The ICAC Recorder

Cotton Vision 2030

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ICAC Researcher of the Year 2012

Dr. Yusuf Zafar, USDA Cochran Fellow, was a pioneer in establishing modern agriculture biotechnology in Pakistan**.** The first GMO crop (*Bt*-cotton) was developed and locally released by NIBGE, Faisalabad, under his leadership. He served as Minister Technical in Vienna, Austria. He also served in International Atomic Energy Agency (IAEA) in Technical Cooperation Division before joining as Chairman, Pakistan Agriculture Council (PARC) in 2016, an apex agricultural research body of Pakistan. Dr. Zafar received the ICAC Researcher of the Year Award in 2012. PAEC awarded him 'Best Scientist' award in 2000. He was awarded Pakistan's civil award, Tamgha-i-Imtiaz (Medal of Distinction) in 2004. He also served as elected Chairman of Asia & Pacific Association of Agriculture Research Institutes (APAARI) in Thailand from 2016-2018.

Challenges And Solutions For 2030

Cotton, the provider of most of the natural fibre to the global community, is under severe challenges. In a few leading countries either the production is static or it is declining as it is in Pakistan, Iran and even in some African countries. The biggest challenge is from the cheaper, stronger and more stable supply of high-quality synthetic fibres due to declining prices of fossil fuel. The global investment in renewable energy alternatives, emphasis on electric/hybrid vehicles and the glut of petroleum — combined with lower demand — resulted in historically low prices of petroleum products which are the feed stock of synthetic fibre**.** Moreover, immense technological advances resulted in the availability of varied types of improved synthetic fibres such as nano-fibres, with increasing utilities in the garment industry. The second biggest challenge relates to climate change. Though this has impacted all crops, cotton crop — being of longer duration and more prone to multiple diseases — is at higher risk and more vulnerable to total crop failure or lower productivity. The low R&D public sector investment by developing countries has resulted in a slower pace of the development of SMART cotton. The third major challenge relates to higher risk and lower profitability of cotton farmers especially in developing countries. The input cost of fertilisers, pesticides and machinery are on the rise while productivity is generally on a downward trajectory. The static or poor genetics of seed, high labour-intensive tasks during crop management and volatility in the price of raw cotton has resulted in shrinkage of area under cotton crop. In Pakistan there is 35% decline in area under cotton in 2019 and production is 45% less than what was in 2014. This is alarming despite the fact that >60% is exported to earn foreign currency**.** The major reason in developing countries is low investment by the public sector which made cotton a less attractive crop.

GM cotton emerged as a promising tool and to some extent promoted as a panacea in the late 1990s. Adoption was fast and India and Brazil benefited immediately**.** However, the success was short-lived. The technology was not only highly controversial but required exorbitant up-front investment to comply with the ever-rising biosafety standards that kept the release of new products limited or delayed for a very long period due to weak or nonexistent approval processes**.** Added to this was higher product cost (GM seed) and even barriers (such as patents) for adopting new technology. The advancement in Gene Editing (GE) technologies, especially the CRIPSR system, ignited new hope that is touted as relatively safe because no exogenous material is planted in the host genome**.** In USA and some other countries, GE technology-based products are released without undergoing a tough and cumbersome biosafety regulatory process. However, the European Union (EU) still insists on its usual regulatory process. This eclipsed the newer technology during its initial phase. Needless to say, further refinement and adoption of GE technologies by most of the cotton producing countries will allow for the delivery of a large number of cotton varieties with desired traits. The

innovative GE technology has provided new hope and if pursued at the present pace will definitely bring a paradigm shift in transforming cotton plant for vital traits. The tailor-made GE cotton will reach cotton growers in the next decade. So far genomics research has been very impressive, but molecular assisted selection is still complex and is yet to be adopted by cotton breeders as a routine. The traits that breeders are looking to improve in cotton (especially fibre quality) are really complex. The recent trend of resolving Big Data and bioinformatics is the new hope. The application of such new tools in solving complex traits is destined to be promising during the next decade. The supersonic speed of advancements in ICT will have a very positive impact on solving the riddles of complex traits. This in turn will enable science to make strong, knowledge-based decisions that enhance cotton production. Utilisation of drones for various management processes of crops including cotton is on the horizon. This will be routine in the upcoming decade.

All major crops such as wheat, maize, rice, pulses, potato, vegetables and even bananas have dedicated international centres (CGIAR) with huge treasures of diverse germplasms and a global effort to improve all aspects of that particular crop. These multilateral centres gathered international expertise and contributed to surplus food production in many parts of the globe. However, there is no such international centre for cotton, denying us a global resource of cotton germplasm, knowledge and technologies covering aspects of production. ICAC may approach International donors to establish an International Cotton Centre. I have a dream: that we will have an international cotton centre like other crops do. The global consolidation of resources, wealth and knowledge could not only preserve the existing cotton germplasm but also have a fair and un-restricted reach and distribution of such material to the global community. Regional inter-country panels especially BRIC, OAU or OIC could take initiative to establish such centre during next decade.

Unfortunately, most of the advanced technologies for growing and harvesting cotton remain confined to few developed countries. These developments, like the first green revolution, bypassed the African continent. The resource-poor farmers of Africa need access to all modern technologies in order to earn a better living — not just enough to survive in poverty. This is the area that must be looked at with special and focused attention. The next decade should bring appreciable change by initiating 'Look Africa' or a similar program. As there is little chance for more than an incremental increase of area under cotton, the best available strategy is to enhance the productivity in Africa and some emerging Asian countries like Vietnam, Thailand, Myanmar and Iran. There is also a dire need to expand and strengthen the international donors and/or national programs such as the Better Cotton Initiative and Fair-Trade.

In conclusion, it is justified to acknowledge that cotton is under a great threat from competing synthetic fibres, not to mention the added burden of climate change. These extraordinary challenges can only be overcome through our extraordinary effort. Establishing an International Cotton Centre like the CGIAR centres is the need of the hour and should be established during the next decade. The improved cotton varieties developed through gene editing are expected to be freely available to resource-poor farmers. As a cotton scientist I have a dream to see the doubling if not tripling of the productivity of cotton in Africa. Cotton associations as well as producing and consuming nations must strive to make this happen during the next decade.