

ABSTRACT

A study of morphophysiological selection criteria related to yield in pigeonpea (*Cajanus cajan* (L.) Millsp.)

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The interrelationships between canopy and root structure, floral abscission, dry mass partitioning and yield were investigated to understand of the physiology of yield development and to develop selection criteria to improve yield . Genotypic differences for canopy and root structure were observed but were found to be influenced by the environment. In the wet season and at higher densities (20 and 30 plants/m²) plants were taller with fewer but more erect branches, while in the dry season and at lower densities (5 and 10 plants/m²) plants were shorter with a large number of less erect branches. Root development was also greater in the wet season. Genotypes which were morphologically less plastic also had greater yield stability over the two seasons. Differences in canopy structure resulted in differences in optimum LAI and optimum density for yield. The optimum LAI was greater in the wet season compared to the dry season. The optimum density for yield varied between ≤ 5 and 15 plants/m² in the wet and between 10 and 20 plants/m² in the dry season. Genotypes with shorter and more compact canopies were found to be more suitable for high density planting. Two distinct rooting patterns—a tap root type (with a strong tap root and fewer but strong lateral roots) and a lateral root type (with greater number of weak lateral roots and a weak tap root) were observed among the genotypes.

Yield development was mainly influenced by HI in the wet season and by both HI and TDM in the dry season. Except at the highest density, yield seemed to be sink limited, and was determined by the number of raceme/m² and pods/raceme. The former was related to the number of primary and/ or secondary branches produced while the latter was influenced by floral abscission. These components were equally important in explaining yield variation in the dry season and under low density, while the number of pods/raceme was more important in the wet season and at high density.

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The more determinate genotypes set a greater proportion of their pods during the early reproductive period and consequently had greater pod sink strength, HI and yield especially in the wet season. In contrast, in less determinate genotypes, pod setting was evenly distributed throughout the reproductive period, and a majority of pods were set when vegetative sinks were stronger. This resulted in higher abscission and reduced pod number, HI and yield. Yield stability over two seasons varied between genotypes, with ICPL 85015 and ICPL 88027 being more stable and therefore suitable for year round production while UW 10 is more suitable for dry season production in Trinidad.

Correlation and path analyses suggest that number of racemes/m² and pods/raceme may be good selection criteria for improved yield, with the latter being more important for high density and wet season production, while both are important for low density and dry season production. The selection criteria are discussed in relation to other breeding imperatives in the Caribbean.