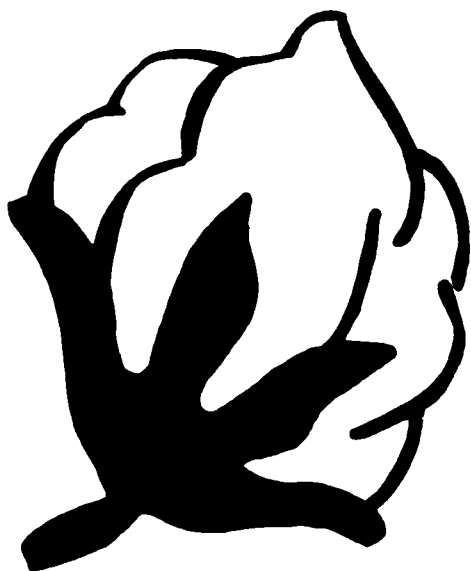




# **THE ICAC RECORDER**

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International  
Cotton  
Advisory  
Committee

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Technical  
Information Section

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- **Update on cotton production research**
- **Nouvelles recherches cotonnières**
- **Actualidad en la investigación de la producción algodonera**

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## Introduction

Officials realized there was a need for regulation before commercial production of transgenic cotton started in Australia and the USA. Regulators realized that emotional overemphasis of potential risks to people and the environment needed to be avoided, so that regulations could be science-based to assure that undesirable products and technologies are not released. The objective of regulation is to make sure that thorough testing has been undertaken in controlled environments to minimize risks from commercial release. In order to achieve this objective, biosafety rules had to be established. Though transgenic cotton is grown on a commercial scale in only six countries, biosafety rules have been established in over fifty countries. However, most of these countries are non-cotton producers. Many other countries are in the process of establishing basic requirements for introduction and commercial use of transgenic crops. General biosafety guidelines have been prepared by the United Nations Industrial Development Organization but nations need to modify the rules to suit local conditions. Egypt is one of the first countries to start working on biosafety standards and procedures. Guidelines are available for commercial introduction, as well as local development and release of transgenics. The Egyptian biosafety system, which involves the Ministry of Health and the Ministry of Agriculture, is briefly discussed in the first article.

The second article describes the need for an international institute/center for research on cotton. The article also explains ICAC's relationship with the Common Fund for Commodities (CFC), an international intergovernmental organization based in Amsterdam, Netherlands. The CFC has recognized the ICAC as the international commodity body (ICB) for cotton. ICAC can recommend projects for cotton research and marketing for CFC funding. ICAC's collaboration with the CFC has brought added funding for cotton research and in the last ten years, the CFC has sponsored nine cotton projects directly benefiting 26 countries, with a total cost of over US\$50 million. Two of these projects have been concluded and two more are expected to conclude by mid-2001. The contributions from the CFC have been in the form of grants and loans. Projects can be prepared on any aspect of cotton production, consumption and marketing and sent to the ICAC. Projects can be submitted to the ICAC at any time as full proposals or as pre proposals. More details on current projects and preparation of new projects are given in the article.

In the last fifteen years, cotton area in Burkina Faso increased by about three-fold without increases in yields. Cotton growing is spread over most of the country and new areas are being explored to expand production. All cotton is grown under rainfed conditions. Farmers are organized into small groups

that form the National Union of Cotton Producers, which represents cotton growers with the government. Research on cotton is conducted by the Institute of Environment and Agricultural Research. However, the Textile Fiber Society of Burkina Faso (SOFITEX) plays a very important role in cotton production and is the organization supplying planting seed, fertilizers and insecticides. SOFITEX also buys cotton from farmers, gins and sells it in the international market. Calendar spraying and use of mixtures are officially recommended and used on all cotton area; consequently, the cotton bollworm has already developed resistance to pyrethroids. Whitefly also became a problem in 1998 and it is now feared that it will become a serious pest. Currently, the greatest challenge for researchers is to establish economic thresholds for various pests and popularize

them with farmers through SOFITEX. The third article gives details on the status of cotton production and research in Burkina Faso.

ICAC has announced the World Cotton Research Conference-3 (WCRC-3), which at the invitation of the cotton industry of South Africa will be held in Cape Town, from March 9-13, 2003. Anyone interested in attending is advised to pre-register to receive complete details. A complete registration package will be mailed only to those who have pre-registered. Full registration will be available closer to the date of the conference. The pre-registration brochure can be obtained by contacting the ICAC Secretariat or online at <<http://www.icac.org/icac/meetings/meetings.html>>.

## Commercial Production of Transgenic Cotton in Egypt

All the currently available transgenics in cotton belong to the upland type, and Egypt grows only *G. barbadense*. However, this does not mean that Egypt has not been able to make use of genetic engineering technology in cotton. In fact, genetic engineering programs started with the establishment of the Agricultural Genetic Engineering Research Institute in 1990, and Egypt has made significant progress in the development of transgenic crops since. A team of researchers/ biotechnologists at the Agricultural Genetic Engineering Research Institute of the Agricultural Research Center has been working for over ten years to develop its own systems to make use of modern technology. The team has been successful, and currently two transgenic crops are ready for commercial release: a potato engineered to resist infestation by tuber moth, and a squash resistant to a viral pathogen. Genetically engineered maize resistant to the stem borer may be the third transgenic crop to go into commercial production, provided field trials prove successful. Egypt has acquired already-developed transgenic maize technology from multinational companies, thus, it has not only relied on its own expertise, but has also been looking for additional ways to make use of new developments in genetic engineering. Egypt has also made significant progress in GE cotton.

### Need for Biosafety Regulations

One of the significant limitations in the spread of genetic engineering to many countries—and particularly to developing countries, which are the main producers of agricultural goods—has been awareness about its usefulness as well as possible risks. Though the benefits of the GE technology may be highly significant and dominant over potential risks, ICAC has realized that there is a need to educate the public about both so that appropriate measures can be taken to avoid risks before damage actually occurs. Many countries have come to realize that in order to adopt the technology and before any biotechnology

products are released, they first need to formulate regulatory requirements. Though GE cotton is grown on a commercial scale only in six countries, national biosafety systems have already been established in over fifty countries to evaluate proposed uses of genetic engineering and its products.

Egypt does not have many GE cotton products ready for use. But, considering the GE products available on the market from over 40 crops engineered so far, it is clear that they are so diverse that some would require a higher level of regulatory control than others. Whether it would be a low or a very strict regulatory process, the fact remains that countries' biosafety systems will serve as gatekeepers for the use of biotechnology in cotton and in all other crops and living organisms. General biosafety guidelines have been prepared by the Biosafety Information and Advisory Service of the United Nations Industrial Development Organization and are available on line at <http://binas.unido.org/binas>. Countries' national biosafety systems are intended to serve as mechanisms for ensuring the safe use of biotechnology application without imposing unacceptable risks to human beings or the environment, or unintended constraints to technology transfer.

### Seed Industry

Egypt has 66 registered seed companies specialized in seed production of hybrid maize, sorghum, sudangrass forage, sunflower, some vegetables, clover and alfalfa. Over fifty companies are registered to import seed, while 148 companies have the required license to export seed from Egypt. The planting seed industry in Egypt started and flourished from the cottonseed industry. In 1922, the government of Egypt established a cottonseed production unit at the Ministry of Agriculture, which served as a basis for the initiation and establishment of the seed industry. From time to time, the unit expanded to include seed production of other crops. The status of the seed production unit was raised to a higher level within the Ministry in 1980. In

1993, when the Ministry started implementing free market economy policies, the seed industry was reorganized into two sub-sectors. Seed certification, quality control, marketing control and law enforcement activities were separated from commercial seed production.

The Agricultural Research Center of the Ministry of Agriculture and Land Reclamation has 17 research institutes/organizations, and the Cotton Research Institute at Giza/Cairo is one of them. The Cotton Research Institute has the primary responsibility of developing varieties. The Central Administration for Seed Testing and Certification, established in 1995, has the primary responsibility of seed quality control, legislation and policy enforcement. For the purpose of quality assurance, the Central Administration for Seed Testing and Certification also undertakes field and lab tests depending upon the status of the variety. Uncertified seeds are tested only under lab conditions.

Seed varieties developed by the Cotton Research Institute are handed to the Central Administration for Seed Production for commercial production and distribution. The Central Administration for Seed Production recommends to the Agricultural Research Center authorities the quantity of certified and registered classes of seed to be produced to meet the requirements of all farmers. The Central Administration for Seed Production contracts with elite growers to produce seed for various crops. The Central Administration for Seed Testing and Certification keeps a close watch during the seed multiplication process and works in collaboration with the respective breeders and the Central Administration for Seed Production, and makes sure that all requirements for maintaining seed quality are properly followed.

All the seed needed to grow cotton in Egypt comes from locally developed *G. barbadense* varieties only, and is produced in coordination with the Cotton Research Institute, the Central Administration for Seed Testing and Certification and the Central Administration for Seed Production, under the overall administrative supervision of the Ministry of Agriculture and Land Reclamation. The breeders at the Cotton Research Institute, who are experts in identification of varieties, are responsible for producing breeder's and foundation seed. Foundation seed is the basis for producing registered and certified seed. Breeder's seed is produced separately but sometimes the same field may be used to produce foundation, certified and registered seed. Within a field, the central part may be designated for producing foundation seed, assuming that no outcrossing has occurred in this part of the field and, subsequently, certified and registered seed may be produced from the outer parts of the field.

#### Planting Seed Produced in Egypt – 2000/01

| Category        | Quantity in Tons | % of Total |
|-----------------|------------------|------------|
| Breeder's Seed  | 150              | 1          |
| Foundation Seed | 1,110            | 6          |
| Registered Seed | 4,068            | 24         |
| Certified Seed  | 11,974           | 69         |
| Total           | 17,302           |            |

The Cotton Research Institute is one of the oldest establishments in agricultural research. The institute was established in 1915, even before the seed production unit was established within the Ministry of Agriculture. The institute started as a breeding station and has turned into a main research facility on cotton research in the country by accommodating many other disciplines. But the main emphasis is still on breeding new varieties and producing breeder's and foundation seed. Other disciplines serve as support to the mainstream work of the institute. A separate institute on plant protection (mainly insects), a diseases institute and genetic engineering institutes take care of the respective disciplines, but physiology, agronomy and fiber quality are housed within the Cotton Research Institute. Breeders get support from allied disciplines and train inspectors and supervisors from the Central Administration for Seed Testing and Certification and the Central Administration for Seed Production in the proper identification of different varieties. The Cotton Research Institute has six research stations that are used not only for varietal trials, but also for the production of breeder's seed. The station at Sakha in the Delta region serves as the main center for production of breeder's and foundation seed.

