Meet the Luscious Legumes – Peas and Beans - Pods and Seeds

John Biernbaum, MSU Horticulture and Student Organic Farm

Common Vegetable Crops in the family Fabaceae – formerly the Leguminacea:

The family *Fabaceae* has over 600 genera and close to 18,000 species. The limited number of food crops represents only a small fraction of the family. These cool and warm season vegetables that produce edible pods and seeds are valuable additions to the garden and farm, and foods that most people enjoy eating.

General information is available at: http://en.wikipedia.org/wiki/Fabaceae

1. Peas – *Pisum sativum* http://en.wikipedia.org/wiki/Pisum_sativum
2. Bush beans, green beans, snap beans (formerly string beans), pole beans – *Phaseolus vulgaris* (common bean) http://en.wikipedia.org/wiki/Phaseolus
3. Dry beans – also *Phaseolus vulgaris* - navy http://en.wikipedia.org/wiki/Navy_bean; kidney http://en.wikipedia.org/wiki/Kidney_bean ,
4. Lima beans – *Phaseolus lunatus* http://en.wikipedia.org/wiki/Lima_bean
5. Blackeyed peas - *Vigna unguiculata unguiculata* (Cowpea)
6. Edible soybean or edmame - *Glycine max* http://en.wikipedia.org/wiki/Glycine_max
7. Peanuts or ground nuts *Arachis spp.* http://en.wikipedia.org/wiki/Arachis_hypogaea
8. Fava beans - *Vicia faba* http://en.wikipedia.org/wiki/Broad_bean
9. Lentils - *Lens spp.* http://en.wikipedia.org/wiki/Lentil
10. Chick peas / garbonzo beans – *Cicer spp.* http://en.wikipedia.org/wiki/Cicer_arietinum
11. Also ground cover or green manure nitrogen fixing crops such as white clover, red clover, alfalfa, hairy vetch, field peas, etc

General Questions to Address when planning, scheduling and practicing vegetable production:

1. What to grow? (crop and varieties)
2. How many/much to grow?
3. When to grow them?
4. Where to grow them?
5. How to grow them?
6. How to harvest?
7. How to store / protect?
8. How to market?

Crop Topics:

1. History, background and folklore

- From diverse regions of the world- east and west, north and south. http://www.hort.purdue.edu/newcrop/hort_306/text/lec05.pdf
  - Americas: common/green bean, lima bean, pinto bean, tepary bean
  - Near east & Mediterranean: peas, lentils, chick peas, fava beans, alfalfa, clover, vetch
  - West Africa: black eyed pea (a type of cow pea)
  - India: chick pea, pigeon pea, mung bean, rice bean, cow pea, pea
  - Far east: soybean, adzuki bean, velvet bean
- Generally referenced as “new world” or western hemisphere types from the Americas or “old world” or eastern hemisphere types from Asia
  - Beans from the western hemisphere or “new world” / north-south America are bush or pole green beans.
  - Beans from the “old world” or Mediterranean/Asia include peas, soybean, mung bean
- Peas grown for thousands of years (6000+) along with wheat and barley. Grown by Romans and Greeks. Over 2000 cultivars available in 1984. Soybeans grown in China for over 5000 years
- Peas can tolerate cold temperatures and some frost, but beans are sensitive to cold temperatures (less than 50^{o} Fahrenheit) and show chilling damage at temperatures well above frost temperature. Fava beans (*Vicia faba*) are a bean crop that is more tolerant of cold temperatures.
- While called vegetables, the plant part consumed is a fruit comprised of the edible pod and seeds.

