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Novel Ideas to Enhance Cotton Production and Value of By-products in Africa

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This chapter is a compilation of the six concept notes on novel ideas proposed by the six authors

Ideas Proposed By Dr. Md. Farid Uddin

Cotton is the main tradable commodity of West and Central African countries, representing the main exported agricultural product for some countries. Cotton is a major concern since it represents an important source of income, accounting for more than a tenth of total exports. Moreover, the subsector as a whole is essential for rural poverty reduction. Cotton in Africa is mainly produced in rainfed conditions with relatively few financial resources. Climate plays an important role in the variability of cotton yields over the course of years.

The most common challenges to cotton production in Africa are as follows:

- Smaller scale of production,
- Limited access to good quality seeds,
- Heavy reliance on insecticides,
- Decreasing soil fertility,
- Increasing production costs, and
- Volatile markets.

The following strategies can help in the development of the cotton sector in Africa:

1) **Upscaling:** There is a need to increase the scale of production. Large-scale projects and a better support by national services and policies will definitively increase productivity and will bring down production costs,
2) **Good quality seed:** Good agriculture results from good seeds. Improving access to good quality seeds will play a major role in yield enhancement. Seed production units in the public sector research institutes need to be strengthened to produce sufficient quantity of good quality seeds.
3) **Integrated pest management (IPM):** Effective pest management can efficiently prevent yield losses. Therefore, there is a need to actively promote IPM practices. A practical, country-specific training curriculum for smallholders and export-oriented farmers needs to be developed. The focus for smallholders should be first on good agricultural practices (GAP) coupled with the basic principles of IPM, whereas the focus for export-oriented farmers can be fully based on IPM.
4) **Soil health:** Adoption of Integrated soil fertility management practices holds the key for good crop health. Integrated Nutrient Management (INM) practices need to be promoted, combining agronomic practices relating to intercrops, mineral fertilisers, organic inputs and other amendments that are tailored for different cotton-based cropping systems, with objectives to enhance soil fertility status and increase socioeconomic profiles of farmers.
5) **Profitability:** Improving income from cotton is important to sustain farmers' interest in the crop. Profitability can be enhanced by optimising the usage of water and agrochemicals to prevent wastage of resources and investment. Cotton production cost should be rationalised by increasing productivity as well as adding value to cotton fibres and by-products derived from the cotton farm.
6) **Subsidies:** Subsidies in farm inputs and cotton prices will help farmers to cope with the uncertainties of volatile markets.

Cotton is one of the most important cash crops in Africa and has had an important role in job creation, poverty reduction and foreign exchange generation. African cotton exporters face three interconnected challenges:

- How to increase yields and quality to achieve higher incomes in the context of small holder farming?
- How to deal with volatile international prices and to be shielded from external vulnerability?
- How to increase value addition through local processing of cotton lint and seed.

An integrated effort to address these issues will increase the sustainability of African cotton sector.

Ideas Proposed By Dr. Md Fakhre Alam Ibne Tabib

Research

Problem-based coordinated research activities in African countries should operate through SEACF under the aegis of the ICAC. Research should be focused on fibre quality improvement, efficient water use, agronomic practices for conservation agriculture, high-density planting systems, insect pest management, heat tolerance, and crop management. Research should also be oriented toward the development of the cotton value chain and cotton by-products. There should be continuous socio-economic surveys and research on cotton production and marketing. Government support for cotton research and development plays a pivotal role in development of the cotton sector.

Extension services

Coordinated government extension services should be developed for cotton growers by forming a Common Interest Group (CIG) and provide cotton production technologies to CIG members through training, ICT-based information sharing, booklets, leaflets, posters and other extension tools. Introduction and dissemination of good extension practices that are practiced in other ICAC member countries. Formation of a central cotton extension/extension advisory service body under ICAC, involving government and non-governmental organisations that deal with cotton production, research and marketing in African countries. Easy access to the cotton market information by the cotton growers and farmers group (CIG) and other stakeholders of cotton. Creation of a central database to strengthen coordinating activities and information sharing for the stakeholders involved in cotton production and marketing.

Contract farming

Asian countries that import cotton can get involved in cotton production and marketing in African countries through contact-farming. Asian investors can establish ginning and processing factories and import cotton fibre from African countries for their textile industries.