## Seed Rate and Varieties

Cotton in Egypt is planted on ridges and virtually all is dibbled by hand. Usually, 10-12 seeds are used per dibble and hills from the center are spaced at 50 centimeters from each other. Plants are ultimately thinned to about two plants per spot. A high number of seeds per dibble, and close spacing between rows increases the need for a higher seed rate, but the seed actually used per hectare is even higher than the required rate. Seed from *G. barbadense* varieties usually has less fuzz compared to upland and diploid cultivated types, and planting seed was not delinted in Egypt prior to 1995. The average seed rate used in Egypt ranges from 80-100 kgs per hectare. The main reason for the application of a higher seed rate is just a tradition to avoid any chances of getting a low plant stand and low yields. Without going into details about how much seed should be used per hectare to obtain an optimum plant stand and to achieve the target yield, the fact remains that a higher seed rate definitely increases the need to produce more planting seed than actually required.

#### Area Under Different Varieties in Egypt - 2000/01

| Variety | Area in % |
|---------|-----------|
| Giza 70 | 14        |
| Giza 80 | 13        |
| Giza 83 | 11        |
| Giza 85 | 14        |
| Giza 86 | 21        |
| Giza 88 | 2         |
| Giza 89 | 24        |

There are at least ten other countries that produce *G. barbadense* on a significant area. These countries grow a limited number of varieties every year. But in Egypt, the number of varieties permitted for commercial production is proportionally much higher

compared with other countries growing similar types of cotton, which gives farmers flexibility to grow a variety of their own choice better suited for their soil and production practices. On the other hand, a high number of varieties adds to the uncertainty of which variety to grow on what area. Due to a much wider choice, farmers keep switching among varieties, multiplying the doubts of how much seed of each variety is necessary to produce next year. Thus, as a precaution, seed of most varieties is produced in higher quantities than the actual amounts used by farmers. This not only increases the cost of seed production but also lessens the efforts of the concerned agencies for strict quality control at various stages of quality monitoring, like in the field, in ginning and in handling.

## Main Goals of GE Cotton in Egypt

There are many GE upland cotton programs in the world. In addition to the work of private companies, many countries have also initiated their own specific programs according to their needs. However, the Egyptian program is the only major program on *G. barbadense* in the world. Genetic engineering of cotton in Egypt has the following main goals in general:

- *G. barbadense*, like the upland varieties, is also affected by insects. One of the main areas of research in Egypt is the development of transgenic cotton resistant to insects.
- Characterization of salt, drought and heat stress-tolerant genes and the development of transgenic cotton varieties possessing traits that offer tolerance to abiotic stresses.
- Molecular and biochemical characterization of cotton fiber initiation and development in Egyptian cotton.
- Identification and characterization, and sequencing of gene families responsible for fiber length and strength traits in Egyptian cotton.

Significant progress has already been made to develop Egyptian cotton resistant to insects, particularly bollworms. Efforts are underway to verify the synthetic Bt toxin gene(s) and work is continuing for the transformation and regeneration of transgenic cotton plants expressing accumulated synthetic Bt gene(s). The regenerated transgenic plants resistant to insects are being tested under greenhouse conditions and soon will be offered for testing under field conditions for insect damage tolerance.

Regarding tolerance to various kinds of stress, Egypt has developed cotton tolerant to drought. Heat and salt stress tolerance are also within achievable targets. Stress tolerant transgenic cotton is also at greenhouse and confined field-testing stage.

The effect of plant growth substances (auxins, gibberellins and cytokinins) on in vitro fiber initiation and development has revealed interesting results. Regulation of gene expression controlling late fiber growth development in fertilized ovules is being studied, and molecular and biochemical characterization of Egyptian cotton fiber initiation and development seem possible. However, work regarding identification and character-

ization of genes responsible for fiber length and strength is still at initial stages.

## National Biosafety System

Egypt is one of the first developing countries that have designed criteria for safe handling, large scale testing and commercial release of genetically engineered crops. Egypt established a national biosafety system as early as 1993. The Biotechnology Service of the International Service for National Agricultural Research (ISNAR) undertook a study along with two other collaborators from the U.S. to assess the impact of genetically engineered crops being released in Egypt, and also reviewed the biosafety policies and procedures associated with the introduction of GE crops. ISNAR has published the results of the study in the form of a report titled "Analysis of a National Biosafety System: Regulatory Policies and Procedures in Egypt," in September 2000.

In 1992, the Agricultural Genetic Engineering Research Institute of Egypt (AGERI) and Michigan State University started a collaborative project called the Agricultural Biotechnology Support Project (ABSP), supported by the U.S. Agency for International Development (USAID). ABSP required Egypt to have an adequate mechanism for biosafety review. Egypt's national biosafety system was formally instituted by the Ministry of Agriculture and Land Reclamation in 1995.

The Egyptian biosafety system involves several ministries, departments and government agencies in the process of importation, exportation, local production and release of GE products. The National Biosafety Committee (NBC) is the final authority in the release of GE products and its main responsibilities, among others, include the formulation and implementation of guidelines for safe handling and commercialization of GE products. NBC also has the mandate of coordinator with national and international organizations working in the same field. NBC provides training and technical advice in the relevant fields. It is the responsibility of NBC to keep up with developments in the field and, accordingly, update guidelines for the effective implementation of regulations and safety of the environment and living organisms. NBC is comprised of three subcommittees specializing in (1) agriculture: dealing with crops; (2) environment: dealing with biopesticides, biofertilizers, etc.; and (3) health: dealing with pharmaceuticals, human and veterinary vaccines.

Under the guidelines established at the national level, every national institution working with the process involving recombinant DNA technology is required to establish an Institutional Biosafety Committee. The Institutional Biosafety Committee not only adheres to the national guidelines but also assembles appropriate institutional guidelines in line with national standards so that all possible research risks are covered. Thus, the institutional committees make sure that plans and programs are available for adoption in case of accidental spills and personnel contamination. The institutional committees are comprised of experts in different techniques used in genetic engineering

of organisms, policies and applicable laws and biological safety. Standard application forms are submitted to NBC for approval and release of a GE product. NBC usually appoints a principal investigator for a more critical review, who submits a report to the full committee after consultation with members of the concerned discipline subcommittee. Applicants are required to indicate what information on the application is confidential, such as plasmid maps, exact genetic change, technique used in developing the GE product, or any other information specified by the applicant. NBC has the right to either issue a permit or discard the product as unfit for commercial release in Egypt. However, permission to import a GE product is granted by the Supreme Committee for Food Safety of the Ministry of Health. Though national biosafety guidelines were drafted in 1994 and made public in 1995, procedures for commercialization of GE products were established in 1998. The Supreme Committee

for Food Safety of the Ministry of Health ensures the safety of the food aspect of any GE product and, similarly, other issues related to products like pharmaceuticals, etc., are taken care of by other ministries/departments. The Environmental Affairs Agency of the Ministry of Environment ensures environmental protection laws. The role of the three main committees is shown in the diagram below. The Central Administration for Seed Testing and Certification is responsible for testing and registration of GE varieties but would act only if a variety has been allowed for growth on a commercial scale by the NBC.

## More Recent Changes

When commercial production of GE crops became popular, and it became clear that products made from GE crops were going to move frequently across countries and regions, the government of Egypt reconsidered its policies. In 1997, the government prohibited the import of any foodstuff produced through GE technology unless confirmed safe. A certificate from the country of origin confirming that seed was not produced from untested GE plants must accompany all imported GE seed/products. This means that only products which have been approved in the exporting country and found safe can be imported into Egypt.

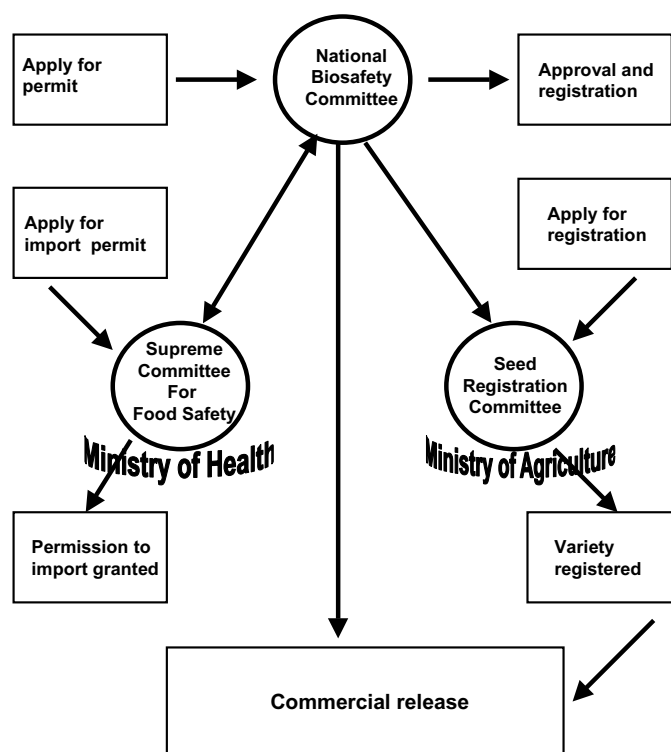
The fine-tuning of the policies, procedures and protocols has been undertaken to improve the release of crop varieties, including cotton. The objective is to include GE crop varieties in addition to conventionally bred varieties of all crops developed locally. Varieties can be released as "open and general" or they can be "exclusive release." If periodical reviews indicate that proper requirements are not followed or applied, the permits for exclusive release can be revoked.

In 1999, the government decided to include fingerprinting as a requirement for registration of all crop varieties. The objective was to confirm identity during the registration process and for subsequent use as a reference.

Some changes have also been made with regard to intellectual property rights, particularly within institutes and the Agricultural Genetic Engineering Research Institute. Under the rules, the Institute will hold all rights and title but will release intellectual property rights to inventors.

For more details on the revisions, refer to the report published by the International Service for National Agricultural Research.

