lima bean (Kaplan 275). The capital city of Peru, Lima, is named after this bean. The small-seeded types, also called sieva beans, are native to Mexico and Central America, and appear in the archeological record around 800 A.D. (Albala 191). Large-seeded types are from the Andes of South America, carbon dated back 3,500

years. Because the two types can be crossed they are considered to be the same species (Kaplan 274). In these high altitude origins, lima beans were originally fried like popcorn because it is inefficient to boil water there (Albala 193). Though never widely grown in Europe, perhaps due to climate, the lima bean is popular in Southeast Asia and Africa. The bean is also called the Madagascar bean due to consumption levels (Albala 193).

## **THE OLD WORLD: VICIA**



Fava Bean Plant  
Pic 12



Purple Fava Bean  
Pic 13

The fava beans of the Old World, also known as broad beans or faba beans, are a staple in the history of beans. *Vicia faba* has spread across the globe due to its adaptability as a crop. These beans grow well in the frosty northern areas of Europe as well as in the arid climates of the Middle East and Africa. Though fava beans have been traced back to the Fertile Crescent where they existed as a domesticated crop, exact origins remain unknown (Albala 33). The Middle East has been ruled out due to lack of archaeological evidence of pulses (Kaplan 277). The wild ancestor is thought to be extinct, which has caused the species *Vicia faba* to be dependent on humans. Domestication has altered the plant such that the uncultivated fava bean has no natural means of seed dispersal (Albala 34). The crop did somehow spread to Spain, Portugal, northern Italy, Switzerland, Greece, and the Middle East by the Bronze Age (Albala 34). This wide proliferation of favas made the variety so common that before 1492, when Columbus came to the New World and brought back the variety of beans therein, ‘bean’ referred almost exclusively to the fava bean. Botanists over the next three centuries generated much confusion because of this generalization. Columbus’ account of the great abundance of beans was not understood to mean different varieties, and so the New World beans were assumed to be akin to those in the Old World (Kaplan 271).

Fava beans served a religious function in Egypt for both Egyptian and Christian churches. For the Egyptians, the beans were used as sacrificial offerings to the gods and priests did not eat them. Pythagoreans also did not eat the beans, “so as to live a non-violent life” (Albala 40). These

Greeks, in addition to developing a system of mathematics, were vegetarians. The reason fava beans became taboo was that a connection was believed to exist between the plant and souls which were in transit between lives. To eat the beans would be no better than to eat the head of a relative, as the plant is of “the same matter as man” (Kaplan 277). By 1373 a book of recipes for the sick, monks, and Christians during Lenten season had been written (Albala 34). The purpose of this book was to circulate recipes for this substitute for those who could not consume meat. In the Jewish community fava beans were suited to religious purposes as well. To keep the Sabbath Jewish observers must not perform any act of work on Saturdays. Because fava beans could be cooked slowly for hours they worked well in “cholent,” a dish which families would place on the fire Friday nights at sunset and enjoy the following day (Albala 35).

The history of the changing perceptions of fava beans is a study in economics. The stigma of the ‘poor man’s meat’ petered out in Europe when the bubonic plague swept across the land in 1348. The portion of the population that managed to survive the epidemic inherited both land and money from the dead in significant amounts. This closed the gap between rich and poor. More people were then able to afford meat regularly. With less of the lower classes eating fava beans the crop no longer carried as much class significance as evidenced by the multitude of bean recipes from this time (Albala 53). By the sixteenth century the gap has been reestablished due to population growth and inflation, stigmatizing beans once again.

Fresh favas and green beans from the New World escaped the stigma because they were seasonal and thus became relegated to upper class tables due to expense. Beans became split by class between fresh and dried. Cookbooks trace the use of the fava by region. After the sixteenth century fava beans had again been labeled the ‘poor man’s meat,’ and appear only sparingly in recipes from Spain to the Netherlands. In these cookbooks “dried beans and peas, eaten by the poor, are nowhere mentioned” (Albala 64). Around this time favas also became associated with medical issues and sexuality. Maybe it was their ladylike shape, which has been referenced as akin to that of female genitals, or perhaps the reason was a false association with springtime. In either case, St. Jerome forbid nuns from eating this aphrodisiac in the early 1500s (Albala 58). Fava beans became a diet of the poor and horses.

