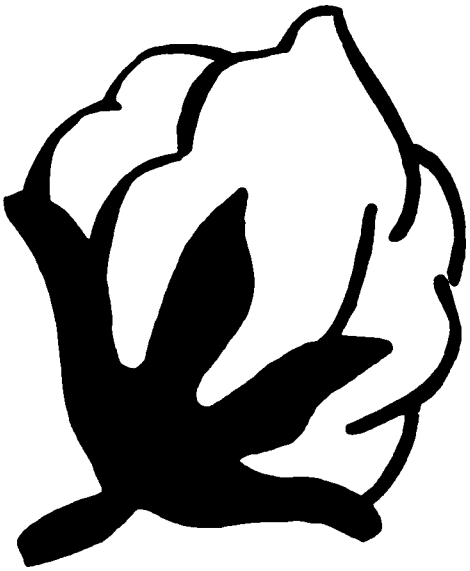

THE ICAC RECORDER

International
Cotton
Advisory
Committee

Technical
Information Section

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

Contents

Introduction

Turkey is the sixth largest cotton producing country in the world and cotton yields are among the highest. For the last eight years, national yields in Turkey have been over one ton of lint per hectare, more than double the world average and only yields in Australia, Israel and Syria have been higher. Cotton area in Turkey is divided into four regions that have different production conditions. The Aegean and Çukurova regions used to be the main cotton growing areas but now the Southeastern region leads with 46% of total area. Turkey has a huge multi-sector project called the Southeastern Anatolian Project (GAP) that will provide additional water to the Southeastern region. In the last ten years, cotton area has more than doubled in the Southeastern region and is expected to increase further. This area has the potential to produce cotton at a low cost with minimum use of insecticides. In order to contain pesticide use, Turkey has started very successful IPM projects in all regions. Labor costs in Turkey are very high and the scarcity of labor is forcing farmers to turn to machine picking. Thirteen machines have been imported into Turkey already and researchers are exploring the feasibility of adopting machine picking. The first article gives more details on cotton production conditions in Turkey.

The second article summarizes the work of the project "Integrated Pest Management for Cotton," sponsored by the ICAC and funded by the Common Fund for Commodities with counterpart contributions from collaborators in Egypt, Ethiopia, Israel and Zimbabwe. The main objectives of the project were to develop novel pesticides for controlling whitefly and aphids, a new spray technology and sprayers to cover the leaves' lower surface, and to study the biological control of the whitefly. The project concluded after five years of work and developed two formulations from castor oil and cotton seed oil that can be safely used to control whitefly and aphids in cotton. The project also explored seven other oils and concluded that coconut oil has a high phytotoxic effect on cotton. The project also developed a knapsack and a tornado sprayer for small and large farmers respectively, to spray novel oil formulations that require high volumes of spray. More details on the project achievements in addition to the composition of novel formulations and techniques used in the development of sprayers are given in this article.

Short Notes, and a Dialog search using the key words cotton and ginning are also included in this issue.

At the 59th Plenary Meeting of the ICAC held in Cairns, Australia from November 5-10, 2000, the Technical Information Section organized a technical seminar on the topic of "Cotton—Global Challenges and the Future." Fourteen papers were presented on various topics including sustainable cotton production systems, environmental issues related to cotton production, biotechnology in cotton and challenges to ginners, spinners and the textile industry. The papers have been published in a report that is available from the ICAC Secretariat.

The Technical Information Section has updated the database on cotton research projects in several countries and published *Current Research Projects in Cotton*. This report includes information from 45 countries. The first section of the 219-page report describes the structure of research in various countries. The report contains a list of institutes/organizations working

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on cotton with their complete mailing addresses, phone and fax numbers and email addresses. The largest section of the report is on projects by individual researchers in all disciplines along with their email contacts. From January 2001, the database will be available free on the ICAC web page at <http://www.icac.org/icac/cottoninfo/research/database.html>, but only in a searchable form. A complete printed copy is also available from the ICAC Secretariat.

