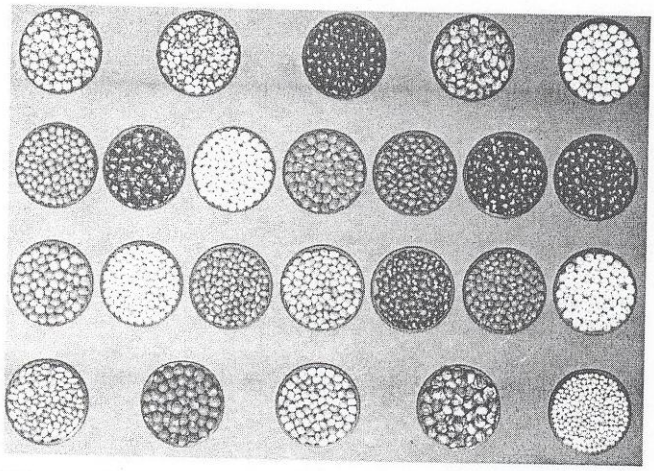
A Mini Core Collection of Pigeonpea: An Efficient and Inexpensive Approach to Improve a Multipurpose Crop

Pigeonpea is an important legume crop in the tropics and subtropics, grown in about 82 countries in a diverse array of cropping systems for its multiple uses. However, statistics from the FAO (Food and Agriculture Organization of the United Nations) are available only for 19 developing countries. During 2004, 3.24 million t of pigeonpea was grown on 4.36 million ha, for an average productivity of 0.74 t ha^{-1}.

Pigeonpea remained a lesser-known crop until recently, but it is emerging more as an international crop, with several countries showing interest in its diversified uses. Recently, it has shown potential to fill forage gaps in the USA during summer and is becoming popular in the hilly areas of southern China for its potential for soil conservation and fodder, food, and vegetable production. Pigeonpea has several uses, such as in medicine, agroforestry, and soil enrichment through efficient extraction of iron-bound phosphorus from typical Alfisols. The curative effects of various parts of the plant are mentioned in folk and Indian Ayurvedic medicine and are known in countries such as India, Indonesia, Madagascar, West Africa, the Caribbean region, and China. Pigeonpea leaf juice and decoction, flowers, young pods, seeds, seed decoction, and roots are known to have 39 different medicinal and cosmetic uses. Pigeonpea leaf decoction is used to cure jaundice in Cuba and Bangladesh. However, no germplasm screening to detect chemical constituents useful for medicinal purposes has been undertaken.

In spite of its multiple uses, pigeonpea germplasm has been primarily used for developing short- and medium-duration varieties and as a source of resistance to major diseases and insect pests. Among the many reasons for its limited use are the restricted funds available for the crop and the nonavailability of data and information on the agronomic potential of a large number of germplasm accessions. To overcome this problem, scientists at ICRISAT, a CGIAR institute in India, developed a core collection (about 10% of the entire collection) consisting of 1,290 accessions representing diversity of the 12,370 accessions in the entire collection. Realizing that even the core collection is large for evaluating agronomic traits in replicated multilocation trials, as it would be unwieldy, costly, and time consuming for the breeders, the authors constituted a mini core subset (10% of core; 1% of the entire collection), using a procedure developed and verified for its utility in a cost-effective way by ICRISAT scientists in chickpea and groundnut. The mini core subset has 146 entries from the core subset.

A profusely podding pigeonpea germplasm accession.



Diversity in seed color of pigeonpea.

Examination of core and mini core data for various morphological and agronomic traits indicated that almost the entire genetic variation and a majority of coadapted gene complexes present in the core subset are preserved in the mini core subset. Because of its greatly reduced size, the mini core subset will provide a feasible starting point for proper and enhanced exploitation of pigeonpea genetic resources for crop improvement and in the various production and cropping systems for food, feed, fuel, and other agricultural and medicinal purposes. The mini core collection can be used to determine diversity at the molecular level using molecular markers and to identify genetically diverse germplasm lines for different characteristics for use by the breeders. Hari Upadhyaya, lead author of the study, considers it a "funnel approach." The funnel works both ways. When you find that an accession in the mini core has desirable characteristics, you can go back to the core collection to find more accessions with the trait. If necessary, you can venture into the entire collection to obtain more accessions of the trait.

Upadhyaya, H.D., L.J. Reddy, C.L.L. Gowda, K.N. Reddy, and S. Singh. 2006. Development of a mini core subset for enhanced and diversified utilization of pigeonpea germplasm resources. Crop Sci. 46:2127–2132. View the full article online at http://crop.scijournals.org/content/vol46/issue5/