*Vicia* beans first reached the New World in the early seventeenth century via a Captain Gosnold who planted them on islands off Massachusetts while exploring the New England coast (Kaplan 280). The Agricultural Revolution had reclassified the fava as “horse beans,” used as fodder for livestock due to abundance the tough nature of the seed (Albala 67). Overall however, bean varieties have become less stigmatized since the late twentieth century. Attempts to reclaim healthy eating habits have led to a growing inclusion of bean varieties in recipes. In addition, the influence of Latin American cuisines is increasing the consumption of beans in the United States (Tobias 71)

## **AFRICA and INDIA**

The origin of black-eyed peas (*Vigna unguiculata*) is still debated between West Africa and Ethiopia. Either way this bean has been cultivated in Africa since around 1,800 B.C. Unlike the rest of the world, farming here began with pearl millet and black-eyed peas as the staple crops (Albala 117). The black-eyed peas were prominent in African religions as food for the gods. This practice spread with the beans to Brazil in Candonble and the Caribbean in Santeria.

The slave trade was the vehicle by which this species came to America: transferred in the pockets of African men and women. Ever since the black-eyed pea has been identified with

black-skinned people “as well as a source of pride and communal solidarity for African Americans for whom they have become an indispensable ingredient in Soul Food” (Albala 117). Cookbooks promoted Soul Food during the black power movement in the United States in the 1970s, which only cemented their place within the community. Despite this bean solidarity, the earliest recorded use of black-eyed peas was in Greece and India. Until recently the origins were unknown. In Europe they were known only as a variety of cowpea, or called phaseolus until a redefinition of bean taxonomy was undertaken in the sixteenth century due to the New World varietal influx (Morris 370).



Black-eyed Peas  
Pic 14



Mung Bean Sprouts  
Pic 15

India is the rare exception to the bean culture rule of lower class status. In this region meat is not consumed as regularly and thus does not fill an upper class protein role. The earliest known cities in South Asia were built in Pakistan and Northwest India around 2,500 to 1,800 B.C. Beans related to the lentil and chickpea have been discovered which either arrived from the Fertile Crescent or which were grown in prehistoric times. Even today beans are often used as an offering in funerary rights as in the Vedic ritual of *shraddha* (Albala 109). This owes to the belief in the purity of the food, which is also part of the reason vegetables were consumed in place of meat originally.

Why beans became so important to Indian culture depends on how Indians became cow worshippers. One theory relies on economics to explain the change. Perhaps the renewable resources cows provide, such as fertilizer, fuel, and dairy products, became more valuable than meat which was thereafter banned. More likely cow worship and the resulting abstinence from meat is rooted in the Hindu religion. The Rigveda explains all life to be of the same first origin, which created all offspring. Every living creature is therefore equal. Unlike in Judeo-Christian thought, the murder of any creature is considered a crime (Albala 106). Despite this religious restriction members of the higher castes still consumed meat until 600 B.C. when a great famine caused the beef-eating Brahmins to change their habits rather than lose moral and political dominance (Albala 106). Beans have ever since been a staple crop in India, although most modern Indians are no longer vegetarians (Albala 107). The importance of beans continues today because the population density of the region drives up the price of meat.

Before the introduction of lentils and chickpeas, native *Vigna* species existed known as “grams.” These included “mung beans (*V. radiate* or green gram), urd beans (*V. mungo* or black gram) as well as moth beans (*V. aconitifolia*), and rice beans (*V. umbellate*)” (Albala 107). Most of these beans are much smaller in size than beans found in America, and they cook quickly. Recently these *Vigna* beans have become a novelty item in gourmet food shops in the United States due to their tiny size. The urd bean is one example of a bean which is ground into flour.

Traditionally it is then fried, fermented, and made into the Indian pancakes called dhosas (Morris 368). Mung beans are the most familiar source of bean sprout, but these beans are also made into pasta (Tobias 70). The translucent “cellophane” noodle found in Asian soups, stir fries, and salads is actually made of beans.

