Agronomic Spotlight

Seminis grow forward

Selecting Bean Varieties

» Yield consistency, pod qualities, and plant structure are important characteristics to consider.
» Qualities required for fresh market and processing beans often differ.
» Disease resistance can be an important tool for disease management.

Yield and Quality

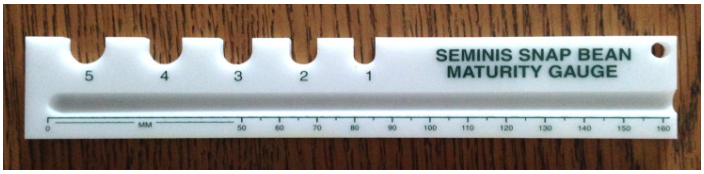
Yield potential, measured as tons or boxes of pods per acre, is one of the most important factors to consider in a bean variety, but yield quality and stability are also important. Yield stability is an indication of how consistent a variety is in yielding over a range of conditions (biotic and abiotic stresses) and environments (temperatures and soil types). A variety with moderately high but consistent yields may be preferred over a variety with more variable yield levels.

It is also important to choose varieties with the appropriate pod and plant qualities, as having the right type of bean can be just as important as having high yields. Many factors are involved in determining yield quality, and the characteristics needed for processing and fresh market uses can differ.

Pod Characteristics

Pod shape, size, color, and straightness are some of the factors used to evaluate quality. There are two basic pod shapes, flat and round. Flat pod types (also called Romano or Italian types), have wide, flattened pods. However, most commercially grown beans are round or garden types with pods that are round in cross-section.[1]

Figure 1. A gauge used to evaluate the sieve size of bean pods



Pods vary in their lengths and diameters, and specific diameters are required for certain uses. Pod diameter is indicated as "sieve size" (Table 1).[2] The beans harvested from a planting will vary in size somewhat, but it is desirable for most of the pods to be of the target sieve size, with the rest in the size categories just above and below the target. For standard processing uses, most of the pods should have a sieve size of 5, with a few in the 4 and 6 size categories. Smaller sized pods can be required by processors that are packing whole bean products. A smaller pod size is also preferred for fresh market beans, where a sieve size of 4 is standard (Figure 1). Variety descriptions often include the distribution of pod sizes typically produced by the variety. [3,4]

TABLE 1. BEAN SIEVE SIZES BASED ON THE CROSS-SECTIONAL DIAMETER OF THE PODS[2]

Sieve Size	Pod Cross-Section Thickness (mm)
1	<5.8
2	5.8 - 7.5
3	7.5 - 8.5
4	8.5 - 9.7
5	9.7 - 10.9
6	10.9
7 and over	>10.9

Pod length is usually a less critical factor. Longer pods usually mean higher yields. However, varieties with longer pods are also likely to produce more curved pods, and long pods are more likely to break during harvest and transport. For fresh market beans, the standard length is 5 to 7 inches, but 4 inch "petite" beans are desired in some markets.

Most of the pods produced should be straight, with fewer than 15% being curved. This is especially true for processing beans. Plants with an upright growth habit usually produce straighter pods, and shorter pods tend to be straighter.

Pod color is another important characteristic. While there are some yellow (wax) varieties, most commercial varieties have green colored pods. However, the green color can vary in intensity (dark to light) and hue (yellow-green to blue-green). Lighter colored pods are usually needed for processing; while a darker, blue-green color is often preferred in fresh market beans. It is also best for the pods on a plant to be uniform in color, as pods that vary greatly in color can be problematic for both processing and fresh market uses.[1]

The types of pod attachment to the stem desired by processors and fresh market buyers are also quite different. Having the pedicel (the pod "stem") remain attached to the pod is preferred in fresh market beans because when they break off the damaged tissue starts to oxidize and turn brown. For processing beans, however, having the pedicels detach at harvest is desirable, as

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they are removed anyway during processing, shortening the processing time.

Two more pod characteristics of importance are "stringiness" and seed size. Modern varieties are all "stringless", meaning that the vascular bundles running down the sutures of the pods do not need to be removed. However, even modern varieties vary in their fiber content (or stringiness), and more tender pods are preferred for fresh market uses. However, some fiber helps pods resist breakage during shipping.

