cottonworks™

Considerations When Evaluating Traceability Technologies

Cotton Incorporated works with companies and technology providers to evaluate and promote solutions that are beneficial to manufacturing with and sourcing cotton. While information about technologies and products is not always publicly available, Cotton Incorporated encourages thoughtful consideration of technologies and performance claims. The following information is intended to serve as guidance for thinking about traceability technologies.

Traceability Technology Fundamentals

The fundamentals of existing traceability technologies intended to confirm cotton origin are based on one of two processes: inherent or additive. In an **inherent approach, the product inherently has a detectable component reported to be linked to the origin.** The inherent component could be trace elements, isotopes, microbiome, or other naturally occurring components in the material that are inherent to the origin's environment. For cotton fiber, where it is grown would be, in theory, associated with those inherent attributes. For the **additive approach, an additive that can be identified through some test technique is applied at any point in the supply chain where the origin is known.** Additives could be DNA tags, tracer chemicals or elements, dyes, or fibers designed to be detected.

Traceability Technology Considerations for Cotton

For inherent and additive technology processes, it is feasible that these technologies could work for 100% single origin cotton if all the factors outlined in the evaluation recommendations section (see below) associated with textile processing are scrutinized. **The critical challenge for both processes for most cotton products is the amount of blending that occurs during textile processing.** Depending on the origin of cotton, blending can begin as early as ginning. In some countries, cotton from multiple farm locations may be combined either before or as part of the ginning process. Blending then occurs in the laydown in a textile spinning mill. The textile mill might know the position of every bale in a laydown and may know the origin of each of those bales, but by the time the cotton goes through opening, carding, and multiple stages of sliver and roving production, those materials have been continuously blended at each stage. Many spinning mills run multiple laydowns and opening ranges where cotton fibers may also be blended during sliver and roving formation, making it impossible to know the absolute blend of which fiber origins end up in a specific lot of yarn. Blending further continues with the mixing of yarns for knitting and weaving. The reliability of any traceability technology for most cotton goods is very much dependent upon the extent of blending that occurs. Therefore, it is **critical to evaluate how traceability technologies perform in blended products.**

Evaluation Recommendations

The following is a comprehensive list of questions that should be applicable when doing initial evaluations of any technology intended to determine or confirm cotton's origin. This list is intended for general guidance. The specific product and processing involved in manufacturing textiles should be considered regarding which factors are relevant and what additional evaluations may be needed. Some of the questions on this list may be answered through publicly available information that has been objectively reviewed; however, **where no public information exists, we recommend that companies use this list to guide their own assessments of such technologies.** Assessment of any traceability technology that has not undergone objective and peer-reviewed evaluation is not trivial. Such evaluation likely will require extensive time and funding to validate a technology's potential and performance claims. With regard to claims about traceability for the origin of cotton, **it should be clearly understood whether origin refers to country, region, farm or some other unit of identification.**

Questions to consider regardless of the technology approach (inherent or additive):

Does the technology work on 100% single cotton origin to confirm that origin? What is the level of errors associated with the test, and what level of sampling is needed for reliable confirmation of the origin?

Does the technology work when multiple origins of cotton are blended, and at what percentage blend differentiation: 1%, 5% etc.? What is the level of errors associated with the test, and what level of sampling is needed?

Does the technology work when cotton is blended with multiple fiber types (natural fibers, synthetic, or man-made), and to what percentage blend differentiation: 1%, 5% etc.? What is the level of errors associated with the test, and what level of sampling is needed?

Does the technology work on raw fiber, processed fiber, yarn, greige and finished fabric, and survive manufacturing and laundering processes? To what percentage blend differentiation: 1%, 5%, etc.? What is the level of errors associated with the test, and what level of sampling is needed?

How does the technology work? What are the physical or chemical processes for identification and confirmation?

What is the error in the testing method itself? Is there sampling error in this testing system? How many samples are necessary to establish a reasonable level of confidence in the results? What other interferences might impact results? How easy would it be to fool the test?

How readily are testing services available for a technology?

Is there independent confirmation of the performance of the technology?

What is the cost of testing, and how long does it take to test?

Questions to consider specific to inherent technology methods:

What is the expected life of the inherent component that is to be measured? What happens to that component during bale storage, and does it survive in a detectable form through every stage of textile processing?

What level of sampling is needed for a database or mapping profile? How discerning is the inherent trait between subtle regional differences? Is the technology impacted by changes in cotton species and variety, soil and climate change over time, and production practice options such as irrigated or rainfed, etc.?

To what level and how often is resampling needed to maintain a reliable database?

Can the areas of concern effectively be sampled, or is this a reverse approach to prove it is from one region rather than another? For instance, prove the cotton is 100% U.S. grown and therefore is not from Xinjiang.

Questions to consider specific to additive technology methods:

At what point in the supply chain is the additive applied, and does it survive the subsequent textile processing? Factors that may alter or remove additives may include mechanical friction in spinning, chemical processing in scouring, bleaching, dyeing, and additive finishes of different types, as well as mechanical finishing.

What side effects are created by adding the additive that may impact storage and later processing (bale storage, spinning efficiency, color change, fabric defects such as barre, ability to scour, bleach, dye, finish, cut or sew). To what level and how often is resampling needed to maintain a reliable database?

Can the additive transfer to machinery and then onto untagged material? Is human exposure a concern? Are there environmental concerns for waste materials that contain the additive (processing scraps, wastewater, air emissions)?

When the additive is applied, what is the expected coverage? If in raw fiber, is every fiber in a bale covered?

What is the stability of the additive through various environmental conditions and over time?

Are there any global or local regulations or restrictions that would negatively impact the trade of the goods containing the additive?

[1] Level of errors specific to the model (algorithms, the experimental method and associated instrumentation) and the error in the outcomes (false positive, false negative). Also known as Type 1 and Type 2 errors in statistical sampling. E. Mansfield (1983) Statistics for Business and Economics, W. W. & Norton Company, Inc.

Reference: Product Traceability: The Tools, Technologies, and Benefits, AAFA Webinar, June 30, 2020.