- Most are annuals (grow and complete the life cycle from seed to seed in one season/year).
- Complete or perfect flowers, either white or colored. Flowers are self fertile and often pollinated before opening, although flowers can also be insect pollinated;
    - Flowers are edible and usually taste good, like peas or beans.
- Can be picked as immature pods with small seeds, mature pods with fresh seeds for shelling, or when dry and fully developed.
- Good source of protein, minerals and fiber as well as health promoting phytochemicals;
- The legume crops do best in high light and most in warm temperatures (not garden peas). Selecting crops for a particular climate or heat zone takes into consideration the number of days needed to harvest mature seeds. Crop times of over 100 days for warm season crops can be challenge for climate zone 5 and less (north). Climate zone 6 and above (south) or urban areas with warmer temperatures have a greater probability of success for the longer season crops.
- Seeds can be collected for future plantings from non-hybrid cultivars; self pollination increases the probability of maintaining purity of the seed line, but cross pollination by insects can occur. Distances of 150' between bean cultivars have been recommended to prevent cross pollination. Most home gardeners minimize cross pollination by only growing one type of pea or bean at a time.
- Beans are one of the three sisters crops (corn, bean, squash), with pole type beans typically using the corn plants as a trellis of sorts. The beans used were traditionally dry bean types that were used through the winter. http://en.wikipedia.org/wiki/Three_Sisters_%28agriculture%29
- Nitrogen fixation can occur in the roots if an association is developed with nitrogen fixing bacteria (*Rhizobia* spp.) from the soil. For garden and field production, inoculation of the seeds is recommended to increase nitrogen fixation. *However, it is clearly not essential and in many fertile garden soils managed with compost and organic mulches there may be little to no benefit. Not having the inoculum should not stop a gardener from growing peas and beans or using legume cover crops.* The bacteria come in the form of a dried fine textured powder that is purchased in small quantities ($4 to $6) which can treat large amounts of seeds (5 to 15 lbs) by dusting or coating the seeds prior to planting. Inoculum can also be applied to the soil after planting if seed treatment did not occur. Purchased inoculum is usually specific to the type of legume, for example peas, beans, soybeans, clover or alfalfa would each have a different inoculum (bacteria). The inoculum/bacteria are in a dormant state but "alive" so need to be kept cool (refrigerated) and out of direct sunlight if not used quickly and are generally reported to only be effective for up to a year if refrigerated. Packaged materials generally have an expiration date.
    - http://www.ext.colostate.edu/pubs/crops/00305.html
    - http://extension.psu.edu/plants/crops/forages/successful-forage-establishment/inoculation-of-legumes-for-maximum-nitrogen-fixation

2. **Crop and Cultivar selection** – (**What?)** how many types? Possible priority if space limited?
    - How much garden space is available? Selecting which to grow will depend on personal eating preferences or for commercial sales the market preference and price.
    - Beans and peas can fit in almost any home garden and are a productive addition. *Green beans are considered one of the most commonly grown home vegetables in the US and is a good warm season vegetable with a short crop time (45-55 days).*
    - Some varieties of pea and beans can be grown vertically on a trellis or fence to save ground space.
    - When root (fusarium) or foliar (powdery mildew) diseases are an issue due to environmental conditions, selection of disease resistant varieties can be a first line of defense.
    - Pea types: Shelling (50 to 60 days), Snap (Sugar Snap) (50 to 60 days), Snow (60 days), Shoots (10 days), and greens or garnish – 30 to 50 days
    - Bean types: bush (Provider) and pole (Fortex); fresh shell beans, dry beans, fava beans, lima beans, soybeans Also pod color – green, yellow, purple, mixed; also round, flat, long, short
    - Dry beans (navy, kidney, chick peas, lentils, etc) are not likely efficient to grow in Michigan gardens. Navy, black, kidney and others grown in the thumb of Michigan are better purchased in bulk.
    - Longer and warmer season crops like Lima beans, black eyed peas and peanuts can be grown but do better in warmer climates. A south wall warm microclimate but work.

- Peas can also be grown in flats for young pea shoots – typically 2" to 4" tall – that are harvested for garnish or for baby salad mix. Or pea tips – a combination of new growth foliage and flowers can also be used for garnish or salad greens.

3. How many plants per person or family? (or yield per plant) **(How much?)**
    - One author recommended 40 to 50 plants per person. My personal experience under good gardening conditions is that as few as 5 to 10 green bean plants can provide a generous serving of fresh beans.
    - A second author suggested that one adult cold eat as many as 15 lbs of fresh green beans over the season which might require 25 feet of row. An estimated yield in this publication was 60 lbs per 100 feet of row or 34 pounds per 100 square feet (10'x10' area with 21" row spacing).
    - An estimated yield for shell peas is 30 lbs per 100' of row with 15' of row per person for 4 lbs.
    - For green beans, harvest may continue for several weeks, but succession plantings are advised to manage pests and diseases. Time between plantings is approximately 2 to 4 weeks.
    - For peas, successions often result in later harvests in warm conditions not conducive to quality. Planting multiple varieties or growth types early in the season at one time is recommended.
    - Most of these crops can be held for a day or more after harvest without refrigeration in a cool place without serious loss of quality.
    - What type of preservation is possible besides eating fresh?
    - Green beans be pickled (dilly beans) or blanched and frozen.
    - Drying or dehydration is an option for peas and dry beans.

