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A great deal of variation for growth habit is found in the common bean *Phaseolus vulgaris* L. Predominance of a type in a given production region may largely depend on its adaptive characteristics, cropping systems, yielding abilities, etc.

Using seed size, type of apical bud at flowering and climbing ability as criteria, Evans (1973) identified 5 different races of beans, suggested their pattern of evolution and presented the range of variation for each of their principal characters such as habit of plant, internode length, number of internodes, leaf size, pod length, seed number per pod, seed size, and pod texture. Each of the five races were characterized by a different habit of plant, e.g. indeterminate climber, indeterminate semi-climber, indeterminate bush, determinate multi-noded and determinate bush for the races 1 to 5, mentioned here in their respective order. Some bean researchers refer to the latter four classes as bush beans, whereas other classify beans into three growth habits namely determinate or bush, semi-indeterminate or semi-viny and climbers or pole beans.

Four principal growth habits; types I, II, III and IV, were identified (CIAT, 1974, 1977). The ideotypes (CIAT, 1976, 1977), the mean values for 13 morpho-physiological characters and yield models for each of the four principal growth habits have been reported (CIAT, 1980).

Each of the growth habit types II, III and IV were sub-divided into one additional sub-type (CIAT, 1979) in order to cover the range of principal types grown in Latin America. Based on their suitability for specific cropping systems these seven types of growth habits have been grouped (CIAT, 1981B) as the following:

1. For monoculture: I, IIa
2. Both for monoculture and intercropping: IIb, IIIa, IIIb
3. For intercropping only: IVa, IVb

It should, however, be noted that type I and IIa are not always grown in monoculture. Traditional farmers in Colombia (Huila, Nariño, Santander del Norte, Caldas, etc.) and Ecuador (Imbabura, Carchi, Chimborazo, etc.) mostly intercrop type I and IIa bean varieties with maize, coffee, cassava, potato, etc. Likewise a large portion of type IIb, IIIa and IIIb are not intercropped. For example all commercial bean varieties of Pinto, Great Northern and Red Mexican types of the U.S.A.; Flor de Mayo, Bayo, Pinto, Ojo de Cabra, etc., of Mexico; Mulatinho, Carioca, Costa Rica, IPA 74-19, Aete 3, Rosinha, Chumbinho, etc., of Brazil; Cristal Fenix, Arroz 3, Tortolas Diana, and Don Timoteo of Chile; Cocacho, Blanco Local and Canario Corrientes of Perú, are all type IIIb varieties, which are grown in monoculture in millions of hectares each year. This is principally because the bush bean varieties of growth habits I, IIa, IIb, IIIa and IIIb do not require support and their maximum yield is realized when grown in monoculture. These are, therefore,

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12823 22 SET. 1993

intercropped only for other reasons, e.g. maximize total farm production and income, insurance from climatic vagaries, food and feed necessities, distribution of labor, to avoid pod contact with the ground, etc.

It is the type IVa and IVb varieties for which some kind of support is essential. Their yield in monoculture is much less than those of bush bean varieties.

Morphological and genetic variation between the two extreme growth habit types I and IVb appear to be somewhat continuous which often makes the growth habit classification rather difficult. The purpose of this brief article is to simplify and suggest a key for identification of the four principal growth habits (Table 1). A brief description of each of these growth habits and their sub-types follows:

TYPE I: Determinate growth habit; reproductive terminal buds on main stem and branches; limited or no further node and leaf production after flowering commences.

Branches and main stem generally strong and upright (Ia).

Branches and main stem weak, prostrate and possess some ability to climb (Ib).

TYPE II: Indeterminate growth habit; vegetative terminal bud on main stem and branches; node and leaf production occur after flowering commences. Both main stem and branches strong and upright.

The terminal guide or leader (excessively elongated and weak internodes) absent, thus, lacking climbing ability (IIa).

Terminal guide of varying length present and hence possess some climbing ability (IIb).

TYPE III: Indeterminate growth habit. Branches relatively weak and open, semi-prostrate or twining. Pod load largely concentrated in the basal part of the plant. The maximum yield is realized in monoculture.

Branches relatively short, guide on the main stem and/or branches is small when present and possess weak climbing ability (IIIa).

Branches long, often prostrate or twining, with relatively long main stem guide and moderate climbing ability (IIIb).

TYPE IV: Indeterminate growth habit. Stem and branches very weak and excessively long, possessing strong climbing ability. Support essential for maximum production.

Pod load distributed all along the length of the plant (IVa).

Pod load mostly borne on the upper part of the plant (IVb).

Branching habits of some genotypes is not necessarily a stable characteristic. The number and length of branches, stem strength, guide length and climbing ability are particularly influenced by the environment, planting density, soil moisture, availability of support, etc. Therefore, the characterization of growth habit of a particular genotype may be only useful in a given environment.

The higher yielding bush bean varieties generally maintain their yield superiority irrespective of the cropping system employed (CIAT, 1981A).

References

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Table 1. A key for identification of the principal growth habits of dry beans, *Phaseolus vulgaris* L.

<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>	<u>f</u>	<u>g</u>	
Growth habit	Terminal bud	Growth	Stem and branch strength	Terminal guide	Climbing ability	Pod load distribution	E x a m p l e s
Type I	Reproductive	Determinate	Strong, upright	Absent or small	Absent or weak climber	Along the length	Sanilac, Canario 101, Calima, Pompadour Checa, Alubia Cerrillos INTA
Type II	Vegetative	Indeterminate	Strong, upright	Absent or small twining	Absent or weak climber	Along the length	Midnight, Porrillo Sintético, ICA Pijao, Jamapa, Rio Tibagi
Type III	Vegetative	Indeterminate	Weak, open or prostrate	Small or medium, twining	Weak or facultative climber	Concentrated in the basal portion	Pinto UI114, Flor de Mayo, Zamorano 2, Carioca, Cocacho
Type IV	Vegetative	Indeterminate	Very weak, twining	Very large, twining	Strong climber	Along the length or concentrated in the upper portion	Garbancillo Zarco, San Martín, Cargamanto, Bola Roja, Caballeros

- NOTE: 1. For growth habit identification the first evaluation needs to be made during flowering and the final evaluation 3 to 4 weeks later.
2. The type of terminal bud separates growth habit I (reproductive) from other three indeterminate types (vegetative). The strength of stem and branches separates type II (strong and upright) from other indeterminate growth habits (weak, prostrate or twining). It is the combination of characters e, f, and g which separates type III from growth habit IV. For evaluation of the latter two types varieties need to be grown with and without support.
3. Types I, II and III do not require support and their grain yield is much higher in monoculture than with intercropping.