### Commercial Release of GE Plants in Egypt



## International Collaboration on Cotton and Role of the Common Fund for Commodities

There are a number of issues in cotton research that are common among countries and could be addressed jointly. A joint approach not only allows sharing experiences but also economizes on resources for finding solutions to problems. Similarly, new issues can be addressed under collaborative efforts

for wider use of research findings. Contributions of the international research centers of the Consultative Group on International Agricultural Research (CGIAR) are an excellent example. There cannot be a better example to be quoted, where developments from one center on a crop have benefited the world across

countries and regions, than the development of dwarf wheat and rice varieties. The Green Revolution by CGIAR centers in the Philippines and Mexico is accredited for the development of rice and wheat varieties, respectively. If rice and wheat can benefit from such joint efforts why shouldn't cotton? But unfortunately, there is no international institute for cotton research. There is a need for an international center for research on cotton production. Cotton-as a commodity-will be the ultimate beneficiary in producing as well as in consuming countries.

## Some Common Areas of Research

The issues to be addressed by an international center/institute could be different at different times depending upon the needs of the textile industry and emerging issues. It is certain that common areas will always exist. If dwarf varieties have been acknowledged as one of the most significant achievements of CGIAR centers, it does not necessarily mean that cotton needs similar dwarf types to be developed by an international center. Since the development of fertilizers and insecticides, there has been inadvertent pressure to change the plant type in cotton. Many countries have achieved changes in plant type and successfully improved yields. The effect of dwarf types was much more pronounced in determinate type crops, which may not be the same in cotton. Because the cotton plant is indeterminate in nature and could express its response in a different direction, inputs could go to waste, the benefits could be significantly reduced, or the input-output ratio could be low.

Experience with cotton in various countries shows that a uniform plant type cannot be grown across cotton producing countries in the world. The cotton plant is very sensitive to changes during the growing period and most countries have to develop their own varieties. But there are important issues that could be addressed by an international center/institute on cotton. Currently, they are:

- Cost of production is a very critical factor in cotton, certainly more than in other crops because of the high input use. ICAC statistics show that many countries had to quit cotton production because of the high cost. Some countries had to do so in spite of the fact that national average yields were much higher than the world average. Many countries are facing the challenge of high and rising costs of production in cotton. This is an issue that could be addressed jointly to find less expensive means of growing cotton.
- Agricultural production is at a stage of embracing genetic engineering technology, which is very expensive. The goals or contributions from this technology are common and can be utilized in any country, although high cost has already limited its use in developing countries. Though many more have to come, the Bt gene, herbicide resistant gene, gene resistant to drought, etc., are developments that could be used in many countries.
- The current focus in genetic engineering is on agronomic characteristics, but contributions from the technology could also be channeled to issues that will directly benefit con-

suming countries. Cotton biotechnology could be used to enhance fiber quality and to improve fiber value.

- Currently, there is no formal way of exchanging cotton germplasm among research institutes and countries. The international center/institute could serve as an international warehouse for receipt, preservation and supply of cotton germplasm.
- The international center/institute could also serve as a facilitator for the exchange of information among researchers, and as an international training center in production research and related issues, particularly for developing countries.

Only a few issues are mentioned here; there are a number of other research areas like insecticide resistance, defense against common diseases, etc., that could be addressed by the international center/institution.

## Why Can't ICAC Do It?

The International Cotton Advisory Committee has a different mandate. Its main functions and objectives are to provide statistics and forecasts on cotton production, consumption, price and trade. ICAC also serves as a forum for discussion of international matters related to cotton production, consumption, trade and prices among cotton producing and consuming countries. The Technical Information Section, which was added to the ICAC Secretariat in 1982, is staffed by only one technical person and is not supposed to undertake research. The Technical Information Section provides updates on production research through technical reports and facilitates communication among researchers through regional networks and world cotton research conferences. The Section has no research facilities.

## International Collaborative Projects

Once every three years, ICAC undertakes a survey of current research projects on cotton in various countries. For the first time in 2000 information was collected on joint projects among countries. The thirty-two countries that participated in the survey reported only thirteen international projects, of which four are sponsored by ICAC and funded by the Common Fund for Commodities. There is one additional ongoing project: a fast track project in Africa-involving eight countries mostly in West Africa-supposed to undertake a review of the cotton bollworm resistance problem in the region. This fast track project could emerge into a full project for all countries involved or for some countries only, but requires a critical analysis of the bollworm resistance problem before further steps are undertaken. CIRAD-CA of France has staff stationed in many countries around the world and there is also some collaboration based on individual contacts among researchers or on a government-to-government basis. But this is not enough, and cannot be considered a substitute for an international cotton institute. From the existing international projects and other contacts among countries, it is clear that there is only minimal collaboration among researchers/countries, most countries are working in isolation, and inadequate sharing of information takes place.

## Common Fund for Commodities

The Common Fund for Commodities (CFC) is an international intergovernmental financial institution. The "Agreement Establishing the Common Fund for Commodities" was negotiated in the United Nations Conference on Trade and Development in the 1970s, concluded in 1980, and came into force in 1989. Currently, the CFC has 104 member countries plus the European Community. The Organization of African Unity/African Economic Community and the Common Market for Eastern and Southern Africa are also members of the CFC. The CFC Secretariat is based in Amsterdam, Netherlands, and has a staff of 28 employees. The main functions of the CFC are:

Develop commodity development measures aimed at improving structural market conditions and at enhancing long-term competitiveness and prospects of particular commodities. These measures include research and development, productivity and quality improvement, transfer of technology, diversification and processing, and improvement of marketing and market access.

Commodity market development activities that assist developing countries, and in particular least developed countries, to function effectively in a liberal global economy. Projects in this field include physical market development, enhancement of market infrastructure, facilitation of private sector initiatives and commodity price risk management.

CFC has also concluded memoranda of understanding with the Food and Agriculture Organization, United Nations Industrial Development Organization, United Nations Conference on Trade and Development, Africa Export-Import Bank, Latin American Economic System and West African Economic and Monetary Union.

## International Commodity Bodies

The 48th and 49th Plenary Meetings (October 1989 and September 1990) of the ICAC discussed the question of ICAC's association with the CFC and adopted resolutions governing the relationship between ICAC and the Fund. On October 19, 1990, the Executive Board of the Common Fund designated the ICAC as the International Commodity Body (ICB) for cotton under the terms of the Agreement Establishing the Common Fund for Commodities. As an ICB, ICAC is entitled to submit projects for funding as grants and loans from the CFC's first and second accounts. Countries must first submit their cotton projects to the ICAC, and only then to the CFC.

The members of the CFC include developed, developing and least developed countries. However, the primary focus of the CFC is the commodity and not a particular group of countries or a region. The Fund finances, monitors and evaluates projects that address a specific problem, irrespective of its importance to a particular country. Projects for sponsorship can only be submitted to the CFC by recognized international commodity bodies. CFC has 25 recognized international commodity bodies. FAO serves as ICB for eleven commodities: banana, citrus fruits, fish, grains, hard fibers, hides and skins, meat, oil seeds

(including oils and fats), rice, tea and tropical fruits. Other commodity specific organizations like ICAC are based in seven different countries and serve their respective commodities, which are cocoa, coffee, copper, grains, jute, lead and zinc, bamboo and rattan, nickel, olive oil, rubber, sugar and tropical timber.

## Sources of CFC Funding

The resources of the CFC are derived from subscription of shares of directly contributed capital paid by member governments in accordance with Schedule A of the agreement establishing the CFC. The capital is paid half in cash and half in "promissory notes." The member governments may transfer a certain number of shares from the First Account to the Second Account. A number of member governments have also pledged voluntary contributions in addition to their shares. Projects are financed from voluntary contributions, shares in the Second Account and interest earned. The interest earned by the capital of the First Account is used to finance projects from the First Account net earnings and to cover the administrative expenses of the Fund. The member governments and organizations do not have to pay an annual membership fee. Commodity development projects are financed either by grants or loans, or both. However, Second Account funds are only used for loan-based projects, whereas voluntary contributions are used for financing projects as a grant and/or loan.

## Project Submission and Approval Process

Under the procedures, project proposals should be submitted to the ICAC Secretariat using a standard format presented in the Common Fund's manual for the preparation of projects to be financed through the Second Account. CFC has revised the manual a number of times and published its third edition titled *Manual for Preparation and Management of Projects to be Financed by the Common Fund for Commodities*, in May 2000. The Fund's manual and ICAC list of priorities for projects are available from the ICAC Secretariat.

Projects are reviewed by the ICAC Secretariat to ensure proper format for submission to CFC. The ICAC Secretariat also critically analyses the technical aspect of projects and makes sure that they fit the priorities for commodity development at the international level. The Standing Committee of the ICAC must approve projects before they are formally submitted to the Fund for consideration by its Secretariat, which reviews projects before taking them to its Consultative Committee. In fact, CFC has an internal Project Appraisal Committee that reviews new projects and reports to the Managing Director. The CFC Secretariat also provides project briefs to the Consultative Committee, which usually meets twice a year to consider in detail all technical aspects of project proposals and makes recommendations for final approval by the Executive Board.

Once a project has been approved, three documents are prepared: a project appraisal report, a project agreement and a



grant agreement. Documents are agreed on and signed by the CFC, ICAC and the Project Executing Agency, located in one of the collaborating countries. The ICAC Secretariat serves as the supervisory body. Projects can be submitted to the ICAC any time and on any aspect of cotton production research and marketing.

## Approved Projects

As of May 1, 2001, the CFC had approved 96 full projects and 20 fast track projects that operated or are operating in approximately 90 countries. The CFC-funded projects seek to alleviate poverty through commodity development in countries that are highly dependent on the commodity concerned. In considering projects, the Fund has given high priority to least developed and developing countries.

Since the recognition of the ICAC as the International Commodity Body for cotton, nine cotton projects have been approved for funding by the CFC. The total cost of each project varies significantly depending upon the nature of the project. The total cost of the nine projects is about US\$52 million, of which CFC contributed a total of \$21.3 million (\$15.6 million in grants and \$5.7 million in loans). Over US\$16 million has been received as co-financing from various institutions. CFC grants and co-financing have encouraged countries to contribute in kind to the implementation of projects. The nine cotton projects were located in 26 countries. Some details on these projects are as follows:

Project Title: Cotton Production Prospects for the Next Decade  
Duration: November 1992 to March 1995  
Countries: Brazil, China (Mainland), Egypt, India, Mali, Mexico, Pakistan, Tanzania and Uzbekistan  
Project Executing Agency: The World Bank

Project Title: Integrated Pest Management for Cotton  
Duration: September 13, 1994 to September 30, 1999  
Countries: Egypt, Ethiopia, Israel and Zimbabwe  
Project Executing Agency: The Israeli Cotton Production and Marketing Board Ltd.