These days there is hardly any meeting on cotton where genetically engineered cotton is not mentioned or discussed. There are people who support this technology that transfers even unrelated genes into cotton, while others oppose it and consider it short-lived and capable of creating a disaster. In January 2000, the International Cotton Advisory Committee constituted an expert panel on biotechnology in cotton for providing objective, sound science-based information on cotton biotechnology. The panel, comprised of nine experts from eight countries, put out a report that was discussed at the 59th Plenary Meeting and which is a critical analysis of the potential benefits and risks of this technology. The 17-page report has been published in English and is available free of charge from the ICAC in a printed form. It is also available free on the Internet at the ICAC home page at <http://www.icac.org/icac/meetings/plenary/59cairns/documents/e_biotech.pdf>.

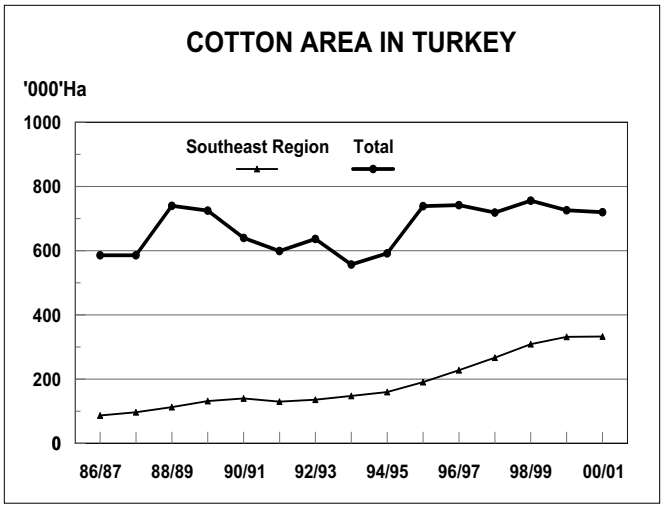
The 59th Plenary Meeting instructed the Secretariat to establish an expert panel to study the effect of ginning on fiber quality and recommend the best ginning practices. Along the lines of the biotechnology panel, the Expert Panel on Ginning will communicate through email and will write a report for consideration at the 60th Plenary Meeting of the ICAC to be held in Victoria Falls, Zimbabwe from September 17-21, 2001.

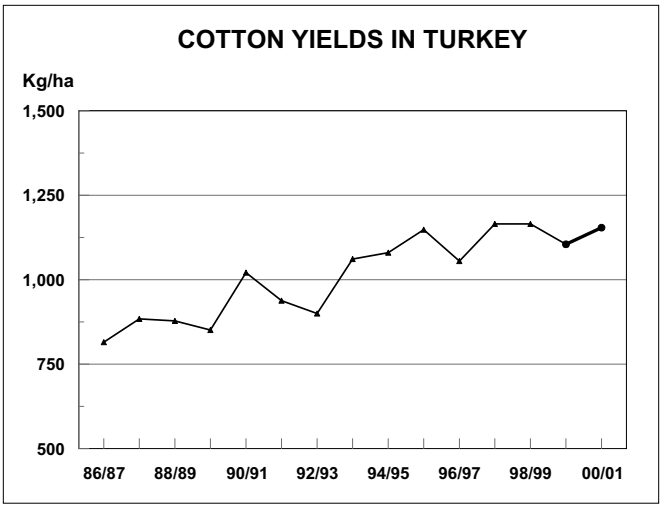
ICAC in collaboration with the Common Fund for Commodities is sponsoring the project "Improvement of the Marketability of Cotton Produced in Zones Affected by Stickiness" in France and Sudan. The project has developed reliable methods to separate sticky from non-sticky cotton and to determine threshold levels for spinning sticky cotton by mixing it with non-sticky cotton under varying environmental conditions. The final workshop of the project for disseminating results, planned for the first week of February 2001, has been postponed to July 2-4, 2001. For more information on the workshop contact the ICAC Secretariat at <rafiq@icac.org>.

