Selection intensity (*i*) and accuracy (*r*) improved using new phenotyping tools in peanut breeding at ICRISAT.

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According to breeders’ equation, response to selection (R), also referred as genetic gain in plant breeding is directly related to selection intensity (i) and selection accuracy (r). The phenotyping tools viz., Computer Tomography (CT) (Fraunhofer, Germany), Near Infrared Reflectance Spectroscopy (NIRS) (NIRS™ DS2500 (FOSS) Harvest Master (HM) (M/s Juniper Systems & Harvest Master, USA) that use Machine Learning (ML) algorithms are deployed in peanut breeding pipeline at ICRISAT to enhance both, selection intensity and accuracy. Phenotyping tools, when they are cost-effective and high throughput can be useful to positively impact both selection intensity and accuracy.

Single seed is used to predict the kernel oleic acid content (R2=0.9) (high oleic acid vs normal) using bench-top NIRS in F3 or F4 single seed bulks to reject the normal oleic acid seeds. NIRS is used to screen the homozygous lines or F5 single plant seeds for oil content and fatty acid profile to exercise selections. For oil content NIRS is also used at multi-environment testing (MET) stage of the breeding pipeline as oil content is influenced of E (environment) and G X E (genotype and environment interaction). CT and HM are used at multi-environment testing stage of the breeding pipeline that oven have a samples of ~2000 per annum.

ICRISAT’s peanut breeding program delivers products to two Market Segments (MS) in South Asia, viz., MS 1- peanuts for oil and home consumption, and MS 2-peanuts for snack and confectionary industry. Kernel oil content of >50% for MS1 and <48% for MS2 are targeted; and high oleic acid content of (80+2%) is targeted for both the Market Segments. Pod yield, shelling outturn, kernel mass and grades are the key market traits that have to be measured on a large number of samples in the peanut breeding pipelines at ICRISAT for both, MS1 and MS2. Accuracy of measuring the pod weight in peanut is improved by using Harvest Master that simultaneously measures moisture content and weight of the sample. Pod weight is corrected to 10% moisture, thus eliminating the bias of moisture content that varies from 10-16% at the time of measuring pod weight. CT-imaging allows non-destructive measurement of three market-traits from a single scan, viz., shelling outturn, kernel mass and grades. The phenotyping tools facilitate timely, accurate and cost-effective measurement of market-traits.