Ideas Proposed By Dr. Kamrul Islam

Improving soil fertility for sustainable cotton production

Cotton (*Gossypium spp*.) is a very important fibre crop and plays a major role in the economies of several African countries. Many cotton farms are in a crisis due to decreasing soil fertility. The cost of chemical fertilisers is high. Many farmers prefer to use chemical fertilisers for cereal crops instead of cotton. Nevertheless, fertiliser use practices in cotton production systems are reported to be inappropriate and are leading to soil nutrient depletion, rapid land degradation and low fertiliser-use-efficiency.

The problems related to soil fertility include:

1. Constrained ability of the soil to supply nutrients to the crops.
2. Constrained ability of the soil to retain nutrients.
3. Asynchrony of nutrient availability as per demand of the cotton crop.

The following practices could be used to address these problems:

- **Appropriate use of chemical fertilisers:** Use of chemical fertilisers that offer an instant solution to the issue of limited nutrient supply, considering the fact that their injudicious use might lead to negative effects on the soil as well as loss of applied nutrient elements particularly of nitrogen (N).
- **Organic fertilisers:** Use of organic fertilisers such as animal manures, green manures or cover crops not only provide nutrition to the crop but also enhance soil health. However, there are two major shortcomings associated with organic fertilisers: 1) The nutrient-release pattern of organic resources does not match with crop requirement phases, and 2) The nutrient contents of most of these organic inputs tend to be very low, and as result, very large quantities (up to 20 tons/ha) are required to meet the nutrient demand. The large quantities required creates logistical challenges of transporting these resources, incorporating them and sourcing for sufficient quantities.
- **Cropping systems:** Intercropping with crops that do not compete with cotton for water and nutrients due to different plant morphology and root architecture, and have a different requirement window for nutrients, water and sunlight. Leguminous intercrops can benefit cotton through nitrogen fixation and integrated pest management. Intercropping also helps to break the cycles of diseases, weeds and pests.

To ensure synchronisation of nutrient availability as per demand of the cotton crop as well as preventing the nutrient loss, a combination of chemical and organic fertilisers is the best option for enhancing the nutrient supply to crops. All the shortcomings associated with the sole use of either chemical fertilisers or organic inputs are addressed by combining the two practices.

The following strategies help in integrated nutrient management:

1) Split application of chemical fertilisers.
2) Replacement of chemical fertilisers with organic manures as much as possible, the quantity of which is determined by location specific field trials and

local availability. For example, in Bangladesh 30% to 40% nitrogen of chemical fertiliser (urea) could be replaced by organic fertiliser (poultry manure).

Ideas Proposed By Mr. Washington Mubvekeri

- **Suitable agro-ecology:** Grow cotton in a suitable agro-ecology.
- **Adaptation and validation:** Avoid using imported technologies before testing them for adaptability.
- **Certified seeds:** Grow certified seeds of adaptable cotton varieties. Zimbabwe has a strong seed-certifying institution.
- **Nutrition management:** Provision of adequate levels of nutrition is critical for both free-input or contract grower schemes. Adequate nutrition promotes crop vigour, desirable and potentially productive vegetative framework, boll retention, and viable boll weights.
- **Early sowing:** Plant early in the season. Ensure that recommended plant populations for particular cotton varieties are achieved and maintained throughout the growing season.
- **Effective weed management:** Sustain an effective and efficient weed-management regime.
- **Effective pest management:** Initiate an effective and efficient pest-management regime that minimises boll loss. In Zimbabwe, pest management tools include the Pyrethroid Window, Acaricide Rotation Scheme, Closed Season, Use of Economic Thresholds
- **Timely harvesting:** Pick only fully mature bolls early enough to preserve colour and avoid unnecessary boll weight loss.
- **Avoid contamination:** Rid the seed cotton of contaminants during harvesting and storage.
- **Contract integrity:** Grow a culture of honesty and accountability among cotton growers. These qualities are critical for dealing with 'side-marketing syndrome'.
- **Fair marketing:** Sustain fair, win-win grower schemes by setting viable input prices and motivating the growers through fair prices.
- **Eco-friendly, farmer-adaptable technologies:** Knowledge and technology generation must be ecologically and environmentally compatible and must be affordable to benefit the cotton sector.
- **Farmer participatory training:** Knowledge and technology transfer should reach the grower in a practical and realistic way rather than in a superficial manner. Most of it ends with the training of trainers.
- **Fibre to fabric:** Value addition enriches the downstream cotton sector.
- **Value addition to cotton by-products:** Economic usefulness of cotton by-products depends on the specific circumstances of countries. Utilisation of cotton stalks for fuel purpose requires 'patriotic' consideration because ecological conditions in most SEACF member countries are favourable for forestry.