Project Title: Integrated Pest Management of the Cotton Boll Weevil in Argentina, Brazil and Paraguay  
Duration: June 30, 1995 to June 30, 2001  
Countries: Argentina, Brazil and Paraguay  
Project Executing Agency: National Service for Phytosanitary and Agro Food Quality, Argentina

Project Title: Genome Characterization of Whitefly-transmitted Geminivirus of Cotton and Development of Virus-resistant Plants Through Genetic Engineering and Conventional Breeding  
Duration: January 1, 1996 to December 31, 2001  
Countries: Pakistan, UK and USA  
Project Executing Agency: National Institute for Biotechnology and Genetic Engineering, Pakistan

Project Title: Improvement of the Marketability of Cotton Produced in the Zones Affected by Stickiness  
Duration: January 1, 1997 to April 30, 2001  
Countries: France and Sudan  
Project Executing Agency: The Sudan Cotton Company Ltd.

Project Title: Sustainable Control of the Cotton Bollworm *Helicoverpa armigera* in Small-scale Cotton Production Systems

Duration: October 1, 2000 to September 30, 2004  
Countries: China (Mainland), India, Pakistan and UK  
Project Executing Agency: Natural Resources International Ltd. UK

Protect Title: Improvement of Cotton Marketing and Trade Systems in Eastern and Southern Africa (Uganda and Tanzania)

Duration: October 1, 2000 to September 30, 2004

Countries: Uganda and Tanzania

Project Executing Agency: United Nations Office of Project Services

Protect Title: Pilot Project on Risk Management for Cotton Farmers

Duration: Three years

Countries: Tanzania, Uganda and Zimbabwe

Project Executing Agency: The Cotton Company of Zimbabwe Ltd.

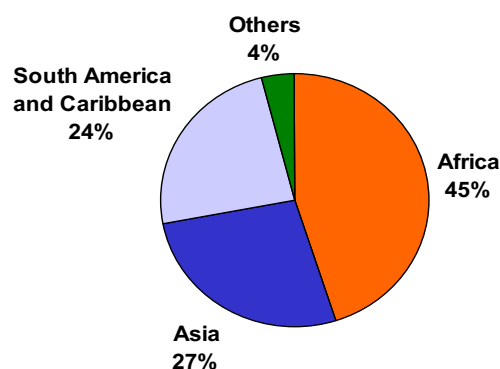
Protect Title: Resistance Management of *Helicoverpa armigera* to Pyrethroids in West Africa

Duration: Fast track project (2000-2001)

Countries: Benin, Burkina Faso, Cote d'Ivoire, Mali, Senegal, Togo, Nigeria and Guinea

Project Executing Agency: Institut de l'Environnement et de Recherches Agricoles (INRA), Burkina Faso

## CFC Projects Operating Sites by Region



## Preparation and Submission of New Projects

Projects can be prepared by any country that is a member of either ICAC or CFC and can be submitted to the ICAC any time. Countries that are neither members of CFC nor ICAC are not eligible. ICAC will not reject a project that includes a non-member country along with an ICAC member country, but would definitely not encourage such projects. If all participating countries are non-members of the ICAC, the project will have almost no chance of approval. The same criterion would be applied by CFC. In the past both ICAC and CFC have approved projects that included non-member countries, but such countries were either members of the ICAC or CFC.

Projects can be submitted in full—with complete details—or as pre-proposals. The main objective of a pre-proposal is to have formal and informal CFC Secretariat views on the overall theme of the project. If a pre-proposal is accepted by the CFC Secretariat, a full project can then be prepared by the intended Project Executing Agency and other collaborators. The CFC

Secretariat also has a Project Preparation Facility that can help, under certain conditions, the identified collaborators in developing a full project. The ICAC Secretariat is willing, within staffing constraints, to help member governments to formulate projects so that they meet CFC requirements.

The project can be approved as a full project for direct implementation or as a fast track project with a small amount of money for initial studies, with the understanding that ultimately a full project will be developed if required. There are some basic guidelines for new projects:

- The CFC requires that projects be ultimately aimed at alleviating poverty through commodity development in line with the commodity development strategy adopted by the ICAC as the International Commodity Body for cotton. Projects originated by least developed countries have an edge over those by developed countries.
- Projects must be focused and problem oriented with a clear description of the problem, the approach to be adopted to tackle the problem, and the expected outcome.
- Projects should not be institution-building, rather they should strengthen ongoing research through qualified manpower and necessary equipment to implement the work plan envisaged in the project.

- Projects must address a general problem of the commodity affecting several countries. So far, ICAC has not recommended to the CFC a project to be implemented by a single country.
- Projects can be prepared for funding from CFC as grants, loans and/or both. However, there must be sufficient co-financing and counter-part contributions from collaborating institutes/countries. Currently, CFC's Five-Year Action Plan stipulates that the combined share of co-financing and counter-part contributions should remain between 40% to 50%. Loan projects and projects with a higher share of co-financing and counter-part contributions have better chances to be approved by CFC.
- Project proposals must define major intended beneficiaries and how and when they may expect to gain from the project achievements. If a project is able to quantify benefits and prove that the outcome will have a high benefit ratio, it stands a better chance of consideration.

More information on the Common Fund for Commodities can be found at <http://www.common-fund.org/>. ICAC has also prepared guidelines for preparation of pre-proposals that can be obtained from the ICAC Secretariat.

## Cotton Production in Burkina Faso

Cotton area in Burkina Faso tripled between 1985/86 and 2000/01 without an increase in yield. In 1985/86, cotton was grown on 94,000 hectares, which increased to almost 300,000 hectares in 1999/00. Data for 2000/01 show that cotton was planted on 267,000 hectares and that area is expected to increase to 281,000 hectares in 2001/02. The increasing trend in area without an increase in yield indicates that the economics of cotton production are better compared to competing crops. Some new areas are also being explored for cotton production, and in the next few years more increases in area may be seen. Production is not expected to increase significantly as no increases in yields are expected. However, the cost of production may decrease due to the implementation of threshold levels, which is the most important issue at this time.

Cotton research is the responsibility of the Institute of Environment and Agriculture Research (Institut de l'Environnement et de Recherches Agricoles – INERA) based in Ouagadougou. INERA has seven research stations for all crops and livestock throughout Burkina Faso. Cropping intensity is not even

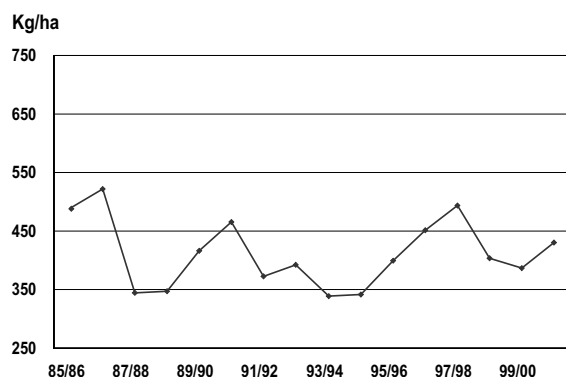
100% as only one crop can be grown during the period when rains occur. Each zone specializes in the production of crops suited to its growing conditions. Five major zones and their major crops are shown in the table.

Over 75% of cotton area is in the western region and 20% in the eastern region. The city of Bobo-Dioulasso is the center of cotton and houses the Textile Fiber Company of Burkina Faso, the cotton research program of INERA and also the farmers' cooperative, in addition to private companies (little related to cotton). Some provinces like Sourou and Houet and Comae to

**Agricultural Regions in Burkina Faso**

| Region      | Major Agriculture                  | Main Provinces and Features                                                                                                                  |
|-------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| North/Sahel | Livestock                          | Soum, Yatenga, Bam, Sanmatenga, Seno, Oudalan<br>Very dry, <600 mm rainfall                                                                  |
| West        | Mainly maize and cotton, some rice | Poni, Comoe, Houet, Kenedougou, Mouhoun, Kossi, Bougouriba<br>Rainfall 1,000-1,200 mm, good fertile soil<br>Rainfed rice is becoming popular |
| Northwest   | Millet and sorghum                 | Sourou, Passore<br>Climate and soil in-between North and West<br>Rainfall 600-800 mm                                                         |
| East        | Sorghum and millets, some cotton   | Tapoa, Gourma, Gnagna<br>Good fertile soil like in the West region                                                                           |
| Center      | Sorghum, soybean and some rice     | Boulgou, Sissili, Naouri, Oubritenga<br>Soil is not fertile and difficult to work with                                                       |

## AVERAGE YIELD IN BURKINA FASO



the west have some irrigation facilities used to grow rice. Food crops have extreme priority, and whatever short supply of water is available is used to secure the food supply for local consumption. There used to be some cotton grown under irrigated conditions, but water use has been shifted to food production. Consequently, almost all cotton is grown under rainfed conditions.

## Role of the Textile Fiber Company of Burkina Faso

The Textile Fiber Company of Burkina Faso (Société Burkinabè des Fibres Textiles-SOFITEX), which is owned by the government (34%), CFDT (34%), the National Union of Cotton Producers of Burkina Faso-UNPCB (30%) and banks (1%) has a very important role in cotton production. A ten-member Executive Board controls SOFITEX, and the director general serves as the chief executive of the organization. All inputs and extension services are supplied by SOFITEX. On average, each cotton farmer owns 3-5 hectares. About 50% of field operations are done with animal traction, 48% by manual labor and only 2-3% by mechanical means. Farmers are joined together in unions, and SOFITEX only deals with groups. There are about 250,000 cotton growers and on average 25-30 cotton growers make a group at the village level. The village level union constitutes a department (district) level, which forms a union at province level and ultimately the National Union of Cotton Producers of Burkina Faso that represents cotton growers with the government and all other committees dealing with cotton issues. The National Union of Cotton Producers of Burkina Faso is very effective and no decision regarding cotton can be made without their consultation.