Cotton Production in Turkey

Turkey is the sixth largest cotton producing country in the world with a national yield in 2000/01 twice the world average. For over 50 years, cotton area in Turkey has been around 600-700,000 hectares, and sometimes higher than 700,000 hectares once every 3-4 years. Cotton area increased to 838,000 hectares only once in 1974/75. Cotton faces tough competition from many crops, so there has been no expansion in area. The lack of irrigation water has also been a factor limiting increases in area, but this is changing because of the expansion of irrigation in the Southeastern Anatolian Project (GAP). Southeastern Anatolia, also known as Upper Mesopotamia, covers the provinces of Diyarbakir, Gaziantep, Sanliurfa, Mardin and Adiyman. The GAP is a composite of many development projects in the areas of industry, livestock and fisheries, mining, transportation, telecommunication and social development. According to the Turkish government, GAP is Turkey's biggest project and will have a significant impact on agriculture in general and cotton production in particular. The project, started in 1976, is planned to be completed by 2006, but the latest reports indicate that only 15% of the work related to agriculture has been finished, although some of the other sectors have 75% of their total work completed. GAP will provide irrigation to an additional 1.7 million hectares, or 19% of Turkey's total land suitable for irrigation.

COTTON PRODUCING REGIONS IN TURKEY





The GAP project is comprised of 22 dams and 19 hydroelectric power plants on the Euphrates and Tigris rivers. Cotton will be one of the beneficiaries from the project in addition to cereals, fruits, vegetables, oil seed crops and legumes. However, in the early years of the project's implementation, most of the work has been in areas where cotton is grown. Earlier estimates suggested that cotton production would go up by 118% after the project was completed, and its impact in the Southeastern cotton region is already visible. Among the four cotton-producing regions in Turkey, cotton area has fallen by almost 50% in Çukurova and Antalya, but area has been maintained in the other two regions. The main reason for the decline in the Çukurova region is the high cost of production due to severe insect problems. Cotton area is expected to further decrease in Çukurova but will increase by a greater amount in the southeast, thus raising the national total.

Cotton Yields

The cotton yield in Turkey is one of the highest in the world. During 2000/01 Turkey is expected to produce an average yield of 1,105 kg/ha compared to the world average of 576 kg/ha. For the last five years, cotton yields have been higher than Turkey's only in Australia, Israel and Syria, and yields in Spain have been equal to Turkey's. For the last eight years since cotton production started increasing in the Southeastern region, the average yield in Turkey has been more than one ton of lint per hectare. Cotton yields in the southeast may be slightly higher than other regions but, in general, there is not a significant difference among regions. However, the cost of achieving those yields is drastically different among regions where the least expensive production is in the southeast. Turkey is expected to maintain the same high yields for many years.

Variety Development

One of the main reasons for high yields in Turkey is the development of varieties suitable for Turkey's production conditions. However, suitable weather also contributes to high yields, and two of the three countries producing higher yields than Turkey are its neighbors, meaning that climatic conditions in the region are excellent for cotton.

Variety development is undertaken at a number of places. The federal government, under the Ministry of Agriculture and

Cotton Growing Regions and Characteristics

Region	Area %	Main Varieties	Area %	Main Characteristics
Aegean	34	Nazilli 84	86	Low insect population and inherent high quality. Farmers get higher price for better quality. Verticillium wilt is a problem. Early maturity is very important to avoid rains.
		Nazilli 87	4	
		Nazilli M-503	5	
		Nazilli 143	4	
Antalya	3	Çukurova 1518	50	Growing conditions similar to Aegean Region.
		Nazilli 84	40	
		Nazilli 143	9	
Çukurova	17	Çukurova 1518	38	Cotton bollworm has become a serious problem; pink already there. Number of sprays may exceed 8.
		SG 125-404-501-1001	29	
		Deltapine 5990	13	
		Maras 92	7	
		Ersan 92	5	
Southeastern	46	Stoneville 453	60	New area for cotton, low pest infestation. Hot climate might encourage pest flareup in the next few years.
		Sayar 314	15	
		Nazilli 143	10	
		DPL 5690	5	
		DPL 50	5	
		Ersan 92	5	

Cotton Varieties Grown in Turkey

Variety	Release Year	GOT (%)	Length (mm)	Micronaire	Strength (tppsi)
Nazilli 84	1984	43-44	30.7	4.7	82.7
Nazilli 87	1987	36-39	29.6	3.4	88.6
Nazilli M-503	1992	40-41	30.9	4.7	73.9
Nazilli 143	1998	39.7	29.7	4.8	81.3
Çukurova 1518	1982	38.0	29.3	4.1	85.9
Sayar 314	1980	41.0	30.6	5.0	78.4
Ersan 92	1992	39.0	28.8	3.9	85.7
Maras 92	1992		30.1	4.6	87.8
Stoneville 453	1995	40.0	30.9	4.9	85.8

Agrarian Reforms, has only one mono-crop multidisciplinary institute for cotton. The Cotton Research Institute, Nazilli, is located in the Aegean region but is supposed to serve all cotton producing areas in the country. The Institute has the mandate to undertake research of national significance and has a strong program on development of varieties with some emphasis on other disciplines. The Institute could be upgraded into a real mono-crop multidisciplinary research institute as a national symbol of research on cotton.