Ideas Proposed By Dr. M. Sabesh

Although many countries in Africa attained independence during the 1960s, the living standards, nutrition, health care and education have not progressed significantly even after six decades. Comprehensive reforms with the support of local governance in basic health care, education, nutrition, labour welfare, and a strong legal framework are required in many African countries. The recent World Bank report mentioned that six of the 10 fastest-growing economies in the world are in Africa. About 60% of the world's unused arable land is in Africa. There is a lot of scope for growth in the agricultural sector in Africa, with ample investment by donors in fertilisers, machinery, water and irrigation systems. African countries would be the world's major destination for the agricultural sector in the years to come, provided proper policies are formulated and implemented effectively.

- **Varietal development programmes should be farmer-participatory.** Farmer opinion on socio-economic and agro-ecological constraints should be considered during adaptive field trials.
- **Germplasm introduction:** Brazilian varieties (BRS 286 and BRS 293) have adapted well in Mali, Burkina Faso and Benin. These varieties yield better under irrigation. Germplasm introduction into Africa will strengthen genetic diversity for varietal improvement.
- **Conservation agricultural techniques:** Zero-tillage, especially with organic mulching, was found to enhance cotton productivity and soil fertility in many countries in Africa. The technique involves dry season land preparation, early planting, early weeding, precise field layout, and careful input application. The technique requires experimentation in Africa and further fine tuning for large-scale adoption with adequate training.
- **Topping and pruning of sympodial branches:** Manual trimming of cotton plants has been adopted successfully in China to greatly enhance yields. Such operations are possible with the availability of sufficient man power. This technique is ideally suited for African countries, where labour is inexpensive.
- **Early sowing is crucial:** Farmers must be inculcated with the technical know-how on early planting with the onset of the monsoon to ensure moisture retention during the critical crop-growth period. Since cotton

cultivation in Africa occurs predominantly under rainfed conditions, early sowing would enable the crop to get adequate soil moisture at a critical phase of the crop to enhance cotton productivity.

- **Investment in water conservation:** Ethiopia, Kenya, Tanzania and Uganda have good rainfall and abundant resources of water, whose potential has not yet been fully tapped, and requires investment.
- **Organic fertilisers:** Most of the African cotton farmers are smallholders with minimal access to financial resources. Chemical-input-intensive agriculture is unlikely to be sustainable for Africa. There is a need for research on developing crop production technologies and pest management strategies using the abundantly available natural resources that can be used as for profitable cotton farming. Crop residue recycling, organic manures and fertilisers can be cost effective and sustainable.
- **Rejuvenating ecosystems for efficient INM and IPM:** African ecosystems are comparatively less disrupted by chemical-intensive agriculture. Thus, there is a great opportunity to rejuvenate the agricultural ecosystems through natural resources, which would in turn allow integrated nutrient management (INM) and integrated pest management (IPM) to function effectively under the prevailing agro-ecological conditions for the benefit of the resource-poor small-holders in Africa. There is a need for strong research institutions across potential cotton growing countries in Africa to strengthen biological control-based pest management. Efficient non-chemical approaches for pest and disease management must to be developed, such as development of resistant varieties, cultural controls, agronomic practices and biological control for the prevailing agro-ecological conditions.
- **Wasteland reclamation:** There are large tracts of lands in Africa that have immense potential for farming. There is a need to identify the resources available in the vicinity of such wastelands for further augmentation. A comprehensive wasteland-development programme needs to be created and implemented with the help of appropriate investment from governments and private agencies. Brazil has converted large tracts of unfertile lands in the Cerrado region in central Brazil and reclaimed them. The region become agriculturally more productive.
- **Decentralised ginning units:** Establishment of small-scale ginning units, as is done in Brazil, can enable farmers to get additional remuneration by value addition to their produce. Farmers would be able to trade cotton lint directly without being exploited by middlemen to get more profits.
- **Fibre processing in eastern and southern Africa:** Textile processing generates significant employment. Data from Asia show that one tonne of lint is known to provide year-long employment to at least five persons (Kranthi, ICAC Recorder, Sept. 2018). The shift in cotton production domain from Eastern and Southern Africa to Western and Central Africa triggered the need for a few processing units in Western and Central Africa. However, 80% of raw cotton is exported from Africa. Establishment of full-scale textile manufacturing factories in Africa can greatly change the fortunes of countries and their farmers.
- **Diligent breeding:** The case of *Bt*-cotton in Burkina Faso presents a case-study on how things can falter if local sensitivities are taken for granted. Beyond a doubt, *Bt*-cotton as a pest management technology was successful. Cotton produced in Burkina Faso was known all across the world for its excellent fibre quality. Cotton harvested from the *Bt*-cotton varieties was inferior in quality compared to conventional non-*Bt* cotton. The problem was basically poor selection and incomplete cycles of back-crossing conducted with the local cultivars. The issue highlights the need for diligent breeding to ensure that the locally adapted varieties are reconstituted properly to their original state at the end of back-cross cycles.
- **Good crop management v/s Bt-cotton:** The current yields in Africa are low mainly because of poor practices. Many of the soil, nutrient, water, and pest and disease management practices, if followed precisely without any compromises in agro-input supply, have the potential to enhance the cotton yields and offer best returns to farmers in a manner that is equivalent to the adoption of *Bt*-cotton technology (Valerie 2011). Crop production technologies, if followed properly, have immense potential to enhance yields.
- **Yield gaps due to socio-economic constraints:** Many African farmers achieve lower yields because they cannot afford to apply proper inputs due to socio-economic constraints. Many African cotton varieties have high yield potential, but poor management leads to poor yields. There is a need to strengthen research that can empower the farmers in Africa to manage their crops with locally available natural resources for profitable farming, and also to sell their produce at competitive prices.