The main functions of SOFITEX are production of planting seed, input supply to farmers, dissemination of cotton production technology, purchase of seedcotton from farmers, and ginning and marketing of cotton lint. SOFITEX owns twelve gins, all saw gins, and is the only ginner in the country. Burkina Faso has no local textile mills and all cotton is exported by SOFITEX.

So far, SOFITEX has a monopoly in all aspects of the cotton production chain and some changes are under consideration, but the situation is not expected to change soon.

## Seed Production and Supply

New varieties are developed by public sector breeders in Bobo-Dioulasso, the only facility for research on cotton. The breeding team comprises two breeders and supporting technicians. Breeders are responsible for the development of varieties, which are handed over to SOFITEX for commercial seed production, treatment and distribution. SOFITEX offers two kinds of planting seed to farmers: delinted and fungicide-treated at 10 U.S. cents per kg (70 CFA/kg), and fuzzy untreated seed at 4 U.S. cents per kg (30 CFA/kg). Concentrated sulfuric acid is used to delint seed. The seed delinting process is completed in five steps: light flame delinting, acid treatment, drying to remove acid crystals as much as possible, neutralization, and grading and fungicide treatment.

SOFITEX recommends that 14 kg of delinted seed and 40 kg of fuzzy seed be used per hectare. Each group of farmers submits a planting plan and, accordingly, SOFITEX provides the seed for the group. If a farmer wants to use a higher seed rate than recommended, he plants the seed supplied by SOFITEX on a smaller area.

## Fertilizer Use

Fertilizer is applied two times, at 15 and 45 days after emergence. NPK, sulfur and boron are applied every year. Fertilizer is supplied by SOFITEX only, at a fixed rate. 150 kg of fertilizer, which has nitrogen, phosphorous potassium, sulfur and boron in a proportion of 15, 20, 15, 6 and 1, respectively, is applied in one dose soon after emergence. One bag of 46% nitrogen fertilizer is applied just before flowering or 45 days after emergence. Fertilizer is applied through side dressing, either with the help of animal traction implements or manually. Cotton follows either cotton or cereal crops, and cotton soil seems depleted because no organic fertilizer is added.

## Planting

Cotton in Burkina Faso can be grown only during the rainy season, which starts in May and continues up to October. The recommended and most popular rotation in the west region is cotton-maize-rice. Soil is prepared before planting and cotton sowing starts around May 20th, after 45 mm of rain have been received and it is assumed that soil moisture is enough. Records show that 75% of planting is completed by June 20th, with the remaining 30% completed by July 10. Usually, it is not recommended to plant cotton after July 10, either in the western nor in the eastern regions. As soil moisture is just estimated by farmers, seed germination may not be good everywhere. It is usually recommend going ahead for resowing if good germination is not seen in the field after ten days of planting. In such cases it is advised by experts that seed be dibbled at empty spaces or resowing be done when moisture level has increased.

Cotton is planted at row-to-row distance of 80 centimeters and plant-to-plant distance of 40 centimeters. The most desirable plant stand is 62,500 plants/hectare. First flower appears after 50 days of emergence and the flowering period extends for almost 45 days. By the time the last bolls are formed, early-formed bolls start opening. On the average, twenty bolls per plant are formed with a boll weight of 3.5-4.0 grams. The plant is usually bushy and the height may extend to 1.2 meters.

## Entomological Research

All the entomological research on cotton is done at the research station in Bobo-Dioulasso. Three qualified entomologists are supported by technicians and research has the following four main objectives:

- Monitor the pest situation in the field every year in order to compare pest pressure with previous years, or deviations from normal trends, and report to SOFITEX, so that proper measures can be recommended to farmers.
- Burkina Faso has used insecticide mixtures for the last two decades. The recommendation to use mixtures existed prior to 1981, when IRCT of France (now CIRAD-CA) closed its research facility in Burkina Faso. The recommendation is still official and farmers like to use mixtures. It is the responsibility of the Cotton Research Program of INERA to test insecticides for use as mixtures and recommend to SOFITEX which products are safe to mix and in what proportion.
- Lately, the assessment of resistance to insecticides has increased. The cotton bollworm *Helicoverpa armigera* has developed resistance to insecticides, most probably due to the use of mixtures and the repetition of some chemicals year after year. Another strong reason for the development of resistance could be calendar spraying for years. INERA has decided to emphasize the analysis of the resistance problem. Efforts are under way to establish the basis and level of resistance, and at the same time find possible solutions.
- Calendar spraying is officially recommended by SOFITEX though researchers would like to adopt economic thresholds. Unfortunately, no official thresholds have been established yet. Thus, the most important challenge for entomologists is to develop thresholds for various insects and convince farmers to adopt them. For guidance, some thresholds from other countries, particularly Egypt, are being tried, but still more work needs to be undertaken to establish critical levels and produce recommendations. Lately, it has become very important to assess losses in yield due to individual pests.

## Main Pests and Control Measures

In Burkina Faso, cotton is first attacked by *Aphis gossypii* at an early stage. At flowering stage, *H. armigera*, *Earias insulana* and *Diparopsis watersii* appear and continue throughout the flowering stage. *Bemisia tabaci* and aphids appear on cotton at late fruit formation stage. Sometimes even leafhoppers may

appear along with late season sucking insects. In the East region, *Sylepta derogata* appears at late flowering stage. Pest pressure may vary from year to year but the cotton bollworm is the major pest in both, East and West regions. For the last three years, whitefly outbreaks have created additional threats to cotton production. The first outbreak occurred in September 1998 and it is feared that whitefly may become a major pest.

Calendar spraying is officially recommended and adopted by all farmers. It is recommended that the first spray be applied at 30-45 days after emergence and then after every two weeks. Though the yield level is not that low in Burkina Faso, the majority of the farmers strictly adhere to SOFITEX recommendations, which supplies insecticides on credit to all cotton growers at the beginning of the season. Thus, farmers have no other choice than to use those insecticides, irrespective of whether they are needed. SOFITEX provides insecticides for about six sprays per season, but sometimes farmers arrange additional insecticides and apply seven or even eight sprays per season.

Diseases are not important in Burkina Faso but fusarium wilt is showing up now and requires attention before it becomes a problem.

Weeds are controlled manually and through bullock cultivation. Pre-sowing herbicides are used by some farmers; however, manual weeding is still the dominant way to keep fields clean. Post-sowing herbicides have been introduced to growers but they are not popular yet.

## Regional Project on Insecticide Resistance Management

Burkina Faso, Côte d'Ivoire and Mali started a regional project in March 1998 on insecticide resistance management with financial support from their cotton companies. Later, Benin, Guinea, Senegal and Togo also joined. The project-particularly directed against the cotton bollworm-was originally for three years but recently has been extended for another three years and is a direct application of recommendations at farmers' fields. One of the key recommendations is the use of a "two-window program," by which only endosulfan products should be used for the first and second applications no later than August 15. The first outbreak of the cotton bollworm occurs in late July, and the second in September. According to the recommendations, pyrethroid and organophosphate mixtures should be used after August 15 only.

Countries are at liberty to use various products within the two-window program and also revise doses as they deem fit. No serious economic or technical evaluation of the project has been undertaken but some studies in Mali indicate that the level of the cotton bollworm infestation is going down and that the project has had a direct impact on the pest. Currently, the seven countries mentioned above plus Nigeria are discussing a similar project sponsored by the ICAC and funded by the Common Fund for Commodities. The project will be more on the research side. Eight countries already have a "fast track" project

approved by the Fund and seed money has been provided to assess the status of the resistance problem and develop a full project.

## Breeding Program

The breeding program is also located at the research station in Bobo-Dioulasso. Its usual objective, as in all other cotton producing countries, is to improve yield and fiber quality, but one focus that is different is the improvement of the ginning outturn to obtain a commercial lint percentage of over 43%. Current varieties produce 41-42% lint in commercial production. Genotypes with over 43% ginning outturn are available in breeding stocks, which could seem strange for some countries but it is not too high in countries like Burkina Faso, Togo, Côte d'Ivoire and others in West Africa. Other specific targets are:

### Breeding Targets for Fiber Quality

| Character  | Target       |
|------------|--------------|
| Length     | Over 27.8 mm |
| Strength   | 35 g/tex     |
| Micronaire | 4.0-4.5      |
| Rd         | 76-77%       |
| +b         | 7-8          |

The pedigree method of selection to screen the segregation of hybridization breeding material is different than the one followed in most other countries. Single plant selections are made in the  $F_2$  generation. In  $F_3$ , two progeny rows are planted in one straight line from selected plants, one measuring 15 meters and the other measuring 10 meters. The 15-meter row is used to select single plants and on average 15-20 plants are selected from each visually good performing row. The 10-meter row is harvested in bulk. The yield from the 10-meter row is compared with the control and other progeny rows. If the 10-meter row shows poor yield performance compared to the control or most other selected lines, it is used as a basis to reject selections from the 15-meter row. A similar process is repeated to  $F_6$  until it is assumed that most characters have been fixed and the lines have become homozygous.

In  $F_7$  and  $F_8$  the selected progenies are grown in four-time replicated trials, each line having three rows 29 meters long. However, only the middle line is used for comparison purposes. Usually, not more than four progenies are selected from progeny row replicated trials from a single cross. The selected four lines that have reached the  $F_9$  stage are planted at twenty locations throughout Burkina Faso for two years. The four lines are further reduced to only two for farmer-field trials under farmers' commercial practices. Farmer-field trial performance is

monitored for two years to know the real varietal potential. The selected one or two strains are handed over to SOFITEX for commercial seed production.

Burkina Faso has no formal variety approval process and there is no competition among breeders because there is only one team working on variety development. The final decision about which variety to use for commercial seed production and planting out of the two or more recommended by the team of breeders lies with SOFITEX. According to breeders, a strain may be very good but if SOFITEX—more familiar with farmers' reaction to varieties—thinks that the strain is not going to be popular among farmers, it may decide not to use it for commercial seed production.

The production of planting seed is SOFITEX responsibility, but breeders supervise it throughout the field operations and up to ginning. There is no formal seed certification process in Burkina Faso. Farmers are provided with only one quality of seed and they have no other choice, even if they are not happy with seed quality or variety performance. All the varieties grown in Burkina Faso have been developed locally except F135, which was hybridized in Togo and selected in Côte d'Ivoire.

FK 290 and STAM 42 are the main varieties of the western region, while F135 is grown in the center and eastern regions. Breeders have finalized testing STAM 59A, which could be the next commercial variety.