In addition to the Cotton Research Institute, Nazilli, a number of regional federal government institutes, state institutes and universities undertake research on cotton. However, the Institute has taken the lead in the development of better varieties, like Nazilli 84, which are grown on most of the area in Turkey.

Verticillium wilt is a serious problem, particularly in the Aegean region. Naked seed of verticillium wilt-resistant variety 153F was imported from one of the Central Asian countries many years ago and has been extensively used in breeding programs throughout Turkey to develop verticillium-resistant varieties. Nazilli 84, the most popular variety in Turkey for the last two decades inherited the 153F naked seed and verticillium-resistant characters. Screening for resistance to verticillium is done through artificial inoculation and testing in a hot spot area established at the Nazilli Institute. The other verticillium-wilt-resistant variety used in Turkey is Carmen, imported from Australia. Still, not all varieties grown in Turkey carry verticillium-resistant genes. Nazilli 84 was developed from a cross of 153F x Carolina Queen 201 and its long stay in commercial production is attributed to its high yielding ability, excellent adaptability, resistance to verticillium wilt and high lint percentage. Keeping in mind the high popularity of Nazilli 84 among cotton farmers, a selection from Nazilli 84 has been approved under the name Nazilli 84S.

The breeding procedure followed in Turkey comprises single plant selection and progeny row trials. However, progenies are not replicated. There is a variety approval process. Candidate varieties should have at least 40% ginning outturn and must exceed the yields of local varieties. Promising candidate varieties are tested in the Regional Cotton Variety Trials for two years with one trial each in the Southeastern and Çukurova regions, and 3-4 trials in the Aegean region. One trial is usually located at Diyarbakir in the southeast of Anatolia. The Regional Cotton Variety Trials are conducted under code numbers allotted to various varieties.

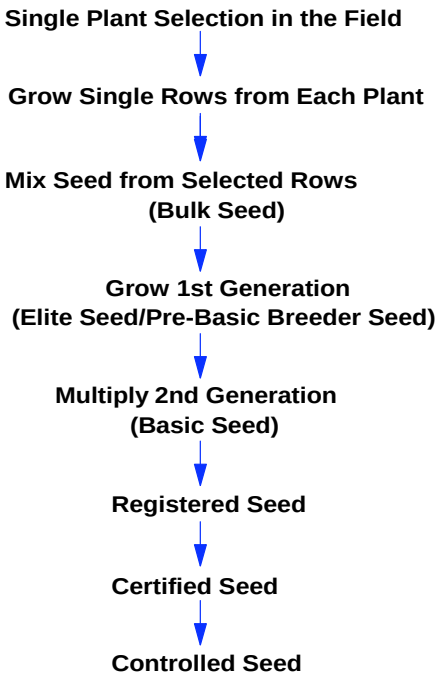
Seed Registration

Every variety to be grown in Turkey has to be registered with the General Directorate of Protection and Control of the government of Turkey. Under the Registration and Plant Varieties Act, 34 cotton varieties have been registered so far. Public sector breeders developed 22 varieties, and private companies bred 12. As in Greece and Spain, if a variety has been developed outside Turkey, it is also eligible for registration in Turkey even if it is not registered anywhere else. One-year trials at two locations are considered enough for verification of varietal characteristics. But, if a variety has been submitted for registration for the first time, two-year trials at three locations are required.

Two types of trials are conducted on any new variety under consideration for registration: Value for Cultivation and Use (VCU) trials and Distinctness, Uniformity and Stability (DUS) trials. The Varieties Registration and Seed Certification Centre is responsible for the VCU and DUS trials. If a variety has been registered in a country recognized by the government of Turkey, DUS trials are not applied.