4. What location and how much space per plant? **(Where?)**
    - Rotation is considered important to minimize root and foliar diseases; general recommendation is production only once every 3 to 5 years in a given location.
    - Full sun is best. Peas and green beans may produce low yields in partial shade.
    - Plant spacing is important to get adequate growth, flowering and fruiting. The more fertile the soil and the more water provided, the less space needed per plant. If your soil is less fertile and you don't water very often, use the wider or larger spacing recommended.
    - Usually planted in rows, peas can be 5 to 7 seeds per foot while beans are 2 to 6 plants per row foot. Cucumber plants typically require about 1 sq foot or 12"x12" as a minimum and 2 sq ft or 18"x18" is recommended for large plants. In row spacing may be 18" and row spacing 36 to 48".
    - Summer squash plants need more space and can use 24"x24". Winter squash vine out over large areas and rows are often spaced 6' with plants spaced 2' in the row.
    - Peas can be produced in a hoophouse but are not a high priority for protected cultivation since outdoor production is possible. Protected cultivation and earlier harvest of greenbeans may be justified in some markets.

5. Rotation Considerations: With, Before or After What Crops? **(Where?)**
    - Recommended to grow in an area where the soil is fertile and well prepared. While legume cover crops such as clovers and alfalfa can add nitrogen to the soil over months and years, a several week (6 to 10) crop of peas or beans is not expected to contribute a significant amount of nitrogen for later crops.
    - Application of compost prior to planting is recommended.
    - Can follow any plants in the rotation.

6. How Long a Crop Time and **When** to Plant? (Cool or Warm Season?)
    - Many pea and green bean varieties are in the 40 to 60 day range.
    - For spring planting outside in Michigan, peas are typically sown the first two weeks of April if soil temperature and moisture allow. Later spring plantings and higher temperature during flowering and pod development usually result in lower productivity and quality.
    - For beans, later start in the season is typical since soil warmth is required.

Crop	Seeding (Zone 5)	Catalog Days	Harvest
Shelling Peas	Late March, Early April	50 to 60 days	Late May and June
Snow Peas	Late March, Early April	60 days	Late May and June
Fall crop Peas	60 days before frost	60 days	End of Sept, Beginning Oct.
Green beans	Late May, Early June; successions	50 to 60 days	July, Aug, Sep
Edible Soybeans	Late May, Early June; successions	75 to 100 days	Late August to September
Clover, alfalfa, vetch	Frost seed in March, or sow late Aug		

7. Propagation/Getting Started – Seeds, Sets and Transplants (**When and How?)**
    - Seeds – germination percentage typically is very good – over 90%; but some lots of bean seeds have had poor or very low germination in recent years. Reason for low germination has not bee identified.
    - Seed is large, usually round for peas or oval shaped for beans.
    - The seeds can be soaked in water for a few hours or overnight to hasten and increase the uniformity of germination. Soaking and pregermination at a warm temperature (65-70F) may improve germination in colder soils.
    - Seeds are generally sown 1" to 2" deep (deeper in sandy soils and dry conditions).
    - The cotyledons of the seed may stay in the ground or emerge from the ground.
    - Seed predation is possible after planting and before emergence by mice and ground squirrels.
    - Seeds generally store well, several years, if stored cool (<40^{o}F) and dry (< 40% RH); most authors list seed longevity at 3 years.
    - Seed germination is strongly influenced by temperature:
        - Seeds will germinate fastest at a warm temperature (70^{o}F).
        - Peas can germinate at low soil temperatures (50^{o}F) but will take 2 to 3 weeks vs 1 week or less at warm temperature.
        - Beans can be direct sown in garden/field if soil is greater than >60^{o}F.
    - Inoculation of seed is recommended for increased nitrogen fixation from nitrogen fixing bacterial nodules that form on the roots. (See information provided in Section 1.)
    - Transplants are not commonly used, reportedly due to slow root regrowth after transplanting. However, green beans have been successfully transplanted into high tunnels at the MSU Student Organic Farm. If transplanting minimize root disturbance or damage by using soil blocks or cells.
    - Seed Keeping: Mature seeds can be collected from non hybrid varieties for future plantings.

