Widening the character base for distinctness in cotton plants

The number of *Bt* cotton hybrids marketed in India has reached 1098, one of the highest to be developed from the private sector. These hybrids are regularly seeking protection under the country's Protection of Plant Varieties and Farmers Rights Act, 2001 (ref. 1). The Act envisages that all entries be observed in the field for Distinctness, Uniformity and Stability based on a set of morphological characters and if found distinct, protection is granted for 15 years. To enable this, a National Test Guideline has been prepared with a list of morphological traits.

The Central Institute of Cotton Research (CICR), Nagpur initiated work on the testing of cotton varieties for variety protection since 2008 and voluminous data have been generated for more than 500 genotypes. An overview of these data revealed that a few qualitative traits (presence of gossypol glands, nectaries, bract shape, solitary boll-bearing, etc.) are consistently uniform among the genotypes. For a few other traits such as leaf colour and hairiness, seed fuzz density and fuzz colour, boll shape and colour, qualitative grading system based on visual examination can result in variation from individual to individual. Less number of unambiguous morphological characters and less variation among varieties can be a major limitation in future when genotypes being claimed for protection are enormous. Although DNA markers are widely reported to be capable of discriminating genotypes in an authentic manner, the International Union for the Protection of New Varieties of Plants (UPOV) has not officially approved its inclusion as a reliable trait for granting variety protection[2]. It is therefore, necessary to determine and establish a multitude of useful characters and keep adding new ones to the list of distinguishable characters.

Other than mere presence/absence or visual grading of a trait, quantification of these could be useful for clear characterization of genotypes. The number of gossypol glands in leaf, sepal, stem, etc. has been determined earlier with varied objectives and found that they vary among the genotypes in cotton[3,4]. The same was also observed in a study at CICR[5]. Similarly, cotton cultivars can be characterized for the number of hairs/trichomes in a specific unit area of leaf[6,7]. Preliminary studies at CICR showed trichome density (fourth leaf from top) to be effective in clearing any ambiguity for visual grading of varieties, especially those with medium leaf hairs. Assessment of marginal bract trichome density (from the bracts of mid-canopy bolls) has revealed considerable variation among the cotton cultivars[8] and can serve as a useful trait for cultivar distinctness.

Subjective rating scales have been suggested in the test guidelines, the effectiveness of which may be questionable when done by multiple raters. The standards also may vary among individuals. Presently, several digital imaging systems to characterize different plant parts are available, which can be further upgraded in their function using readily available add-ons. Digital colour and shape analysis using software has been utilized in various crops[9] and its importance in cultivar description and patents has been highlighted[10]. There is a need to overcome the present ambiguity observed at times in recording boll shape, and boll and leaf colour in cotton for which the above systems could be adopted.

Distinct cultivar differences for length of leaf petiole and bracts were observed in cotton[11,12]. These traits studied earlier with the aim to understand preferences for ovipositions by insect pests can be included for testing distinctness of varieties. Seed fuzz grading presently performed visually can be also quantified by determining the fuzz or linter percentage. The number of fibres per seed and fibre density are novel traits determining seed cotton yield being advocated by breeders[13]. Determining these could be possible with the help of high volume instrument and can be added to the regular fibre trait parameters. It is therefore emphasized that unambiguous variety discrimination based on existing traits as well as enhancing the discrimination including additional traits is of significance under varietal protection system.

1. Venkatesh, P. and Suresh Pal, *India J. Intell. Property Rights*, 2013, **18**, 448–456.
2. Huw, J. *et al*., In *Diagnostics in Plant Breeding* (eds Libberstedt, T. and Varshney, R. K.), Springer Science, 2013.
3. Schefler, J. A. and Romano, G., *Agric. Sci.*, 2012, **3**(1), 14–23.
4. Bolek, Y. *et al*., *Bot. Hort. Agrobot. Cluj*, 2010, **38**(1), 81–87.
5. Santhy, V. *et al*., In Abstr., XIII National Seed Seminar, UAS, Bengaluru, 8–10 June 2013.
6. Bourland *et al*., *J. Cotton Sci*., 2003, **7**, 8–15.
7. Nawab, N. N., Ph D thesis, University of Agriculture, Pakistan, 2010.
8. Bourland, F. M. and Hornbeck, J. M., *J. Cotton Sci*., 2007, **11**, 242–251.
9. Murakami, P. A. *et al*., 2005; http://www.fs.fed.us/ne
10. Corrado, C. *et al*., *Food Bioprocess Technol.*, 2011, **4**, 673–692.
11. Hussain, *et al*., *Int. J. Agric. Biol*., 2008, **10**, 705–708.
12. Chatzigeorgiou, A. C. *et al*., *J. Pest. Sci*., 2010.
13. Clement, J. D., Constable, G. A. and Liu, S. M., *Field Crops Res*., 2014, **xxx**.

V. SANTHY*
MITHILA MESHRAM

Central Institute for Cotton Research,
Shankar Nagar P.O.,
Nagpur 440 010, India
**e-mail: santhy100@gmail.com*