AUTHOR:
Lawrence Malinga[1]

AFFILIATION:
[1]Secretariat: Southern and Eastern African Cotton Forum, Agricultural Research Council, Rustenburg, South Africa.

CORRESPONDENCE TO:
Lawrence Malinga

EMAIL:
lawrencem@arc.agric.za

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Southern and Eastern African Cotton Forum: Platform for the advancement of cotton production in Africa

Background

The Southern and Eastern African Cotton Forum (SEACF) was established in 1996 under the auspices of the International Cotton Advisory Committee (ICAC) that had supported three African regional meetings prior to the formation of SEACF: in Sudan (1982), Tanzania (1984) and Togo (1989). In 1994, researchers from the southern and eastern African countries set up the African Cotton Research Network, which later merged with SEACF. Initially, the main purpose of the forum was for each country to present national reports on cotton activities, but in 2010 the format was altered to a scientific symposium at which the regional network of researchers would present research results to their peers. The objective of SEACF is to promote cotton production through collaborative research and technology transfer and bi-annual research symposia are held in different member countries. Since its inception, SEACF has held 14 meetings. The chair of SEACF rotates with the country that hosts these symposia; member countries are Ethiopia, Kenya, Mozambique, Namibia, South Africa, Sudan, Tanzania, Uganda, Zambia and Zimbabwe.

Since 2006, the SEACF Secretariat has been based at the Agricultural Research Council – Industrial Crops in Rustenburg, South Africa. The Secretariat organises meetings and workshops and maintains a database of relevant scientists, currently numbering almost 100. Cotton industry players like Monsanto, Bayer and Cotton SA also attend meetings and make presentations, while after each meeting, visits to farmers' fields, research institutions or cotton ginneries are arranged. Membership is free and SEACF is self-funding; it receives some financial support from the ICAC. The SEACF Secretariat and the local organising committee of the hosting country raise additional funds for special events at meetings.

In 2001, SEACF initiated a collaborative project among South Africa, Zimbabwe, Tanzania, Uganda, Ethiopia and Sudan to determine the importance of cotton diseases in the region that was successfully completed the following year. This project was funded through ICAC and the fast-track programme of the Common Fund for Commodities. Regional germplasm exchange programmes have been established to allow cotton breeders to exchange cotton breeding lines from their respective countries.

The SEACF network has an electronic mailing list, hosted by ICAC, for communications among researchers.

Report on the 14th Meeting in Zimbabwe 2018

The most recent SEACF meeting was that in Harare, Zimbabwe, the theme of which was 'Global best practices for cotton yield enhancement in Africa'[1]. The meeting was hosted by the Zimbabwe Cotton Research Institute under the leadership of Dr Dumisani Kutywayo; 77 researchers from seven countries (Bangladesh, China, India, Kenya, Mozambique, South Africa and Zimbabwe) attended. Topics prioritised are discussed below.

Enhancing the competitiveness of southern and eastern African cotton

Of the total world cotton production, 10% is grown in sub-Saharan Africa and 18 million people in the region rely on cotton production either directly or indirectly. Input costs are supported by ginners and contract production and are later recovered through sales. The benefits are that farmers receive inputs and advisory support; ginners are ensured production and quality; and the export earnings of the country are improved through quality cotton to boost the textile industry and the cotton lint price. Mozambique cotton production is, however, unique in the region as it is entirely based on a concession set-up ('One Zone, One Gin Concept') that allows the cotton sector to operate in a monopsony system, where ginning companies are granted rights as exclusive buyers of cottonseed in their respective areas of the concession. Tanzania is currently investigating this system at a district level. There are benefits to the concession system, the most important of which are the exclusive right to purchase all cotton grown within the concession area; farmer support; extension training; and the supply of seed and crop chemicals.

In Zimbabwe, however, the Agricultural Marketing Authority regulates the production and marketing of cotton and administers matters like registration of growers, licensing of contractors, buyers and ginners; monitoring of seed cotton grading; and classification of lint. The Agricultural Marketing Authority also monitors the marketing and export of cotton and fosters the growth of the sector by providing a level playing field for all players in the cotton industry in Zimbabwe.

