# Gene pools and hybrid dwarfism

Gepts (1998) reported that the common bean has Andean and Middle American gene pools. Singh et al. (1991) noted that there were different races of common bean within each gene pool. The gene pools and races can be distinguished based on plant and seed morphology and Phaseolin seed protein patterns (Table 1).

Table 1. Principal characteristics of cultivated common bean from the Middle American and Andean gene pools.

| Characteristics | Gene pool | |
|---|---|---|
| | Middle American | Andean |
| Shape of terminal leaflet of the trifoliate leaf | Ovate, cordate | Hastate or lanceolate, rhombohedric |
| Leaf pubescence | Sparce, short | Dense, long |
| Length of the fifth internode | Short | Long |
| Pod-bearing inflorescence | Multi-noded | Single-noded |
| Shape of bracteole | Cordate, ovate | Lanceolate, triangular |
| Base of the standard | Striped | Smooth |
| Pod beak position | Placental (dorsal suture) | Between placental and ventral sutures |
| Seed size | Small, medium | Large |
| Phaseolin seed protein patterns | S,Sb,Sd,B | C,H,A,T |

Singh et al. (1991).

Singh and Gutiérrez (1984) identified two complementary dominant genes ($Dl_1$ and $Dl_2$) that can cause hybrid dwarfism in common bean. The dominant $Dl_1$ allele is found in the Mesoamerican gene pool whereas the $Dl_2$ allele is found in the Andean gene pool. There are, however, Mesoamerican and Andean bean lines that have the recessive for $dl_1$ and $dl_2$ alleles and can be used for crosses between gene pools (Table 2).

Table 2. Bean lines that have the recessive for $dl_1$ and $dl_2$ alleles and can be used for crosses between gene pools.

| Bean line | Seed type | Gene pool |
|---|---|---|
| Opus | Snap bean | Andean |
| ICA Pijao (indeterminate)<br>5-593 (determinate) | Black<br>Black | Mesoamerican<br>Andean |

Source: Ferwerda (2001)

Shii et al. (1981) reported that the primary abnormal development event associated with hybrid dwarfism was restricted root growth and exogenously applied cytokinin was shown to produce more normal root growth in hybrid dwarf plants. Koinange and Gepts (1992) reported the production of adventitious roots of the lower internodes of hybrid dwarf plants. Hybrid dwarfism is also more severe in higher temperature environments.

Beaver (1993) developed a simple method to produce seed from hybrid dwarfs. The main stems of the hybrid dwarfs were covered with soil above the cotyledonary node. A solution of "Hormex" (0.24% 1-napthaleneacetic acid and 0.013% 3-indolebutyric acid) was applied to the soil at a concentration of 4 ml $l^{-1}$ of water to promote adventitious root growth. Plants were watered frequently to avoid water stress. The hybrid dwarf plants began to grow a few weeks after the main stems were covered with soil. Inspection of plants after the harvest revealed a profuse growth of adventitious roots on the main stem. Kelly (personal communication) was able to avoid hybrid dwarfism by grafting hybrid dwarf scions onto normal stocks.

## References


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