8. Cultivation, management and training: Fertility, Irrigation, Pollination (**How?)**
    - As stated previously, well drained, fertile soils that are irrigated and minimal weeds are very helpful.
    - Fertility provides for rapid early season growth and leaf development necessary for flowering and fruit formation. Some authors suggest that legumes do not need to be fertilized due to the process of nitrogen fixation. Depending on the soil and the setting building soil fertility with minerals or organic fertilizers can increase yields.
    - Organic matter and fertility from compost also helps to increase water absorption and retention. Soil moisture is very important for early crop establishment.
    - Water availability is a key to maintaining growth – general recommendation of an inch of water per week applies for irrigation;
    - Beans and peas can be trained on a single string, a round cage / tipi, or netting. What are some examples of good trellis material? Can purchase white netting.
    - Many of the more common beans are self-fertile, meaning insect pollination is not essential for seed set. Pollen may shed and pollination occur prior to the flower opening. This method of pollination is common in peas, which is a good thing since bees may not be flying in the cold early spring season when peas are flowering. However, pollination of some types are reported to be improved by insect visitation. In one reference it was reported that bumble bees are more effective and honey bees were not that effective at altering pollination and seed set.
      http://www.pollinator.ca/canpolin/beans.html

9. Plant Protection – what herbivores, decomposers and predators to consider?
    - Seed predation is possible after planting and before emergence by mice and ground squirrels.
    - Very susceptible to feeding by rabbits, groundhogs/woodchucks and deer. Put protection in place prior to seedling emergence.
    - Aphids can be a problem in warmer weather. Natural predators can often manage or reduce the aphid population for garden plants. Another possible treatment of aphids is soap solution to wash them off the plants. Example soaps are Murphy Oil Soap, Dawn dish detergent or other dish detergents. A rate of 1 teaspoon to 1 tablespoon per gallon of water with thorough spraying.
    - Mexican bean beetles
    - Root disease – seedlings are susceptible to root rot organisms and damping off (fusarium) in heavy and or wet soils; provide for good drainage.
    - Foliar disease – powdery mildew is a possible problem on peas. Adequate plant spacing to provide aeration of foliage is a preventative.

10. Harvest, Storage, Display, Preservation
    - Harvest methods are very important to the quality of pods and seeds harvested in the legume family.
        - Peas and beans can be harvested when the fruit is still immature and the seeds are not developed, often based on size of the pod. Smaller is generally considered better.
        - Shelling peas and beans are harvested when the seeds are filled but still fresh, not mature.
        - Dry peas and beans are harvested with the pods have begun to dry and the seed is fully mature. The dried pod is split to release the seeds.
    - When peas and beans are not picked regularly to remove the fruit, the production of flowers and therefore future pods will decrease significantly. Regular harvest is a key to longer term productivity.
    - Peas and green beans can be consumed uncooked but some mature legume seeds such as kidney beans can contain a toxic compound that is rendered non-toxic by cooking.
    - Storage of fresh peas and beans best at cool (40-45^{o}F) conditions with high RH (80-90%) for quality.
    - For freezing, highest quality freshly picked crop is recommended. Blanching in boiling water followed by ice bath is common practice.
    - Green beans can also be preserved by pickling (vinegar, sugar, spices) and or fermentation.

11. Marketing, Economics and Value (What is the selling price or unit?)
    - Peas and beans can be sold either by the pound of by volume (pint, quart, etc).
    - The market season of snow or edible pod peas is relatively short in the spring season (May-June).
    - Green beans are generally available from local production in Michigan from early July to early September.

12. Some Keys to Success
    - Sow peas very early in the season and grow during cool spring weather.
    - For beans wait until danger of frost is past and grow in bright light and hot weather.
    - Provide moderate fertility and regular moisture; if nitrogen fixation is necessary, inoculate seeds.
    - Harvest at the “right” time and regularly to maintain flowering and production.
    - Multiple or succession plantings for bush beans over the season.

References or other sources of information

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3. Voigt, C.E. and J.S. Vandemark. 1995. Vegetable Gardening in the Midwest. University of Illinois Cooperative Extension Service. IL. 176 pgs.
4. Top Ten Tips for Bush Beans http://www.weekendgardener.net/vegetable-gardening-tips/growing-bush-beans-061006.htm