Increasing cotton productivity and public/private sector interventions

An important session focused on the ecological, technological and social environment of cotton production. In Africa, cotton is cultivated exclusively by smallholder farmers, and in Zimbabwe, it is grown by more than 200 000 smallholder farmers on an average plot of about 1 ha. The norm is that cotton is produced based on agreements signed by farmers and contractors who buy the cotton. Contractors supply the farmers with inputs as a loan, from which deductions are made when the product is delivered. In 2015, the Zimbabwean government approved a 3-year plan to support the smallholder farmers with free production inputs with the aim of reviving cotton production in the country. While the plan has resuscitated production, challenges remain: increasing costs of production; low cotton yields and poor-quality seed cotton production; input distribution based on generalised recommendations; side selling of free inputs from government; and the limited involvement of the private sector. Various recommendations were made to address these challenges.

Technology transfer

The experiences in India were highlighted in a paper on front line demonstrations. Field demonstrations, conducted by the National Agriculture Research System, the Indian Council of Agricultural Research (ICAR) and the State Agricultural Universities, provided effective learning. ICAR introduced the 'Lab to Land' programme that tested viable technologies developed by the researchers' on-farm field to convince farmers to adopt them. The programme further enabled scientists to obtain direct feedback from cotton farmers and create effective linkage among scientists, extension personnel and farmers. To date, 1157 demonstrations have been conducted and the analysis of yield parameter over 20 years has revealed an average yield increase of 18% compared to the farmers' previous practices, as well as a reasonable reduction in the cost of cultivation. Considering the profile of African cotton growers and the Indian experiences, conducting front line demonstrations is suggested for improving the socio-economic status of African cotton growers. Replicating the success of front line demonstrations would pave the way for profitable and sustainable cotton farming in the future.

An interesting study was done in Zimbabwe on value-added products that can be obtained from cotton stalk by-products. An average of 3 tonnes of the cotton stalk is generated per hectare of land; cotton stalk is an appropriate raw material for manufacturing bio-composite products. Due to the high deforestation rate, cotton stalks can be used as an alternative for the paper and pulp industry, as well as for providing crop residues to cultivate oyster mushrooms. This initiative is a valuable addition to the cotton-farming process and more research into natural resins with cotton stalk fibres will be done.

Despite water scarcity and soil degradation, most parts of Africa continue to use traditional and inefficient tools for cotton production. Over 9 years, the ICAR Central Institute for Cotton Research in India conducted a research study on conservation agriculture as best management practices for sustainable cotton production. The research revealed that the three key principles in conservation agriculture were minimum soil disturbance, increased soil cover and crop rotation. Reduced tillage systems with crop residue recycled resulted in increased boll retention, high seed cotton yields and profitability. The question was posed that if conservation agriculture is so beneficial, why is it not followed? After raising some of the challenges, it was clear that the solution lay in collaborative research, efficient technology transfer, appropriate mechanisation to improve farm labour efficiency, and the identification of crops that are compatible with cotton for intercropping.

Plant breeding

Due to low cotton yields of 500 kg/ha in Mozambique, the cotton research programme in that country has been developing and introducing new genotypes to discover suitable varieties for local production. As many as 18 cotton genotypes, including 16 imported, were tested in different localities around the country. From these genotypes, however, only three presented acceptable adaptability and potential stability, perhaps indicating that the seed cotton yield was affected more by the environmental complex than by the genotypes.

In Zimbabwe, 11 genotypes (8 experimental lines and 3 commercial varieties) were evaluated in order to identify superior genotypes for the Lowveld region conditions. Three genotypes had good yield and stability, and it was recommended that they be further tested for distinctiveness and uniformity based on field performance and fibre qualities before their release.

Eight Mahyco cotton hybrids were registered for commercial production in Zimbabwe and Malawi in 2017 and in Zambia the following year. Two of the tested hybrids yielded 5500 kg/ha dryland production, had an early maturity index of above 60%, high boll retention, and tolerance to jassids (leafhoppers). Seven other African countries are currently in the process of registering the hybrids, which have the potential to transform cotton production through improved farmer viability, increasing the area under cotton and cotton output.

The Institute of Cotton Research in China has done research on genome-wide quantitative trait locus (QTL) mapping for resistance to Verticillium wilt, fibre quality and yield traits in cotton chromosome segment substitution lines. In total, 251 QTLs have been detected, among them, 98 are of the fibre-quality traits, 93 of the yield-related traits, and 60 are Verticillium wilt resistant. Of these, 86 QTLs were consistent and three chromosomes contained more QTLs. Another study was presented from China which focused on cloning and expression of drought- and salt-tolerant genes on cotton. The study suggested that, on average, saline stress resulted in 70–80% loss of productivity in cotton, and that the Chinese cotton germplasm had 8873 cotton accessions. Few of the accessions that were tested were resistant to salinity as well as drought. The genetic diversity of cotton germplasm was also analysed among the salinity-tolerance relevant accessions, which showed that most of the germplasm had a closer genetic relationship.