## **EAST ASIA: GLYCINE**



Soybeans in Typical 'Furry' Pods

Pic 16



The Soybean Seed

Pic 17

Soybeans, the only type of *Glycine*, were first cultivated around the Yangzte River in Northern China around 1100 B.C. (Albala 209). Like other domesticated crops, soybeans became larger, sturdier, and indehiscent (meaning the pods do not naturally split open to release the seed). Soy is central to the Chinese diet, and is “considered one of the five ancient sacred grains, including glutinous and regular millet, wheat, beans and rice” (Albala 210). The influence of vegetarian teachings in Buddhism probably contributed to this centrality. The ban of animals as food in Japan since the seventh century contributed to the country’s reliance on soy products as a source of protein (Albala 216). Another name for soy is “Cow of China” (Albala 211). The Han dynasty (202 BC to AD 220), roughly contemporaneous with ancient Rome,” was the period in which the Chinese made gunpowder, tofu and fermented soy products. Records indicate that this preservation method allowed the people to survive on soybeans and other grains in times of famine (Albala 212). Also during this period a medical system was developed which categorized beans and their uses in a variety of ways. The Chinese believe that the four elements influenced the balance of *chi*, a universal energy, in each individual’s body. The right sort of food and acupuncture were ways to regulate this balance and avoid disease. Black soybeans were heat to treat colds, white or yellow soybeans were cold (Albala 215).

One of the earliest Europeans to leave a record of their travels to Asia was a Dominican missionary named Friar Domingo Fernandez. His account of China includes the first description



of tofu, which he enthusiastically promoted (Albala 221). In the eighteenth century soybeans traveled from Asia to Europe and North America. The West remained enamored of a meat based diet until the nineteenth century when the vegetarian movement gained momentum. Since that time the plant has become economically important in those areas. The culturally Asian preparations of soybeans migrated along with the actual plant. Like the cultural cuisines of other countries, Asian food eventually found a place in American society. "Soybean soon became the third most important agronomic crop in the United States" (Morris 366). A variety of soybean based items such as soy sauce, miso soup, anko (a bean paste often put in deserts or buns known as mooncakes) and tofu, a meat substitute, have gained popularity within the country (Tobias 72). John Harvey promoted soy products in 1917 "as an ideal food for diabetics (Albala 225). Today, due to popularity among vegetarians, agribusiness for insecticides and livestock fodder, pharmaceuticals, as well as industrial uses such as ink, disinfectant, and textiles, soy is the number two crop in America (Morris 366).



An Anko-filled dessert  
Pic 18



Miso Soup with Tofu  
Pic 19

## The 1812 Garden Model:

The purpose of this section is to investigate the cultivation of legumes in early 19th century America in an attempt to re-create our own 1812 garden which will be planted at Hamilton College. Cultivation of legumes was initiated by the Native Americans who had been gardening for hundreds of years before the Europeans first settled in North America. European immigrants brought seeds from Europe and quickly began the cultivation of their own gardens in collaboration with the seed varieties the Native Americans relied on (Kline et al. 1).

Prior to the 19th century, the majority of vegetable seeds were imported into America from England. For example, all peas were introduced to North America by the colonists. It was also a common practice among farmers to save their seeds for insurance against crop failure and to supplement the next year's crop. In fact, the upstate New York Shakers are believed to be the originators of seed sales in "papers" or seed packet envelopes to local farmers. Yet by the 1850s it was no longer necessary for farmers to grow and preserve their own seed, as commercially produced seeds were so readily available by that time (Kline et al. 2). In addition, before the advent of pesticides in the mid-part of the 20th century, heirloom vegetable crops were usually de-pested by hand. As seen here in an excerpt taken from *The Young Gardener's Assistant* in 1840:

*Broad beans are particularly subject to green bugs. Tobacco water, or salt water, will sometimes destroy them; but the most certain way is to watch their first appearance, and to pick off that part on which they first settle, and burn it; or, if such plants be cut down close to the ground, they will produce fresh shoots which may bear a good crop (Bridgeman 32).*

Beans were known as a Native American crop in both North and South America for thousands of years. Beans and corn have historically been cultivated alongside one another as climbing pole beans are known to use the corn stalks as bean poles (Kline et al. 9). Various English legume varieties were grown throughout North America depending on climate variability. For instance, the following English Dwarf beans primarily flourished best in the "Eastern, Western and Middle States" (Bridgeman 31):

