SAT Trends

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Spotlight on science

Conserving and using plant diversity

Mini Core collections make it easier

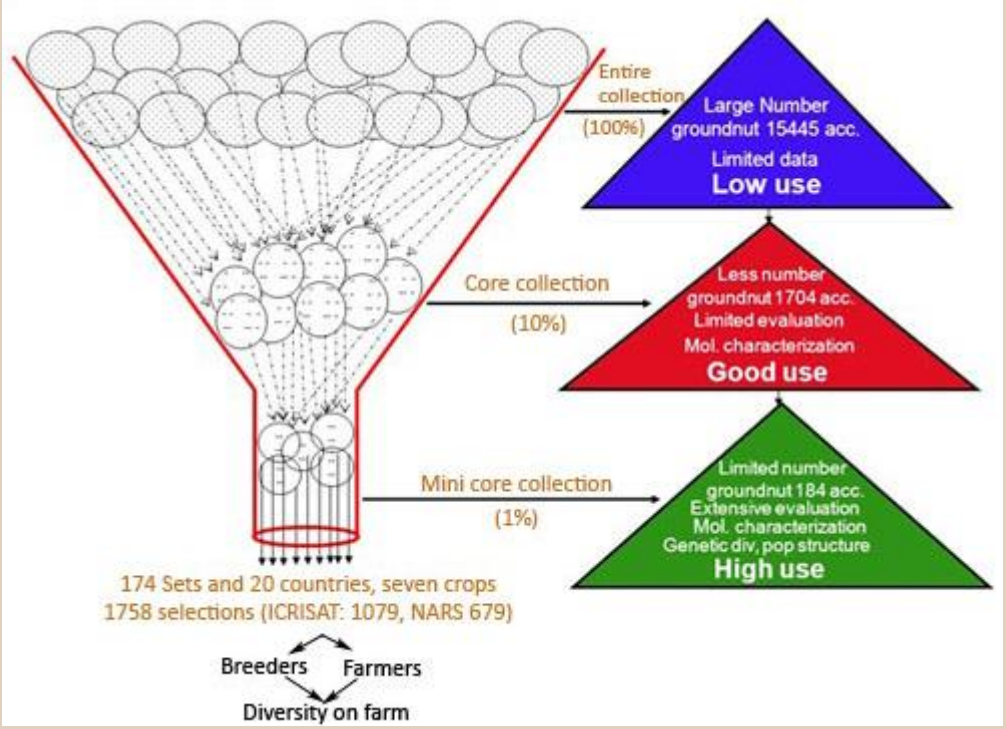
Scientists inspecting a mini core evaluation field.

Genetic diversity in domesticated plant species and their wild relatives, created through natural and human selection over millennia, provides the raw material for improving crop productivity and quality for food and nutritional security of the rapidly growing global population.

Besides crop improvement requirements, the erosion of crop germplasm due to replacement with high yielding cultivars, change in dietary habits, natural calamities, land and crop conversion (deforestation, urbanization, developmental activities such as hydroelectric projects and roads), introduction of exotic crops and environmental pollution (causing loss of pollinators), spurred large scale germplasm collection programs all over the world.

Globally over 7.4 million accessions of various economically important species are conserved in around 1750 genebanks (about 0.74 million in 11 CGIAR genebanks). The ICRISAT genebank at Patancheru, India holds in trust a huge collection of 119,739 accessions from 144 countries, of sorghum (37,949), pearl millet (22,211), small millets (10,235), chickpea (20,267), pigeonpea (13,632), and groundnut (15,445).

A large number of these germplasm accessions are continuously distributed for use by crop breeders and farmers. The ICRISAT genebank has distributed more than 1.4 million samples to scientists in 144 countries. Seventy-five germplasm accessions have been released directly as cultivars in 39 countries.



Assembling the mini core collections and their global usage.

Of the germplasm conserved in the genebanks, only a very small proportion (<1%) has been used in crop improvement programs. Most economic traits are quantitative and interact with the growing environment, which necessitates multilocation evaluation to identify specific germplasm lines for use by breeders. As multienvironment evaluation of such huge collections is enormously expensive, the concept of 'mini core' collection (~1% of the entire collection that truly represents the large diversity) was developed at ICRISAT, which is now an "International Public Good".

Using passport information and characterization data, a core collection is first assembled by stratifying the accessions based on geographic origin, range of variation and hierarchical clustering, retaining maximum diversity among the included accessions. The mini core is then constituted using the evaluation data of the core collection for important mopho-agronomic traits.

Extensive multilocation evaluation of the mini core collections have resulted in identification of many high yielding and trait specific donor lines for tolerance to several important biotic and abiotic stresses, agronomic and nutritional (protein, oil and micronutrients) traits. For example, drought tolerance in chickpea and groundnut; salinity tolerance in chickpea, groundnut, and pigeonpea; low temperature tolerance (at germination) in groundnut; resistance to pests and diseases in chickpea, pigeonpea and groundnut; early maturity, large-seed size and high grain yield in chickpea, pigeonpea and groundnut; high temperature tolerance in chickpea and pearl millet. These mini core collections have also been characterized using molecular markers to select genetically diverse germplasm for use in breeding programs to develop high yielding cultivars with a broad genetic base.

The "mini core" is a cost effective, easily manageable and efficient "gateway" to the unexplored world of crop germplasm. It provides the crop breeders with what they need – trait specific, genetically diverse and agronomically desirable and stable lines to develop high yielding cultivars.

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