Cotton agronomy

South African national cotton cultivar trials are conducted in different localities under irrigation and dryland conditions. These annual trials are aimed at evaluating cultivar performance that will be recommended to farmers in their respective areas. Characteristics that are taken into consideration include yield, fibre percentage, length, strength and micronaire. Even though a cultivar is identified as very stable, it does not necessarily mean that it will always give the highest yields, although it will perform better in unfavourable climatic conditions.

Cotton production is mainly dependent on the conventional tillage system in Zimbabwe which exposes the soil to degradation. Conservation agriculture is premised on the principles of reduced or no-soil disturbance. A study was conducted to determine the effects of conservation tillage technologies on seed cotton yield under Zimbabwean rainfed conditions. The lowest seed cotton yield was 511 kg/ha while the highest yield was 3000 kg/ha. The study recommended that the project continue and focus on low rainfall areas. It was also recommended that a cost–benefit analysis and crop rotation should be taken into account.

Crop protection

In Kenya, 80% of the population live in rural areas and depend on agriculture, and the cotton industry has been identified as one of the sub-sectors for alleviating poverty. However, cotton is characterised by low production per unit area. This low productivity is attributed to poor-quality seeds, poor land preparation, declining soil fertility, inadequate pest control, low adoption of technologies and inadequate technical support. A study was conducted in six districts to examine the transfer of integrated crop and pest management strategies based on an approach that meets the needs and circumstances of target farmers. The outcomes included increases in cotton yield, an improvement in cotton incomes, demonstration of the use of good production practices, an improvement in post-harvest handling, better communication among farmers, and collective action by farmers.

Verticillium wilt is one of the most important diseases of cotton worldwide, and affects yield and fibre quality. It is caused by *Verticillium dahliae*, a soil-borne fungus. There is no effective chemical control, so the use of tolerant cultivars is of great importance in controlling the disease. The objective of the research that was conducted in Zimbabwe was to determine the tolerance levels of new cotton genotypes to Verticillium wilt. Verticillium wilt screening indicated that the varieties used had different tolerance levels and most genotypes which were tolerant to the disease produced high yields. It was recommended that further research was required to determine the mode of tolerance.

Best practices for yield enhancement in Africa

Yield enhancement in Africa is an extremely important topic. It was agreed that to a greater extent cotton research should address the cotton value chain and the development of technologies that are affordable, viable, sustainable and easy to use. Moreover, researchers need to ensure that those technologies reach the end-user. In addition, the technology, knowledge and information generated by research must reach the grower in a practical manner. To enhance production yield, effective weed and pest management is vitally important, and timely planting in rainfed areas is

critical to ensure that the crop takes full advantage of rainfall. As smallholder farmers form a larger percentage in cotton farming, there is a need for specially designed mechanisation that caters for smallholdings.

There are 24 countries that have adopted biotech crops, of which the USA constitutes 40% of the global share. Cotton is planted in 15 of those countries – covering 81% of global planting. The major traits in biotech crops are those for insect and herbicide tolerance. By 2015, the adoption rate of GM cotton was almost 80% worldwide. The highest year-on-year increment in the biotech cotton area was obtained in South Africa (a remarkable 315%), followed by the USA (24%) and Brazil (19%).[2] Although technology has increased the yield and reduced the production costs, challenges are the minor pests that have become major pests and the development of insect resistance. Some solutions towards challenges in increasing yield include reduction of plant density per hectare, lower crop duration, short critical window and efficient management of insect pests, nutrients, water and light. The training workshop was led by Dr Keshav Kranthi, head of the Technical Information Section at the ICAC, and he also conducted participatory practical sessions on Bt-detection using immuno-chromatographic strips and Bt-quantification through enzyme-linked immunosorbent assays.[3]

Recommendations

The following are some of the key recommendations from the 2018 meeting in Zimbabwe:

- Improve research and development in the region
- Introduce farmer training programmes to improve production
- Manage high production costs due to the increase in input cost and labour wages
- Mitigate the low viability of cotton production due to international prices and its volatility
- Consider the role of climate change on low cotton yields through drought and the recurrence of diseases and pests
- Improve collaboration among the member countries and information exchange
- Develop a regional germplasm database and exchange programme

Uganda has been proposed as the host country for the 15th Meeting of the SEACF in 2020.

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