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World Order Changeth

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EXPERT's Column

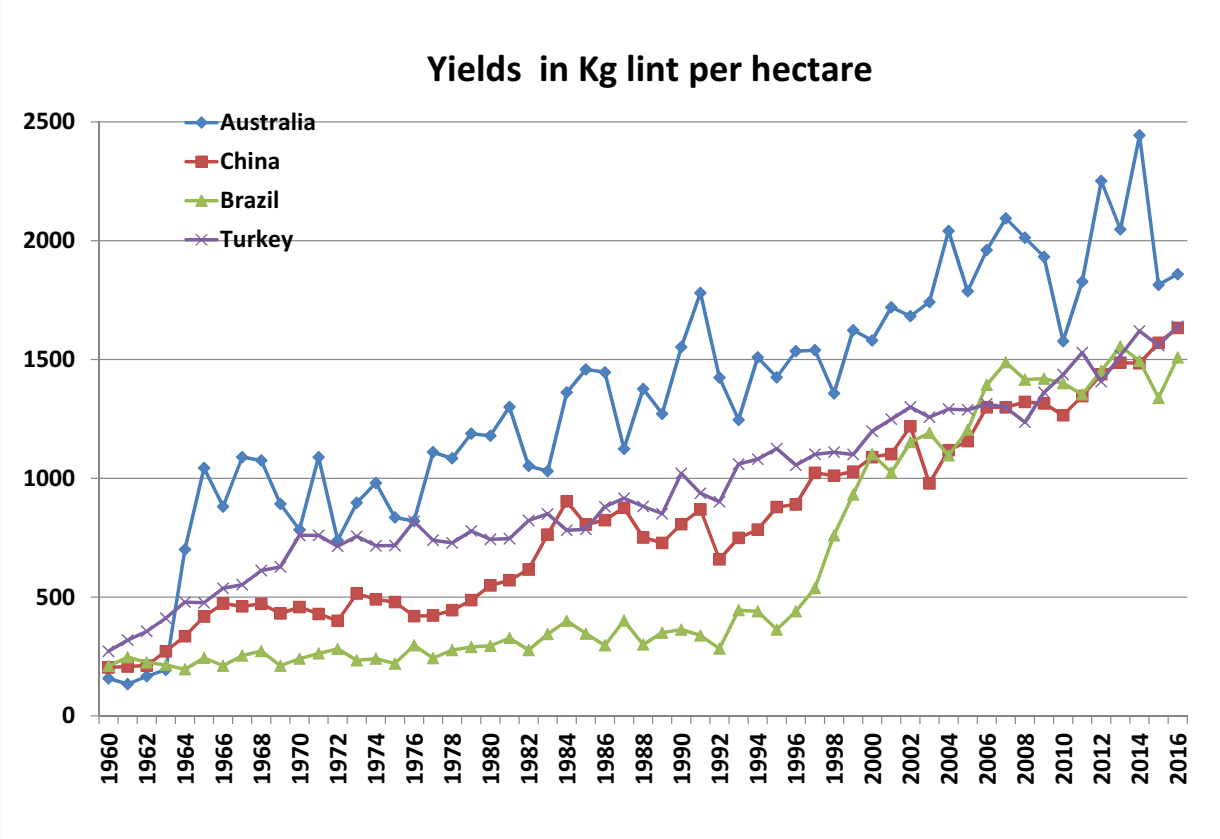
Dr. K.R. Kranthi

"Only 'change' is constant in history, everything else changes". I am not aware if anyone ever said this before, but when I wrote this sentence it sounded very familiar, as if it may have been written somewhere by someone. Everything is changing, so is the cotton world. New ideas are evolving. Some technologies made their mark with high impact, some are still delivering and some are being phased out while new technologies are struggling to make an entry. In this article I would like to make a brief assessment of the global changes that are likely to have a significant impact on cotton production, trade and use.

