

Yield Stability Among Gene Pools of Phaseolus vulgaris

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Yield stability of determinate and indeterminate dry bean cultivars was compared using regression of genotypic performance on environmental means. Yields of 28 dry bean cultivars differing in plant growth habit, centers of domestication and commercial class designation were obtained from 42 Michigan performance nurseries over the 6 year period 1980 to 1985. Cultivars representing the Middle American center with S. phaseolin had above average yields and below-average yield stability as compared with cultivars from the Andean center possessing T-type phaseolin (Figure 1). Since the dry bean cultivars utilized in this study represent two distinct centers of domestication (Gepts & Bliss), the regression analysis suggests that cultivars from the predominant genetic center demonstrate more yield stability. A non-significant rank correlation coefficient ($r_s=0.1$) between the combined and separate analyses for deviation mean square values of large seeded cultivars implies that commercial dry bean classes should be grouped and compared separately based on center of domestication.

Within the Middle American center Evans has described four separate races or gene pools based on a variety of morphological differences including growth habit and seed size features, while within the Andean center she described 2 other gene pools, one which includes the large seeded kidney types.

Figure 2 shows that the determinate large-seeded kidney and cranberry bean cultivars from gene pool-5 had below-average seed yield and large mean square deviations from regression as compared to all genotypes. Lower yielding determinate small-seeded navy cultivars from gene pool-4 had low deviation mean square values, while higher yielding determinate navy cultivars had correspondingly higher mean square deviations from regression. Although seed yield of cultivars with an indeterminate growth habit was greater than determinate cultivars, prostrate type III indeterminate cultivars representing gene pool-2 had deviation mean square values equivalent to those of large-seeded determinate cultivars. The erect, short vine type II indeterminate cultivars (archetypes) belonging to gene pool-3 had greater than average seed yields and minimum deviations from regression. Compared with other plant types, the archetype group showed a greater yield response to more productive environments, with regression coefficient values significantly greater than unity.

These results indicate that the type II growth habit offers the breeder the best opportunity of obtaining greater seed yield without incurring loss of yield stability as occurs with the type I and type III growth habits. To date, the evolving gene pool concept in beans has been based on major qualitative differences like growth habit, seed size, disease reactions and phaseolin patterns to effectively categorize bean germplasm in similar genetics groupings. The data presented on yield and yield stability represent substantial quantitative evidence to additionally support the same gene pools described within Phaseolus vulgaris.

Evans, 1973, In P.A.G. Symposium FAO Rome: 107-115,
Gepts & Bliss 1985, J. Hered 76:447-450

YIELD & STABILITY PARAMETERS

COMPARISON OF 2B BEAN CULTIVARS

