

Dry Bean Types and Development Stages

Two basic plant growth habits are found in dry edible bean: determinate (bush) or indeterminate (vining or trailing). Cultivars may be classified according to plant growth habits (Tables 1 to 4). For example, navy beans may be the bush or vining type.

With the determinate habit, stem elongation ceases when the terminal flower racemes of the main stem or lateral branches have developed. With the indeterminate habit, flowering and pod filling will continue simultaneously or alternately as long as temperature and moisture availability permits growth to occur.

In addition to the distinction between determinate and indeterminate plant habits, four plant growth types have been identified. These are: Type I – determinate bush; Type II – upright short vine, narrow plant profile, three to four branches; Type III – indeterminate, prostrate vine; Type IV – indeterminate with strong climbing tendencies requiring trellis systems for optimal production. Most cultivars in the U.S. belong to the first three plant growth types. These refined growth types have become useful in the identification and classification of newer upright bean cultivars.

The development of new cultivars that combine upright architecture (Type II) and competitive yields have allowed many growers to switch their harvest operation from conventional to direct harvest

(two- or three-step vs. one-step operation). This allows for faster harvest, along with a reduction in time, equipment and labor. In addition, it allows for a better harvest timing among different crops, which is crucial in this region.

However, seed losses during harvest in many cases may be higher in direct harvest because of pods located close to the ground and increased shattering. These seed losses can be minimized by choosing the appropriate cultivar and having the optimal setup in the harvest equipment. In addition, the environmental conditions at the time of harvest (soil conditions, plant and seed moisture, and temperature, among others) are also important factors that influence the amount of seed losses.

Plant development for determinate and indeterminate plant types has been divided into vegetative (V) and reproductive (R) stages, as indicated in Table 5 (Pages 15-16). Vegetative stages are determined by counting the number of trifoliolate leaves (V1 to Vn) on the main stem beginning above the unifoliolate leaf. Reproductive stages are described with flower, pod, and seed characters. The first pod developing on the plant is described and followed to maturity.

At the time of first bloom (reproductive stage indicated by R), secondary branching begins in the axis of lower nodes, which will produce secondary groups of blooms and pods. Following the main stem, which is readily discernible on determinate

and indeterminate plants, is important. A node is counted when the edges of the leaflets no longer touch.

A bean plant may have the same number of nodes at two locations but differ in height because of the stem length between nodes. The average days from planting to reach a certain growth stage and days between stages are very broad and will vary from year to year and cultivar to cultivar. Flower color varies among cultivars. Beans normally are self-pollinated, with less than 1 percent natural out-crossing.

Immature pods of most cultivars are green, turning yellow and then light brown or tan as they mature. An exception is black bean, in which some cultivars may have light purple pods. Pods of the navy bean are more cylindrical, compared with the longer, wider and more flattened pod typical of the pintos. The pods of dry bean are very fibrous, compared with the pods of snap beans. A satisfactory dry edible bean cultivar bears its pods sufficiently high above the ground, ripens uniformly and does not shatter appreciably at maturity.

Table 5. Stages of vegetative and reproductive development in determinate bush (Type I) and indeterminate (Type III) dry bean.

| Stage No. | GENERAL DESCRIPTION* | Days from Planting** |
|--|--|------------------------------|
| Vegetative Stages | | |
| VE | Hypocotyl emergence (crook stage) | 7-8 |
| VC | Cotyledon (seed leaves) and unifoliolate leaves visible | 8-9 |
| V1 | First fully developed trifoliolate at the third node | 10 |
| V2 | Second trifoliolate (count when leaf edges no longer touch) | 19 |
| V3 | Third trifoliolate (secondary branching begins to show in leaf axils) | 29 |
| V(n) | Nth trifoliolate, but with blossom clusters still not visibly opened | A new node every 3 to 5 days |
| V5 | Bush (determinate) plants may begin to exhibit blossom and become stage R1 | 50 |
| V8 | Vine (indeterminate) plants may begin to exhibit blossom and become stage R1 | 40 |
| Determinate BUSH (Type 1) Reproductive Stages | | |
| R1 | One blossom open at any node | 50 |
| R2 | Pods ½ inch long at first blossom position (usually node 2 to 3) | 53 |
| R3 | Pods 1 inch long at first blossom position; secondary branching at all nodes, so plant is becoming denser but not taller, ½ bloom | 56 |
| R4 | Pods 3 inches long (seeds not discernible; bush types may be shorter) | 59 |
| R5 | Pods 3 to 4 inches (seed discernible) | 64 |
| R6 | Seeds at least ¼ inch over long axis | 66 |
| R7 | Oldest pods have developed seeds (other parts of plant will have full-length pods with seeds almost as large as first pods; pods will be developed over the whole plant) | 72 |

Determinate BUSH continues on Page 16

| Stage No. | GENERAL DESCRIPTION* | Days from Planting** |
|-----------|--|----------------------|
| R8 | Leaves yellowing over half of plant, very few small pods and these in axils of secondary branches; small pods may be drying (point of maximum production has been reached) | 90 |
| R9 | Mature, at least 80 percent of the pods showing yellow and mostly ripe; only 40 percent of leaves still green | 105 |

**Indeterminate VINING Plant (Type III)
Reproductive stages**

| | | |
|----|---|----|
| R1 | One blossom open at any nodes; tendrils will begin to show | 40 |
| R2 | Pods ½ inch long at first blossom position (node 2 to 5 most plants); blossom would have just sloughed | 43 |
| R3 | Pods 1 inch long at first blossom position; pods are showing at higher nodes when blossom sloughs, ½ bloom | 46 |
| R4 | Pods 2 inches long at first blossom position | 50 |
| R5 | Pods more than 3 inches long, seeds discernible by feel | 56 |
| R6 | Pods 4.5 inches long with spurs (maximum length); seeds at least ¼ inch long axis | 60 |
| R7 | Oldest pods have fully developed green seeds (other parts of plant will have full-length pods with seeds near same size; pods to the top and blossom on tendrils, nodes 10 to 13) | 70 |
| R8 | Leaves yellowing over half of plant, very few small new pods/blossom developing, small pods may be drying (point of maximum production has been reached) | 82 |
| R9 | Mature, at least 80 percent of the pods showing yellow and mostly ripe; only 30 percent of leaves are still green | 94 |

* Adapted from: Growth stages according to Marshall J. Lebaron (University of Idaho, College of Agriculture, Current Information Series No. 228).

** Approximate number of days. This will vary from season to season, cultivar to cultivar and location.

Figure 1. Plant description.

1. Hypocotyl
2. Radicle
3. Cotyledon (simple leaf)
4. Cotyledonary node
5. Tap root
6. Lateral (branch) root
7. First true leaf (unifoliate)
8. Trifoliolate leaflet
9. Terminal bud
10. Axillary buds
11. Hypocotyl arch
12. Nodes (point of leaf attachment)
13. Nodules
14. Root hairs