A number of Deltapine and Stoneville varieties have been tried in Burkina Faso but were not comparable to local varieties: they were low yielding and produced shorter fiber. This could be one of the reasons against adopting Bt cotton. The government of Burkina Faso is already working on legislation on biosafety standards, but transgenic cotton is many years away.

Burkina Faso has grown glandless cotton for years. It is estimated that up to 1995, 40-45,000 hectares were under glandless varieties but now all varieties have glands. No comparative studies have been undertaken, but it is understood that glandless varieties were ousted because of low yield and higher pest attack compared to normal varieties, an observation shared by many breeding programs in West African countries. The breeding program still continues to work on developing glandless varieties but there is no hope for their coming back. Breeders are also working on colored cotton, but there is high emphasis on developing varieties suitable to the changing rainfall pattern. The rainfall period is shrinking and breeders must adapt to it.

## Price Payment to Farmers

All cotton is picked by hand in Burkina Faso. Seedcotton is categorized in three grades to encourage farmers to pick clean cotton. Price is paid according to grade, which SOFITEX officials decide at the time of buying the cotton from farmers. The price received by farmers during 2000/01 and announced for the coming season is as follows:

### Commercially Grown Varieties in Burkina Faso

| Variety | Release Year | Area (%) | GOT (%) | Strength (g/tex) | Length (mm) | Micronaire |
|---------|--------------|----------|---------|------------------|-------------|------------|
| FK 290  | 1997         | 77       | 42.9    | 29.7             | 31.2        | 3.7        |
| STAM 42 | 1997         | 6        | 42.9    | 28.5             | 29.4        | 4.2        |
| F 135   |              | 9        | 40.1    | 29.0             | 31.1        | 3.5        |

**Seedcotton Prices in Burkina Faso  
(CFA/Kg)**

| Grade | 2000/01 | 2001/02 |
|-------|---------|---------|
| A     | 175     | 200     |
| B     | 140     | 165     |
| C     | 120     | 145     |

grade C. SOFITEX buys and pays for cotton on the basis of group, and then farmers arrange payment within a group. According to SOFITEX, on average, every farmer receives payment within 21 days of his cotton delivery at the procurement center. The cost of inputs is deducted by SOFITEX and, on average, farmers receive 60% of the total value of seedcotton.

The ginning season extends for almost five months as all

Because mainly family labor is engaged in field operations, most of the cotton picked belongs to grade A and very little to

seedcotton cannot be taken over by SOFITEX and brought to gins at the same time. Sometimes farmers have to wait and the same truck used to deliver inputs for next season picks seedcotton from a group. SOFITEX prepares a schedule and farmers know when their cotton will be picked. It is a challenge for the regional staff to maintain a consistent supply of seedcotton and keep all the gins running to their full capacity.

SOFITEX has eight regions and twelve gins. The situation may be different from region to region depending upon the number of groups in a region and the staff efficiency in a particular region, but at one of the regional offices 59% of the seed supply, 74% of the NPK compound fertilizer, and 98% of urea fertilizer had been delivered to farmers as of April 20, while the planting season starts on May 20.

## Short Notes

### ● Resistance to Transgenics

Genetically engineered Bt cotton has been grown for five years under the fear that insects will develop resistance to the Bt toxin. How long it will take to develop resistance or how many crop generations of a particular Bt gene can be grown without development of resistance is not known. However, the Bt toxin's presence during the entire life of the plant and in all parts suggests that it will not take many generations for the problem to come to the surface. The Agricultural Research Service (ARS) of the USDA has monitored the development of resistance in transgenic cotton since the beginning of commercial cultivation in the USA. According to their latest report, insects are not developing resistance to the Bt toxin. The ARS Southern Insect Management Research Unit at Stoneville, Mississippi, has tracked tobacco budworm tolerance to the Bt protein as part of the resistance management program. In five years, researchers have not detected any change in the tolerance of tobacco budworm to Bt cotton. This does not mean that the chances of the development of resistance have been lessened and that resistance management programs can relax. Many insects have developed resistance to the Bt toxin in foliar applications. Therefore, concerns over the emergence of resistance to the Bt protein within the cotton plant are justified, and a strong resistance management strategy is required. The team also studies other bollworms but results are not yet available.

Plants can also develop resistance to chemicals. If a herbicide is sprayed year after year, chances are that weeds will develop resistance. The development could be slow because, unlike the Bt protein, the sprayed weed is killed. According to the March 2001 issue of the *Ag Biotech Reporter*, horseweed *Conyza canadensis*, a cotton weed readily found in reduced-tillage production practices, is developing resistance to Roundup, a popular herbicide. Horseweed plants

showing resistance to the herbicide have been detected in soybean fields.

### ● Resistance to a Novel Insecticide

The cotton bollworm *Helicoverpa armigera* is a major pest on cotton and legumes in India and has developed resistance to a variety of chemical groups, particularly pyrethroids. In India, nearly 50% of insecticides are used to control insects on cotton, and the most serious target is the cotton bollworm. India is the largest cotton growing country but yields are among the lowest in the world. India cannot afford expensive plant protection operations and has to find less expensive and sustainable means of controlling the bollworm. Researchers are challenged to develop a program that does not result in the resistance problem that occurred in the past decade. According to Kranthi et al (2000), an intensive countrywide resistance-monitoring program has demonstrated that pyrethroid resistance is now widespread across the country and significant levels of cyclodiene and organophosphate resistance are also present in most insect populations.

Recently, a number of novel insecticide groups have been tried in India and studied for their baseline toxicity by Dr. Kranthi and his team at the Central Institute for Cotton Research, Nagpur. One of the groups is spinosad, a mixture of two naturally occurring active components, 85% spinosyn A and 15% spinosin D, produced by actinomycetes *Saccharopolyspora spinosa* in soil. The mode of action of spinosad is considered to be of great interest, particularly in rotation with other commonly used insecticides in India for the implementation of resistance management programs. The objective of the study at Nagpur was to establish baseline toxicity and a diagnostic dose resistance monitoring of spinosad on field populations of the cotton bollworm.

Cotton bollworm larvae were collected from various parts

of India and reared on a chickpea-based semi-synthetic diet. The third instar larvae of the resulting  $F_1$  generation were used for bioassays and results were compared against a susceptible strain acquired from the UK. The topical application method was used for insecticide applications. According to Kranthi, spinosad showed a slightly lower insecticidal activity than cypermethrin and was much better than most conventional insecticides. The toxicity of spinosad was comparatively less variable, falling within 0.023 to 0.24 (g/larva, the range of an  $LD_{50}$ , and 0.27 to 4.33 (g/larva, the range of an  $LD_{90}$ . There was a difference in the susceptibility of populations collected from different parts of India. The studies concluded from an average of the pooled data that an  $LD_{50}$  of 0.058 could be used as a baseline susceptibility index for resistance monitoring through the conventional log dose probit assays, and an  $LD_{90}$  of 10.0 (g/larva as a diagnostic dose for routine monitoring of resistance to spinosad through diagnostic dose assays. (*Resistant Pest Management*, a biannual newsletter of the Center for Integrated Plant Systems, Michigan State University, Vol. 11, No. 1, Winter 2000, USA.)

- **Roundup Ready-Cotton Approved in Argentina**

Bt cotton is already grown on a commercial scale in Argentina. Although Bt cotton is not grown on a significant area—only 5% of the total area—it is important that the technology is accepted for commercial utilization. Argentina has gone a step forward and approved herbicide resistant Roundup Ready-cotton for commercial cultivation next year. So far, herbicide resistant varieties, either BXN or RR, have only been grown in the USA. Australia has also approved

herbicide resistant varieties for commercial production. Argentina, Australia and Mexico can grow RR alone or RR + Bt and will be the countries approving the varieties' releases after the U.S.

According to Monsanto, Roundup Ready-cotton offers growers greater simplicity in weed control, a reduced need for tillage, the opportunity to save valuable soil moisture and nutrients as well as reducing their overall input cost. CONABIA, Argentina's national advisory agency on biotechnology, and SENASA (National Service of Food Safety, and the Foreign Markets Agency) reviewed and evaluated the performance of Roundup Ready cotton varieties and final approval was granted by Argentina's Secretariat of Agriculture, Livestock, Fisheries and Food. The Roundup Ready-cotton varieties will be offered for sale through CDM Mandiyu S.R.L., a joint venture between Ciagro, Delta and Pine Land Company, and Monsanto. CDM Mandiyu and Monsanto plan to make the Roundup Ready technology available in varieties bred by the National Institute of Agricultural Technology (INTA) and Delta and Pine Land Co. on a limited number of acres.

The completion of Argentina's regulatory review process and the recent approval means that Roundup Ready-cotton varieties will be available during the 2001-growing season. Argentinean farmers will have to pay a technology fee on herbicide resistant varieties as they do for Bt varieties. The fee has not been decided, but it will correspond to the cost of weed control operations and expected benefits. Roundup Ready cottonseed is covered by intellectual property laws in Argentina, so seed saving will not be allowed.

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# World Cotton Research Conference–3

## Cotton Production for the New Millennium

Cape Town, South Africa

9-13 March 2003

### Sponsored by the

- **International Cotton Advisory Committee**
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- **CIRAD-CA, France**
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After the great success of the World Cotton Research Conference–1, held in Brisbane, Australia in 1994, and the World Cotton Research Conference–2, held in Athens Greece in 1998, the World Cotton Research Conference–3 (WCRC–3) will be held in Cape Town, South Africa, from 9-13 March 2003 under the auspices of Cotton SA and the Agricultural Research Council of South Africa.

The theme of the WCRC–3 will be “Cotton Production for the New Millennium.” All aspects of production research and fiber quality will be discussed. The Conference will embrace all disciplines and will cover aspects such as seedbed preparation, seed production, growing, irrigation, plant protection, crop management, nutrition, plant physiology, modeling, transgenic cotton, organic cotton, harvesting, contamination, ginning and quality measurements and dissemination of production technology.

Please, return the pre-registration form to:

Dr. M. Rafiq Chaudhry  
Head  
Technical Information Section  
International Cotton Advisory Committee  
1629 K Street, Suite 702  
Washington DC 20006-1636, USA  
Tel: 202-463-6660 Ext. 22  
Fax: 202-463-6950  
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### PRE-REGISTRATION FORM

This form is also available on the Internet for on-line pre-registration at the ICAC web page at <<http://www.icac.org/icac/meetings/meetings.html>>. Additional information will be available in the next brochure that will be published in early 2002. To enable us to draw up a program for the WCRC–3, please complete and return the pre-registration form.