Ideas Proposed By Dr. Usha Rani Joshua

Africa is an important cotton producer with a significant role in the value chain of cotton. Cotton is one of the most widely cultivated cash crops by small and marginal farmers

in Africa. Despite its economic potential, the cotton sector in Africa is subject to many risks with respect to weather conditions, price fluctuations and pest attacks, all of which threaten the sustainability of cotton production in Africa. A reform to sustain and foster cotton production in Africa is imperative since millions of smallholder farmers depend on cotton for their livelihood. This concept suggests seven strategies to enhance the cotton production and value of by-products in Africa:

- **Diagnose the constraints.** First of all, there is a pressing need to diagnose constraints in cotton cultivation and identify the needs of cotton stakeholders in Africa. This can be attempted by using standard interactive tools such as participatory rural appraisal, brainstorming, stakeholder interface meetings, and focused group discussions at the micro and macro levels. The results would shed light on researchable issues, policy perspectives, and the obvious and unrecognised needs in cotton sector at micro and macro levels.
- **African cotton mission.** Devise an 'African Cotton Mission' with best production practices, efficient techniques for transfer of technology, policy and regulatory interventions to solve the constraints and enhance productivity in small-scale farms. The nationwide mission mode approaches under 'African Cotton Mission' should include technological, extension, capacity building, policy and regulatory interventions involving the line departments and all stakeholders in a Public Private Partnership (PPP) mode.
- **Global best practices.** As part of the 'African Cotton Mission', researchers must develop the best integrated crop management package of practices for cotton in Africa, based on global best cultivation practices in cotton. Such best practices include short duration varieties, soil health management, planting system alterations, precision farming, use of mulching, conservation agriculture, canopy management, good harvesting practices, and integrated management of pests, diseases, weeds, nutrients and water.
- **Transfer of technology:** To disseminate the best management practices in farmers' fields, technology translators should devise mechanisms that combine both conventional and contemporary good extension practices such as: field demonstrations, training for trainers, Farmers Field Schools (FFS), soil health cards, printed materials, short videos, personal field visits, exposure visits, radio broadcasts, Television, mobile-phone-based voice texting, mobile apps, Web-based advisories, decision support systems (DSS), usage of social media, WhatsApp, Facebook and blogs, expert systems, market intelligence, organising Farmers Interest Groups (FIGs), Commodity Interest Groups (CIGs), producer organisations, and contract farming.
- **Capacity building:** Design and implement a country-wide, massive-capacity building program through training, field camps and study tours within the country and abroad for all stakeholders, including government officials, bureaucrats, researchers, extension functionaries, private partners, and farmers. To strengthen and support both the technology developers as well as translators, governments should drive training programmes at all levels — from top policy makers to para extension workers at field level — including visits to far-away cotton growing countries and even to successful local farmers' fields.
- **Supportive policies:** Create supportive policies that attract and involve women and rural youth in cotton cultivation through government-aided supportive policies such as smart credit, micro financing, and price support mechanisms that will reinforce and strengthen the mission.
- **Right regulatory interventions:** Aim to double the cotton yield and reduce the cost of cultivation by optimising inputs to prevent waste of water and agrochemicals, thereby executing the mission with the proper regulatory interventions.