In the current wave of change, some countries are drifting away from cotton production while some are actively pursuing cotton cultivation to survive and thrive. Over the past few years, the cotton area declined significantly in USA, China, Egypt, Sudan, Uganda, South Africa, Mexico, Brazil, Paraguay, Peru and Colombia. It is not clear if the cotton area is influenced by new technologies, markets, prices, demand, biotic or abiotic stress factors. For example, cotton area in India increased phenomenally from 8.0 m hectares to 12.9 million within 12 years after the introduction of Bt-cotton. It is interesting that cotton area in the countries mentioned above (except Egypt and Uganda) declined despite the adoption of Bt-cotton. The Bt-cotton technology became popular and almost saturated India, USA, China, Australia and Pakistan. However, Bt-cotton did not have a similar influence on either area or yields in other countries such as Argentina, Burkina Faso, Brazil, Myanmar, Paraguay, Mexico, Sudan, South Africa, Costa Rica and Colombia. Cotton area increased in India, Pakistan, Burkina Faso, Mali, Chad, Benin, Cameroon and Cote D'ivoire. The first three countries have Bt-cotton, but the area in the rest of five countries increased despite not having access to any new technologies recently. Over the past 15-20 years, yields were on a significantly increasing trend in China, Brazil, Australia and Turkey, while in other major cotton growing countries yields were either stagnant or were declining. Consumption of raw cotton increased in India, Pakistan, Bangladesh, Vietnam, Turkey and Indonesia. Nevertheless, for the first time in history, in 2015-16, though the beginning stock was higher than the global production, market prices are still looking good and are expected to remain at a decent level.

Acreage Changes

There are a few countries that matter most for the global production. Any changes in cotton acreage in these countries would have strong impact of global production. Six countries - India, USA, China, Pakistan, Uzbekistan and Brazil - together have about 75% of the global cotton area. Trends indicate that cotton area is on a decline all over the world except in India, Pakistan and African



countries such as Burkina Faso, Chad, Mali, Benin, Cote D'ivoire, Cameroon, Tanzania, Zambia and Zimbabwe. Following are the significant changes that have taken place over the years in some countries and also in the immediate recent past in a few others.

USA: The cotton area was 3.0 to 4.3 million hectares (m ha) in USA during the past nine years. The area was 5.58 m ha ten years ago in 2005. Interestingly the cotton area in USA was 6.48 m ha in 1995 and 10.9 m ha in 1951.

China: The cotton area crashed to 2.8 m hectares in 2016-17, an all time low in 65 years. China had 6.2 m ha eight years ago in 2007, 6.83 m ha in 1992 and 6.92 m ha in 1984. With the current yields of about 1500 kg per hectare, with a probable area of 6.92 m ha, China could produce about 11.0 m tonnes of lint, equivalent to half of the world's current production.

Latin America: The area in six countries, mainly Brazil, Mexico, Peru, Paraguay, Colombia and Argentina declined to one third over the past 25 years. The six countries together had an average area of only 15 m hectares over the past 18 years from 1998 to 2015. However, the cotton area in the six countries was 52.6 m ha in 1984. After 1992, over the past twenty five years, the cotton area was always less than 50% of what it was in 1984. In 2015, the cotton area was 0.1 m ha in Mexico, 9.6 m ha in Brazil, 0.37 m ha in Argentina, while Peru, Paraguay, Colombia together had just 0.05 m hectares. In the early 1990s Brazil had 2.4 m ha, Colombia had 0.28 m hectares, Paraguay had 0.56 m ha, Argentina had 0.9 m ha, Peru had 0.17 m ha and Mexico had 0.23. The boll weevil was supposed to have been one of the main reasons for this decline over the past 25 years.

Egypt, Sudan and Uganda: In 2004, cotton area was 0.4 m ha in Uganda, 0.3 in Egypt and 0.2 in Sudan. Ten years later, the total area declined from 0.9 m ha in 2004 to 0.15 m ha in 2015 with only just 0.05 m ha in each of the three countries. Interestingly, 50 years ago cotton area was about 1.0 m ha in Uganda, 0.8 m ha in Egypt and 0.5 m ha in Sudan.

Iran, Syria and Turkey: The 65 year average area under cotton in Syria prior to 2013 was 0.25 m ha. There is hardly any cotton cultivation now. Ten years ago, Turkey had 0.7 m ha, which declined to 0.4 m ha in 2015. The cotton area in Iran declined to 0.1 m ha in 2015 from 0.3 m ha in 1996.