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## A DIALOG Search of Agricola and CAB Abstracts Databases

The key words used in the search are **cotton** and **ginning**.

3788708 11060390 Holding Library: AGL  
Cotton ginnings annual report  
United States National Agricultural Statistics Service, United States  
Agricultural Statistics Board  
Cotton ginnings annual report (PCG-BB) Cotton ginnings summary  
Washington, D.C., National Agricultural Statistics Service  
LCCN: sn 99015205  
DNAL Call Number: aSB252.A35U522  
Language: English  
Status: Currently published frequency: Annual  
Uniform Title: Cotton ginnings annual report (Online)  
URL: <http://usda.mannlib.cornell.edu/reports/nassr/field/pcg-bban/>  
Description based on 5.10.95; title from index screen caption (viewed  
May 20, 1999)  
Electronic journal in ASCII and Adobe Acrobat 1999  
Also available in print  
<http://usda.mannlib.cornell.edu/reports/nassr/field/pcg-bban/>  
Released by: Agricultural Statistics Board, National Agricultural Sta-  
tistics Service, U.S. Dept. of Agriculture  
Place of Publication: District of Columbia  
Government Source: Federal  
Subfile: USDA (US DEPT. AGR), NASS  
Document Type: Series; Periodical  
Annual data on cotton production, including running bales ginned,  
480-pound bales produced, average bale weight, and number of ac-  
tive cotton gins by state and county for each survey period

3694964 10855980 Holding Library: OKX; AGL  
Revision of cotton ginning census report dates report  
United States Congress House Committee on Post Office and Civil  
Service  
Washington, D.C., U.S. G.P.O., 1971 3 p.; 23 cm.  
Report 92d United States Congress, 1st session, House of Represen-  
tatives; no. 92-518  
DNAL Call Number: KF32.P6 1971  
Language: English  
Caption title: September 28, 1971  
Place of Publication: District of Columbia  
Government Source: Federal  
Subfile: OTHER US (NOT EXP STN, EXT, USDA, SINCE 12/76)  
Document Type: Monograph

3701129 10857267 Holding Library: AGL  
Cotton ginning charges, harvesting practices, and selected marketing  
costs, 1987/88 season  
Edward H. Glade and Mae Dean Johnson  
Glade, Edward H. Johnson, Mae Dean  
United States Dept. of Agriculture, Commodity Economics Division  
Washington, D.C., U.S. Dept. of Agriculture, Economic Research  
Service, Commodity Economics Division, 1988  
1 v. (unpaged); 28 cm.  
ERS staff report; AGES881026  
DNAL Call Number: aHD9075.G5 1988  
Language: English  
Caption title: November 1988  
Place of Publication: District of Columbia  
Government Source: Federal

Subfile: USDA (US DEPT. AGR)  
Document Type: Monograph

3701130 10857268 Holding Library: AGL  
Cotton ginning charges, harvesting practices, and selected marketing  
costs, 1989/90 season  
Edward H. Glade and Mae Dean Johnson  
U.S. Dept. of Agriculture, Commodity Economics Div., 1990, Wash-  
ington, D.C., Economic Research Service, 1 v. (unpaged); 28 cm.  
ERS staff report; AGES 9065  
DNAL Call Number: aHD9075.G5 1990  
Language: English  
Caption title: October 1990  
Place of Publication: District of Columbia  
Government Source: Federal  
Subfile: USDA (US DEPT. AGR)  
Document Type: Monograph

03221875 CAB Accession Number 962400597  
Comparison of cottonseed shear testing with ginning quality  
Abrams, C. F., Jr.; Mangialardi, G. J., Jr.; Bowman, D. T.; Seaboch, T.  
R.; Kay, M. W.  
North Carolina State University, Box 7625, NCSU, Raleigh, NC  
27695-7625, USA  
Paper - American Society of Agricultural Engineers (No. 941022): 6  
pp.  
Publication Year: 1994  
ISSN: 0149-9890  
Publisher: American Society of Agricultural Engineers (ASAE) St  
Joseph, USA  
Language: English  
Document Type: Miscellaneous

03160107 CAB Accession Number: 960700230  
Effect of harvest, temporary storage and processing on technological  
characters of herbaceous cotton  
Original Title: Influencia da colheita, armazenamento temporario e  
beneficiamento nos caracteres tecnologicos do algodao herbaceo  
Queiroga, V. de P.; Barros, M. A. L. de; Vale, L. V.; Matos, V. P.  
EMBRAPA, Centro Nacional de Pesquisa de Algodao, 58107-720  
Campina Granda, Paraiba, Brazil  
Revista Ceres vol. 41 (236): p.337-357  
Publication Year: 1994  
ISSN: 0034-737X  
Language: Portuguese; Summary Language: English  
Document Type: Journal article

3485808 10713720 Holding Library: AGL  
Cotton ginning charges, harvesting practices, and selected marketing  
costs, 1993/94 season  
Edward H. Glade, Jr., Mae Dean Johnson, and Leslie A. Meyer  
Washington, D.C., U.S. Dept. of Agriculture, Economic Research  
Service, 1995  
1 sheet: ill.; 28 x 44 cm. folded to 28 x 22 cm.  
Statistical bulletin no. 918, An Economic Research Service report  
DNAL Call Number: 1 Ag84St no.918  
Language: English

Caption title: March 1995  
 Place of Publication: District of Columbia  
 Government Source: Federal  
 Subfile: USDA (US DEPT. AGR); 1; ERS  
 Document Type: Monograph

03379489 CAB Accession Number: 971605931  
 Some varietal and ginning effects on textile quality  
 Hughs, S. E.; Bragg, C. K.  
 USDA-ARS Southwestern Cotton Ginning Research Lab, Mesilla Park, NM, USA  
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 Conference Title: 1995 Proceedings Beltwide Cotton Conferences, San Antonio, TX, USA, January 4-7, 1995: Volume 1, p.628-633  
 Publication Year: 1995  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference paper

03186520 CAB Accession Number: 960702746  
 1995 Proceedings Beltwide Cotton Conferences, San Antonio, Texas, USA, January 4-7, 1995  
 USA, National Cotton Council of America  
 PO Box 12285, Memphis, TN 38182, USA  
 Conference Title: 1995 Proceedings Beltwide Cotton Conferences, San Antonio, Texas, USA, January 4-7, 1995, 1458 pp.  
 Publication Year: 1995  
 ref. at ends of papers  
 Publisher: National Cotton Council Memphis, USA  
 Language: English  
 Document Type: Conference proceedings

3626104 10837951 Holding Library: AGL  
 Queensland cotton past & present  
 Robert Longhurst  
 Fortitude Valley, BC, Qld.: Queensland Cotton Holdings, c1996  
 117 p.: ill. (some col.), map 25 cm.  
 ISBN: 0646315013  
 DNAL Call Number: SB251.A8L66 1996  
 Language: English  
 Includes bibliographical references  
 Place of Publication: Australia  
 Subfile: OTHER FOREIGN  
 Document Type: Monograph; Bibliographies

3606763 10832495 Holding Library: AGL  
 Cotton production manual  
 Technical editors: S. Johnson Hake, T.A. Kerby, K.D. Hake  
 University of California (System), Division of Agriculture and Natural Resources  
 Oakland, Calif.: University of California, Division of Agriculture and Natural Resources, 1996  
 417 p.: ill. (some col.); 28 cm.  
 Publication University of California, Division of Agriculture and Natural Resources; 3352  
 ISBN: 1879906090  
 DNAL Call Number: SB249.C672 1996  
 Language: English  
 Includes bibliographical references and index  
 Place of Publication: California

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Monograph; Bibliographies; Handbooks

3579202 20567178 Holding Library: AGL  
 Cottonseed moisture and seed damage at gins  
 Columbus, E.P. Mangialardi, G.J.  
 U.S. Cotton Ginning Laboratory, ARS, USDA, Stoneville, MS  
 St. Joseph, Mich.: American Society of Agricultural Engineers 1958  
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 ISSN: 0001-2351 CODEN: TAAEAJ  
 DNAL Call Number: 290.9 Am32T  
 Language: English  
 Includes references  
 Place of Publication: Michigan  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Article

3563643 10821600 Holding Library: AGL  
 Cotton ginning charges, harvesting practices, and selected marketing costs, 1994/95 season  
 Edward H. Glade, Jr., Mae Dean Johnson, and Leslie A. Meyer  
 United States Dept. of Agriculture, Economic Research Service  
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 4 p.: ill.; 28 cm.  
 Statistical bulletin United States Dept. of Agriculture no. 929  
 DNAL Call Number: 1 Ag84St no. 929  
 Language: English  
 Caption title: An Economic Research Service report; March 1996  
 Place of Publication: District of Columbia  
 Government Source: Federal  
 Subfile: USDA (US DEPT. AGR); ERS  
 Document Type: Monograph

03518887 CAB Accession Number: 971600750  
 Ginning regional cotton cultivars at Stoneville  
 Anthony, W. S.; Calhoun, S.  
 USDA-ARS, Cotton Ginning Lab, Stoneville, MS, USA  
 1996 Proceedings Beltwide Cotton Conferences, Nashville, TN, USA, January 9-12, 1996: Volume 2  
 Conference Title: 1996 Proceedings Beltwide Cotton Conferences, Nashville, TN, USA, January 9-12, 1996: Volume 2. p.1567-1579  
 Publication Year: 1996  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
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03350219 CAB Accession Number 970703488  
 Comparison of lint fraction and fiber quality data from hand vs machine-harvested samples in cotton yield trials  
 Calhoun, D. S.; Wallace, T. P.; Anthony, W. S.; Barfield, M. E.  
 MAFES-Delta Research and Extension Center, Stoneville, MS 39762, USA  
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 Conference Title: 1996 Proceedings Beltwide Cotton Conferences, Nashville, Tennessee, USA, January 9-12, 1996: Volume 1. p.611-615  
 Publication Year: 1996  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference paper