Pod smoothness is affected by the size of the seeds that develop within the pods as they mature. In varieties with smaller, cylindrical seeds, the pods usually stay smooth longer (Figure 2). Varieties also differ in the rapidness of seed growth. Those that have seed that increase in size rapidly are said to be "flashy", meaning that there is a narrow window of time between pods becoming mature and becoming bumpy as seeds enlarge.[2] Large seeds are also a problem in processing beans, as they tend to fall out of cut pods, leaving cavities in the pods and seed pieces at the bottom of the can.

Figure 2. Pods that are smooth and uniform in length and diameter

Plant Characteristics

The commercial bush type bean plants vary in their height, degree of upright growth habit, and location of pod formation on the plant. For both fresh market and processing types, an upright plant with pod formation concentrated in the mid to upper part of the canopy is desirable. Taller plants usually yield better, but they are also more susceptible to lodging (plants falling over), especially when they have a large pod load in the upper part of the canopy. Plants with strong root systems can be less susceptible to lodging, and they are less likely to be pulled out of the ground during mechanical harvesting.[1]
Having plants with strong branches is important, as this reduces the amount of trash (stems and leaves) harvested along with the beans. More compact, erect plants are usually preferred for processing beans, but it is still important to have a variety where the pods do not contact the soil, as this increases the incidence of pod rots and curved pods.

Disease Resistance

Disease resistance traits need to be considered, as diseases can dramatically impact both yield and pod quality. Bacterial diseases, including bacterial brown spot and halo blight, show up as water-soaked to brown spots on both leaves and pods. The leaf symptoms cause a loss of photosynthetic area, which results in fewer and smaller pods. Spots on the pods affect pod quality, making the pods unmarketable.[4,5] Anthracnose and bean rust are fungal diseases that also affect both leaves and pods.

Aphanomyces root rot, Pythium root rot, and Pythium aerial blight are diseases caused by fungal-like organisms that live in the soil and infect roots and stems. Infected plants initially wilt as root and vascular functions decline. When severe, these diseases can result in plant death.[6]

Important viral pathogens of beans include Bean common mosaic virus (BCMV) and Cucumber mosaic virus (CMV). Viruses are often vectored by insects, such as aphids, thrips, and white flies. Once a plant is infected, the viruses spread systemically throughout the plant affecting plant growth and pod development.[6]

Many of these diseases can be managed through the selection of resistant varieties. A resistance trait may be designated as "high resistance", indicating that a variety with this trait is able to highly restrict the activities of the pathogen, when compared to a susceptible variety. "Intermediate resistance" indicates that a variety with that trait restricts the growth and development of the pathogen, but may exhibit a greater range of symptoms than would be seen on a variety with high resistance. Some symptoms may develop, even on varieties with high resistance, but lower disease levels usually result in higher yields and quality.

Sources:
1 Myers, J. R. and Baggett, J. R. 1999. Improvement of Snap Bean. p. 289-329. IN: Singh S. P. (ed) Common Bean Improvement in the Twenty-first Century. Dordrecht:Kluwer. 2 Duncan, A.A., Every, R.W., and, MacSwan, I.C. 1960. Commercial production of bush snap beans in Oregon. Oregon State Coll. Ext. Bull. 787. 3 Neibauer, J. and Maynard, E. 2012. Commodities-Snap beans. Purdue University. https://www.hort.purdue.edu/prod_quality/commodities/bean.html. 4 Rutgers New Jersey Agricultural Experiment Station. 2015 Commercial Vegetable Production Recommendations for New Jersey. Publication E001. Beans: Snap and Lima. 5 Elwakil, W. M. and Mossler, M. A. 2015. Florida crop/pest management profiles: Snap beans. University of Florida IFAS Extension, CIR1231. http://edis.ifas.ufl.edu/pi032. 6 Schwartz, H. F., Steadman, J. R., Hall, R, and Forster, R. L. 2005. Compendium of bean diseases; Second edition. American Phytopathological Society. Web sources verified 03/17/2016.

For additional agronomic information, please contact your local seed representative.
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