Yield Increase

Four countries, namely Australia, Brazil, China and Turkey have used advanced technologies to enhance yields progressively over the past two decades. Though yields have also increased impressively in a few other countries such as South Africa, Greece and Mexico, these countries may not contribute much to the global production because of the greatly reduced acreages. Myanmar and Pakistan have also made reasonably good progress in yields, but not above the global average.

China's progress can be considered as most spectacular because of its steady increase of national average lint yields from 1000 kg/ha to 1500 kg/ha during 2003 to 2012 in a large acreage of 5.2 to 6.2 M hectares. Yield increase in Brazil, Turkey and China are identical with an increase from 1000 kg/ha in the year 2000 to 1500 kg/ha in 2015. Impressively, the yield enhancement in Brazil happened in a large area of 0.8 to 1.4 m hectares during the past 12 years. However, chemical usage has increased enormously to an extent of 40-50 chemical applications in a single season, despite large scale adoption of GM cotton which includes herbicide tolerant and Bt-cotton. Insecticides in Brazil are used to control boll weevils, nematodes and sucking pests. Herbicides and plant growth regulators are used very frequently. It is quite likely that such rampant usage of insecticides would lead to the collapse of the crop sooner than later. In stark contrast, insecticide usage has reduced very significantly in Australia due to Bt-cotton and in Turkey due to organic cotton. Both countries present very different perspectives. The most significant aspect of Australia is its application of science and discipline in implementation. Yields were above 1600 kg /ha after 1999 and reached as high as 2500 kg per ha in 2014. Impressively, insecticide usage declined to just about 2-3 sprays per season over the past 15 years at least. Similarly chemical insecticides in Turkey are restricted to small areas and are not used in organic cotton. The science of organic cotton in Turkey is very impressive. Though cotton area in Australia increased steadily until 1999 to reach 0.53 m hectares, acreage fluctuated wildly between 0.065 to 0.65 m hectares during the period 1999 to 2016 mainly influenced by drought.

Consumption Changes

The future of cotton dependent livelihood of stakeholders depends on raw cotton consumption by the industry across the world. Significant changes in raw cotton consumption have occurred over the past ten years, but more prominently during the past five years. Four countries, namely, India, Turkey, Bangladesh and Vietnam progressed substantially in cotton consumption, while three countries, China, USA and Brazil reduced consumption by about 30%. Over the past four years, India enhanced its consumption from an average of 4.3 million tonnes during 2007 to 2011, to an average of 5.2 million tonnes from 2012-2016. Similarly the average consumption in Turkey was 1.1 million tonnes in five years prior to 2011, and 1.4 million tonnes in the five year period from 2012-2016. Bangladesh, Vietnam and Indonesia have been rapidly enhancing their consumption capacities. The average consumption of Bangladesh was 0.4 million tonnes during the five year period from 2002-2006, 0.85 million tonnes during 2007-2011 and 1.2 million tonnes from 2012-2016. Consumption in Vietnam increased from 0.1 million tonnes in 2002 to 1.02 million tonnes in 2016.

Technological Changes

Technological changes have swept the cotton world over the past 20 years. Biotech cotton, water management, new selective herbicides and insecticides, mechanisation and new varieties brought in major changes in production technologies. Indeed, yield increases in Australia, China, Brazil and Turkey were technology driven. The following passages focus on the case studies of China and Australia.

China: Improved varieties coupled with a series of intensive farming technologies and cultural practices were developed and implemented on a large scale over the past 10-15 years for yield enhancement in China. It is believed that along with new varieties, agronomic practices such as double cropping or multi-cropping of short-season cotton with wheat and watermelon, nursery beds; raising seedlings in soil plus organic manure at 9:1 ratio; transplanting cotton seedlings just before wheat harvest or after harvest; drip irrigation in mechanised plastic mulching and training plant architecture in high density planting played a major role in enhancing yields. Super-high density planting technique is used with 'short-dense-early' varieties planted at 200,000 to 300,000 plants per hectare, mainly in the north-west inland area of China. Aeration and ventilation in the high density crop is ensured by controlling the plant height to 65-70 cm by using growth regulating chemicals coupled with management of water and nutrients. Other practices such as removal of