03350126 CAB Accession Number 970703395  
 Analysis of cost minimization of cotton cleaning in a systems framework  
 Bennett, B. K.; Misra, S. K.  
 Department of Agricultural Economics, Texas Tech University, Lubbock, TX 79409, USA  
 1996 Proceedings Beltwide Cotton Conferences, Nashville, Tennessee, USA, January 9-12, 1996, Volume 1  
 Conference Title: 1996 Proceedings Beltwide Cotton Conferences, Nashville, Tennessee, USA, January 9-12, 1996: Volume 1. p.466-472  
 Publication Year: 1996  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference paper

03350113 CAB Accession Number 970703382  
 Harvest aid effects on lint quality  
 Valco, T. D.; Bragg, K.  
 Cotton Incorporated, USDA, ARS, Raleigh, North Carolina, USA  
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 Conference Title: 1996 Proceedings Beltwide Cotton Conferences, Nashville, Tennessee, USA, January 9-12, 1996: Volume 1. p.94-96  
 Publication Year: 1996  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference paper

03350112 CAB Accession Number 970703381  
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 Mayfield, W. D.  
 USDA/CSREES, Memphis, Tennessee, USA  
 1996 Proceedings Beltwide Cotton Conferences, Nashville, Tennessee, USA, January 9-12, 1996, Volume 1  
 Conference Title: 1996 Proceedings Beltwide Cotton Conferences, Nashville, Tennessee, USA, January 9-12, 1996: Volume 1. p.93-94  
 Publication Year: 1996  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference paper

03318387 CAB Accession Number 971601016  
 1996 Proceedings Beltwide Cotton Conferences, Nashville, TN, USA, January 9-12, 1996  
 USA, National Cotton Council of America  
 Correspondence address: PO Box 12285, Memphis, TN 38182, USA  
 Conference Title: 1996 Proceedings Beltwide Cotton Conferences, Nashville, TN, USA, January 9-12, 1996. 1708 pp.  
 Publication Year: 1996  
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 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference proceedings

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 Vigil, E. L.; Anthony, W. S.; Columbus, E.; Erbe, E.; Wergin, W. P.  
 USDA-ARS, Climate Stress Laboratory, B-046A, Beltsville, MD 20705, USA

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 Publication Year: 1996  
 ISSN: 1058-5893  
 Language: English  
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3671869 21236911 Holding Library: AGL  
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 Bradow, J.M. Bauer, P.J.; Hinojosa, O.; Sassenrath-Cole, G.  
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 ISSN: 1161-0301  
 DNAL Call Number: SB13.E97  
 Language: English  
 Includes references  
 Place of Publication: Netherlands  
 Subfile: IND; OTHER FOREIGN  
 Document Type: Article

3669906 21233500 Holding Library: AGL  
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 DNAL Call Number: 64.8 C883  
 Language: English  
 Includes references  
 Place of Publication: Wisconsin  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
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 DNAL Call Number: S671.A66  
 Language: English  
 Includes references  
 Place of Publication: Michigan  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Article

3639441 20616885 Holding Library: AGL  
 Effects of mechanical cleaning on cotton fibers. III. Effects of card wire condition on white specks  
 Bel-Berger, P. Von Hoven, T.  
 USDA, ARS, SRRC, New Orleans, LA  
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 Language: English  
 Includes references

Place of Publication: New Jersey  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Article

03583323 CAB Accession Number 981807441  
 Minimizing farm-to-mill cotton cleaning cost  
 Bennett, B. K.; Misra, S. K.  
 Department of Agricultural and Applied Economics, Texas Tech University, Lubbock, Texas, USA  
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 Publication Year: 1997  
 ISSN: 0081-3052  
 Language: English  
 Document Type: Journal article

03531046 CAB Accession Number 981804164  
 Optimising the yield grade trade-off (growers and ginner teaming up)  
 Solomon, B.  
 Cotton Computer Systems, Moree, New South Wales, Australia  
 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 2  
 Conference Title: 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 2. p.1621-1623  
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 Document Type: Conference paper

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 Harvesting and ginning of cotton in the world  
 Chaudhry, M. Rafiq  
 Technical Information Section, International Cotton Advisory Committee, Washington, DC, USA  
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 Anthony, W. S.; Calhoun, S.  
 Cotton Ginning Research Unit, ARS-USDA, Stoneville, MS, USA  
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 Publication Year: 1997  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference paper

03490921 CAB Accession Number 981102402  
 Preliminary evaluations of an enzyme approach to reduce cotton lint stickiness

Henneberry, T. J.; Blackledge, B.; Steele, T.; Hendrix, D. L.; Perkins, H. H.; Nichols, R. L.  
 USDA, ARS, Western Cotton Research Laboratory, Phoenix, AZ, USA  
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 Conference Title: 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 1. p.430-436  
 Publication Year: 1997  
 Publisher: National Cotton Council, Memphis, USA  
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 Document Type: Conference paper

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 Boman, R. K.; Raun, W. R.; Westerman, R. L.; Banks, J. C.  
 Dep. of Agronomy, Oklahoma State Univ., Stillwater, OK 74078, USA  
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 Publication Year: 1997  
 ISSN: 0890-8524  
 Language: English  
 Document Type: Journal article

03486745 CAB Accession Number 980701538  
 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 2  
 USA, National Cotton Council of America  
 Conference Title: 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 2. p.807-1671  
 Publication Year: 1997  
 Editors: Dugger, P.; Richter, D.  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference proceedings

03472002 CAB Accession Number 980700574  
 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 1  
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 Conference Title: 1997 Proceedings Beltwide Cotton Conferences, New Orleans, LA, USA, January 6-10, 1997: Volume 1. 805 pp.  
 Publication Year: 1997  
 Editors: Dugger, P.; Richter, D.  
 Publisher: National Cotton Council, Memphis, USA  
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 Document Type: Conference proceedings

3741059 21980874 Holding Library: AGL  
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 Texas Tech University, Lubbock  
 Memphis, Tenn.: National Cotton Council of America, 1991  
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 ISSN: 1059-2644  
 DNAL Call Number: SB249.N6  
 Language: English  
 Includes references  
 Place of Publication: Tennessee  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
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3739940 21979573 Holding Library: AGL  
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 Proceedings / 1998. v. 1 p. 21-24.  
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 DNAL Call Number: SB249.N6  
 Language: English  
 Place of Publication: Tennessee  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Article

03607627 CAB Accession Number 980709969  
 1998 Proceedings Beltwide Cotton Conferences, San Diego, CA, USA, 5-9 January, 1998: Volume 2  
 USA, National Cotton Council of America  
 Conference Title: 1998 Proceedings Beltwide Cotton Conferences, San Diego, CA, USA, 5-9 January, 1998: Volume 2; p.875-1744  
 Publication Year: 1998  
 Editors: Dugger, P.; Richter, D.  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference proceedings

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 1998 Proceedings Beltwide Cotton Conferences, San Diego, CA, USA, 5-9 January, 1998: Volume 1  
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 Conference Title: 1998 Proceedings Beltwide Cotton Conferences, San Diego, CA, USA, 5-9 January, 1998: Volume 1, 873 pp.  
 Publication Year: 1998  
 Editors: Dugger, P.; Richter, D.  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
 Document Type: Conference proceedings

3893223 11094748 Holding Library: AGL  
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 Mississippi State, MS: Mississippi State University, Dept. of Agricultural Economics, c1999  
 Professional paper; 99-010  
 Professional paper series (Mississippi State University, Dept. of Agricultural Economics); no. 99-010  
 DNAL Call Number: HD9077.M7 B69 1999  
 Language: English  
 URL: <http://agecon.lib.umn.edu/cgi-bin/pdf>  
 Title from caption: October 1999  
 Includes bibliographical references  
 Text (electronic publication)  
<http://agecon.lib.umn.edu/cgi-bin/pdf>  
 Place of Publication: Mississippi  
 Government Source: State/Provincial  
 Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Monograph; Bibliographies

03875381 CAB Accession Number 20001609351

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 Munir-ud-Din Khan; Iqbal, M. Z.; Mushtaq Ahmad; Altaf Hussain  
 Cotton Research Station, Multan, Pakistan  
 Pakistan Journal of Scientific and Industrial Research vol. 42 (6): p.355-359  
 Publication Year: 1999  
 ISSN: 0030-9885  
 Language: English  
 Document Type: Journal article

3814258 22037018 Holding Library: AGL  
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 USDA, ARS, Southern Regional Research Center, New Orleans, LA  
 Princeton, N.J.: TRI/Princeton  
 Textile research journal: publication of Textile Research Institute, Inc. and the Textile Foundation. Oct 1999. v. 69 (10) p. 754-759  
 ISSN: 0040-5175 CODEN: TRJOAJ  
 DNAL Call Number: 304.8 T293  
 Language: English  
 Includes references  
 Place of Publication: New Jersey  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Article

3803225 22023840 Holding Library: AGL  
 Assessing ginnability of Australian cotton fiber  
 Porter, M.A. Wahba, F.T.  
 University of Southern Queensland, Toowoomba, Australia  
 St. Joseph, Mich.: American Society of Agricultural Engineers 1958, Transactions of the ASAE  
 July/Aug 1999. v. 42 (4) p. 853-857  
 ISSN: 0001-2351 CODEN: TAAEJ  
 DNAL Call Number: 290.9 Am32T  
 Language: English  
 Includes references  
 Place of Publication: Michigan  
 Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)  
 Document Type: Article

03793731 CAB Accession Number 990709282  
 Cotton: origin, history, technology and production  
 Correspondence address: Department of Soil and Crop Sciences, Texas A&M University, College Station, TX 77843, USA  
 xiii + 850 pp.  
 Publication Year: 1999  
 Wiley Series in Crop Science  
 Editors: Smith, C. W.; Cothren, J. T.  
 Publisher: John Wiley and Sons, New York, USA  
 ISBN: 0-471-18045-9  
 Language: English  
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03785116 CAB Accession Number 991610054  
 1999 Proceedings Beltwide Cotton Conferences, Orlando, Florida, USA, 3-7 January, 1999, Volume 2  
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Conference Title: 1999 Proceedings Beltwide Cotton Conferences, Orlando, Florida, USA, 3-7 January, 1999. Volume 2. p.755-1488  
 Publication Year: 1999  
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 Editors: Dugger, P.; Richter, D.  
 Publisher: National Cotton Council, Memphis, USA  
 Language: English  
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03784893 CAB Accession Number 991609831  
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