Early Mazagan	Sandwich Bean
Early Lisbon	Green Genoa
Early Long Pod	Dwarf Cluster
Large Windsor	White Blossom
Large Toker	Green Nonpareil
Broad Spanish	Sword Long Pod

What is best to note about these bean varieties, is that they are particularly sensitive to "summer heat overtaking them before they are podded, causing the blossom to drop off prematurely" (Bridgeman 31). Therefore, according to *The Young Garden Assistant Garden and Flower Seed Manual*, it is best;

*If a few of the best varieties of these Beans be planted in the open ground, as soon in the season as it can be brought into good condition, they will come into bearing in the regular succession, according to their different degrees of earliness, and planting may be repeated every ten days of the first spring month (Bridgeman 31).*

On the other hand, there are various other dwarf bean varieties which are native to India and South America that cannot withstand any cold weather and should not be planted in open ground until warm weather will "stay for good" (Bridgeman 31). The following beans require light, rich soil for optimum yields:

Early Dun-Colored or Quaker	Large White Kidney Dwarf
Early Valentine	White Cranberry Dwarf
Quail's Head	Red Cranberry Dwarf
Early Mohawk	Yellow Cranberry Do.
Early China Dwarf	Warrington or Marrow
Early Yellow Six Weeks	Refugee or Thousand to One
Early Rob Roy	Marble Swiss Bean
Early Black Dwarf	Royal Dwarf Kidney

Also found in Bridgeman's *Young Gardener's Assistant*, the following pole or running bean varieties should be planted in early May or June when the weather is just beginning to warm;

Scarlett Runners	White Dutch Runners
Dutch Case Knife	Asparagus of Yard Long
London Horticultural	French Bicolour
Red Cranberry	White Cranberry

Various catalogues of garden seeds produced by the United Society of the Shakers in the early to mid 19th century are the most reliable source of information about what seed varieties were grown. An example of a seed catalogue from 1843 listed the following bean varieties in a published gardener's manual:

Beans:

- Early China (bush)
- Early Purple “
- Early White “
- Royal White “
- Clapboard (pole)
- Cranberry “

Peas:

- Early Washington
- Early Frame
- Large Marrowfat
- Tall Sugar

\*Seed varietal information found in J.W. Kelley's *Gardener's Manual*, 1843.

Also taken from a Shaker garden seed list, one can see the various legume varieties that were in demand in 1826:

Beans:

- Early Bush

Peas:

- Early Petersburg
- Large White Marrowfat
- Green Dwarf Marrowfat
- Strawberry

\* Seed varietal information found in Margaret Sommer's *Shaker Garden Seed Industry Book*, 1972, p. 38.

As was mentioned earlier, it is rather difficult to identify with complete precision the specific varieties of plants that were grown in the US in the early 19th century, and seed catalogue

listings continue to be one of the best ways to determine what types of legumes were being cultivated. For instance, the following is an excellent source to identify early 19<sup>th</sup> century legume varieties, taken from McMahon's *A Catalogue of Garden, Herb, Flower, Tree, Shrub, and Grass Seeds* written in 1810:

Early Mazagan Bean	Dwarf Cluster Bean
Early Lisbon Bean	White Blossom Bean
Long-podded Bean	Large Windsor Bean
Field or Horse Bean	Large Toker Bean
Early Frame Peas	White Rouncival Peas
Early Golden Hotspurdo Peas	Green Rouncival Peas
Early Charlton Peas	Large Gray Rouncival Peas
Early Dwarf Sugar Peas	Spanish Morotto Peas
Leadman's Dwarf Peas	Pearl or Nonesuch Peas
Spanish Dwarf Peas	Common Field or Boiling Peas
Sugar Poland Peas	Glory of England Peas
Blue Prussian Peas	Essex Reading Peas
Tall Crooked Sugar Peas	Dutch Admiral Peas
Green Imperial Marrow Peas	Yellow Split Peas
Large Marrowfat Peas	Green Split Peas
Dwarf Marrowfat Peas	

\*It is important to note that a much more detailed analysis of cultivation and growing instructions for both beans and peas may be found in the cultivation section\*

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