vegetative branches, old leaves, empty branches, early fruiting branches, apical points of vegetative and fruiting branches and removal of growth-tip (de-topping), are done for canopy management and also to facilitate nutrients to be redirected to fruiting parts. High density cotton is cultivated with early planting of maturing varieties using drip irrigation under plastic mulches, which also promotes early maturity and high lint yields. Bt-cotton varieties are used for effective bollworm protection. Other technologies include, precision seeding technologies with 15-19 kg seed per hectare, inter-cultivation and tillage at full post-emergence and flowering and fertilizers as controlled release. Reports from China indicate that farmers of Xinjiang were able to easily obtain yields of 2,250 kg lint per hectare, while record yields of 4,900 kg lint per hectare were also obtained.

Australia: Currently, Australia tops the world in lint yields. Cotton in Australia represents intensive high input system with high cost of production to obtain a high national average lint yields that range between 2000 to 2500 kg lint per hectare. Average irrigated yields range between 2500 to 3500 kg lint per hectare. Production systems from pre-sowing to post harvest are completely mechanized and are least dependent on manual labour. GM varieties resistant to insects and herbicides are used all across the country. Input application of water, nutrients and pesticides, is recommended by consultants based on scientific principles. Short to medium duration cotton not exceeding 180 days are used. The varieties have okra leaves which are ideal for high density planting to facilitate aeration and light penetration. The new cotton cultivars of Australia have reduced leaf sodium uptake, increased tolerance to water-logging, increased water use efficiency, increased nutrient efficiency and increased leaf photosynthesis. Some of the main practices are, reduced tillage, crop rotations with wheat, application of nitrogen (220 kg/ha) and phosphorus (10 kg/ha), 7-8 ml/ha furrow irrigation, 1-2 application of insecticides for sucking pests, 1-2 inter-row cultivations during the first 60 days and herbicide application depending on weeds. At 60% boll bursting stage, two defoliants are applied. Studies showed that water stress and nitrogen at peak flowering had the greatest negative impact on yields. Therefore irrigation scheduling coupled with nutrient management received highest priority in Australia. Australian scientists have been able to show that it was possible to get 5,034 kg lint per hectare.

Hope For A Positive Change

Cotton fibre is the most skin friendly of all natural fibre based apparel available to mankind. Competition from synthetic fibres if not effectively countered, is likely to phase out this brilliant gift of nature. For the cotton fibre to become more competitive against the synthetic fibres, it is necessary that the production and processing systems are made more environment-friendly, cost-effective and cost of production is lowered significantly. Factors such as the ever-fluctuating uncertain markets, insect pests, diseases, drought and salinity warrant management strategies, thereby enhancing production costs to threaten the competitive ability of the crop. Area is declining in some countries, because of market trends, competition from other crops or because of insects, diseases or drought. It is sad to see the decline of cotton area in Egypt, which is a great cotton nation. There is a need for all the major cotton growing countries to come together to see how best the best of available technologies can come to the rescue of the current imbroglio in many nations where the area or yields are declining. There is a need to make cotton production systems as climate resilient as possible with least foot prints of carbon, nitrogen and water. If all countries of the world have access to the best of all available 'environment-friendly' technologies, it should be possible, theoretically at least to obtain high yields of 1500 kg lint per hectare from rain-fed cotton and 2500 kg lint per hectare from irrigated cotton. This would certainly make cotton highly competitive as a natural fibre that can stand against all threats of synthetic fibres.

In Alfred Lord Tennyson's poem *Idylls of the King*, the courageous King Arthur consoles his Knight Sir Bedivere, from his death bed to say *"The old order changeth, yielding place to new, And God fulfils himself in many ways, Lest one good custom should corrupt the world."* These powerful lines underscore that fact that *"Everything shall change"*. Hope the changes that are happening in the cotton world are only changing for the better.

(The views expressed in this column are of the author and not that of Cotton Association of India)