Texas: turning substandard cotton into eco-friendly products

Immature cotton due to Texas droughts is being turned into oil-spill wipes and decontaminants. But does this innovation mask the true environmental problems?

Seshadri Ramkumar, professor at Texas Tech Uni, has been developing innovative commercial uses for immature cotton. Photograph: Lisa Palmer

Cotton growers in the High Plains of West Texas are facing deep declines in water resources. Only half the land is irrigated and many cotton growers can no longer irrigate their crops due to depletion of the Ogallala Aquifer. That means more Texas cotton producers, who comprise the fourth largest cotton market in the world, will likely move to dry land farming where cotton is grown without a supply of supplementary water. And, without the benefit of water, yields diminish with at least 10% of the harvest resulting in immature cotton. Clothing manufacturers can’t use this substandard cotton because it doesn’t spin into threads.

Seshadri Ramkumar, associate professor at Texas Tech University, has been looking for innovative, new commercial uses for the immature cotton, which has little value in the marketplace. Using a nonwoven, natural process, Ramkumar and his team at the Nonwovens and Advanced Materials Laboratory created new cotton products from this otherwise throw-away commodity.

"Nonwoven fabrics are porous compared to tightly woven regular fabrics," said Ramkumar. "The porous structure helps to adsorb toxic vapours and gases and hence they are better. Also, for huge consumption and predominantly single-use, these fabrics can be made cheaper."
Dry crops with no irrigation at Lubbock, Texas. Photograph: Lisa Palmer

One product is decontamination wipe that’s usable in chemical warfare. Marketed under the Fibertect label, a layer of carbon is sandwiched in between two layers of nonwoven raw cotton to create a low-cost, organic wipe for chemical decontamination. Ramkumar said the cotton absorbs liquid quickly and vapours more efficiently than the powdered decontaminant currently in use. Part of the added benefit of this new Fibertect is that it contains biodegradable cotton, Ramkumar said. A problem with the powdery form is that it leaves dirty residue.

"That is why the US Department of Defense wants to get away from the powdery form," he said. "Fibertect is a fabric. It is skin-friendly. When it comes to adsorbing the surrogate nerve agent’s vapours, it just works better. So the powdered decontaminant will be phased out." The wipes are now manufactured by Texas-based Hobbs Bonded Fibers and sold by Virginia-based First Line Technology, which also sells products to emergency first responders and the military.

A recent report in the journal Industrial & Engineering Chemistry Research, published by the American Chemical Society, includes Ramkumar’s scientific data on the use of unprocessed, raw cotton to clean up crude oil spills.

Ramkumar in his lab has undertaken one of the first research project on the crude oil absorption by unprocessed raw immature cotton. His research indicates that for each pound of immature cotton it has the ability to sop up and hold more than 30 to 33 pounds of crude oil. "Immature cotton gets discounted due to its inability to take up colours compared with regular cottons, and the apparel industry does not prefer such immature cottons," said Ramkumar. "However, these cottons can be used for environmental protection and remediation as is evident from our work."

Ramkumar has developed low cost oil-spill product that is sustainable and biodegradable. He said in that extensive studies exist on fibers such as barley straw, kapok and wool — but there are also big gaps in knowledge about their basic crude oil-uptake mechanisms and no data on unprocessed raw cotton.
"My team decided to fill those gaps with research on the oil sorption properties of low micronaire cotton, a form of unprocessed cotton with relatively less commercial value," said Ramkumar. He added, "The cotton fibres take up oil in multiple ways, including both absorption and adsorption (in which oil sticks to the outer surface of the cotton fibre)."

Another innovation under development is a carbon-encased cotton wrap absorb natural gas from leaky pipelines. The carbon is basically charcoal, which absorbs natural gas vapors, Ramkumar said.

In parts of Texas, the aquifer is replenished by rainwater at a rate of just 0.024 inches per year. Moves are underway to address the root causes of diminishing water availability including water conservation practices and no-till farming methods, in which cotton producers protect water by keeping it the soil.

As diminished water resources in the Ogallala Aquifer lead to more dry land farming, innovative uses of immature cotton yields will continue and could soften the hard edges of the economic effects that drought has on the cotton industry.

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