

Morphological and Phenological Diversity between Bean Gene Pools

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In 1983, 11 morphological, 5 phenological and 5 yield component measures (Table 1) were made on 375 Malawian landrace accessions grown in replicated plots at Bunda Agricultural College. Data from each of 15 farm samples of 25 accessions were analyzed separately by principal component analysis (PCA), and visualized by plotting the first two components (1). It was recognized that a PCA and plot including all 375 lines would be valuable.

Subsequent isozyme analysis separated 373 of the lines into three groups on the basis of allozyme combinations at six loci. 266 lines were associated with the large seeded (Andean), and 51 lines with the small seeded (Mesoamerican), gene pools of beans. 56 lines were segregating at isozyme loci, and were assumed to represent recent interpool crosses (2). When grouped by gene pool, averages for all the traits analyzed differed significantly ($P < .05$) (Table 1). Andean lines were divided into 76 determinate and 190 indeterminate types; no determinates were present among the Mesoamerican accessions (2). Using a SAS analysis package on an IBM mainframe, a PCA was produced and the first two PC's were plotted onto the same axes by group (Figure 1).

Major loadings on PC1 were due to traits No. 6, 7, 13, 19, and 20, separating accessions on seed size differences. Traits No. 3, 5, 17, and 21 had high loadings on PC2, which separates on the basis of vinniness, or growth habit. Maximum genetic diversity occurs between, not within, gene pools.

Table 1. Gene pool averages for 18 traits in 373 Malawian lines.

No.	Trait	Andean n=266	Mesoamerican n=51
1	Days to emergence	12.9	12.4
2	Days to first flower	50.0	53.6
3	Days to end of flowering	68.2	73.5
4	Duration of flowering	13.3	20.0
5	Days to maturity	95.4	93.0
6	Leaflet area cm x cm	49.0	34.3
7	Leaflet length cm	10.8	8.8
8	Leaflet width cm	7.0	6.1
9	Leaflet shape	1.6	1.4
10	Petiole length cm	5.8	5.2
11	Hypocotyl length cm	6.8	6.4
12	Hypocotyl diameter 1/32"	8.3	7.4
13	Seed length cm	1.5	1.1
14	Seed width cm	0.8	0.7
15	Seed weight gm	46.8	27.1
16	Seedling weight gm	1.3	0.8
17	Nodes on the main stem	14.8	19.2
18	No. of seeds per pod	4.4	5.2
19	No. of pods per plant	27.2	47.7
20	Seed yield/plant gm	55.3	63.5
21	No. of seeds per plant	119.3	251.5

(1) Martin, GB 1984 MS thesis, MSU. (2) Sprecher, SL 1988 PhD diss. MSU.

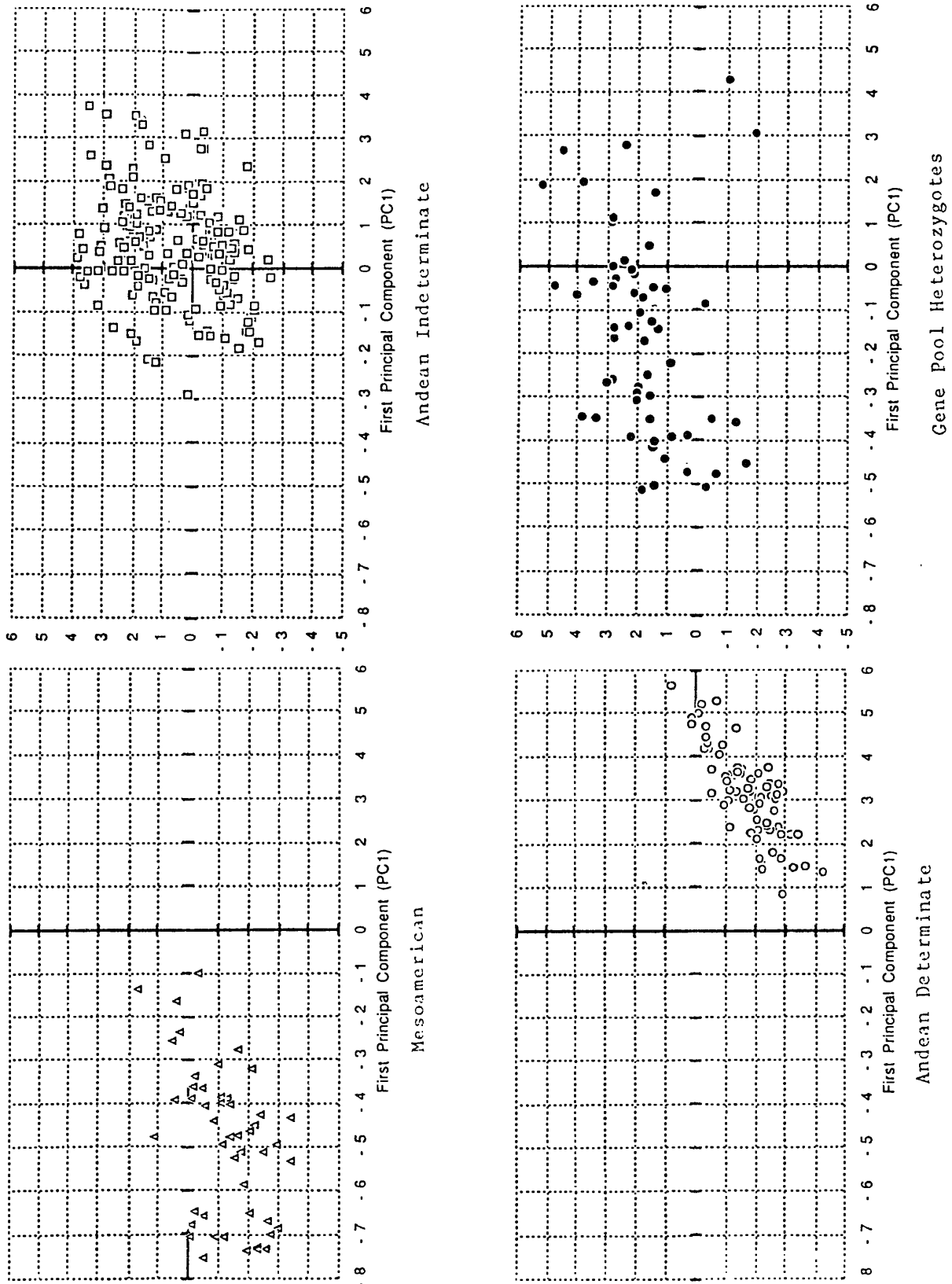


Figure 1. PC1 and PC2 of PCA of 373 Malawian lines. Andean determinate ○
 Andean indeterminate ◻ Mesoamerican Δ Heterozygotes ●