The Varieties Registration and Seed Certification Centre reports the data collected to the General Directorate of Protection and Control for evaluation by the Registration Committee.

Cotton Seed Production Steps



The Registration Committee is comprised of 12 members from various academic and research institutes and has the final decision on the conformity of the data recorded with the original specialty document submitted by the parent organization at the time of submitting the variety. The decision is made based on a two-thirds majority and then follows the seed production process.

Seed Production

The organizations that are officially recognized as research institutions have the authority to produce seed. Private companies/organizations can also obtain a permit to produce seed for commercial distribution, but they have to submit documents prior to the start of the season in order to arrange field inspections. Breeders are involved in the seed production process at least until the seed is ready to be multiplied on a large scale (pre-basic stage) for distribution to farmers. The certified and controlled seed stages are also grown by contract farmers in addition to public and private seed companies.

Thirteen public and private seed companies are involved in the commercial production of planting seed. Seed is distributed to farmers by public and private sector organizations under the overall coordination of the General Directorate of Agricultural Production and Development of the Ministry of Agriculture. According to some estimates, 70% of the total seed produced is certified seed. Controlled seed, considered to be the lowest grade seed in Turkey, is produced in small quantities, approximately 2% of the total produced every year.

Quality seed production and its availability to farmers is an important issue in the southeast. Demand for seed is increasing, but there is a need to control production of poor and illegal varieties and to install a good system to provide quality seed to farmers. Growing conditions in the Southeastern region demand that varieties have hairy leaves, which is not the case in other regions, particularly the Aegean region. The lack of a good quality seed supply in the Southeastern region has encouraged farmers to grow the U.S. variety Stoneville 453 on 60% of total area. It is very important that a good quality seed system be established in regions that have a chance to increase area. Poor quality seed could not only slow area expansion but could also affect the pest complex and growers' confidence in investing in cotton production.

General Production Practices

Average farm size in Turkey is about 5.4 hectares, and about 50% of farms are less than two hectares. Most field operations are mechanized, and differences in farming practices even across regions are not drastic. A farmer in the Aegean region will prepare the seed bed and plant cotton in early May. On average, 50 kg/ha seed rate is used. Planting is done by machine, and only delinted seed is used. 95% of the total seed supply is from local origin while 4-5% is imported from other countries. Cotton is planted only in rows spaced 30 inches (76 cm) apart. Fertilizer as a basal dose is applied after soil testing. The first insecticide application is done soon after emergence, even before the first thinning, against early attacks of sucking insects, particularly thrips, and is followed by soil tilling and tractor hoeing. A second hoeing is done 20-25 days later, after thinning to maintain a proper plant stand. 45 days after planting or by mid June, when squaring is just starting, preparations for irrigation and ridges are made. The first irrigation is applied 60-65 days after planting, at the end of June. Normally, a second application of insecticide is required against lygus and red spidermite prior to irrigation. Though the number of insecticide sprays depends on pest pressure, generally 4-5 sprays are required every year in the Aegean region. The average number of irrigations is four. On average, 100 kg of nitrogen is applied before planting and with the first irrigation, in the form of a 50:50 ratio of ammonium sulfate and ammonium nitrate. 50-60 kg of phosphorous and potassium may also be applied every year except in the Çukurova region, where cotton-wheat is a major rotation and potassium is applied to wheat every year, thus eliminating the need for applying it to cotton. The Çukurova region also requires higher doses of nitrogen, 150-160 kg/ha. Cotton follows cotton on almost three-quarters of the one-year-rotations in the Aegean region, thus necessitating potassium applications.

Experiments have been done on foliar application of nitrogen on cotton in Turkey, but the data did not prove any positive effect on yield. Almost no foliar fertilizer is applied, but there is a need to study the effect of potassium foliar application, which at peak boll maturing stage could have an effect on yields.

In the GAP area, cotton's seasonal water requirements are 1,325 mm with a daily requirement of 11 mm in July. Studies have shown that the highest yield was obtained when the moisture level in the top 90 cm of soil did not fall below 40%. Flood and furrow irrigation are commonly used irrigation methods. In the case of furrow irrigation, there may be as many as eleven per season.

Integrated Pest Management

On average, cotton is sprayed with insecticides four times per season. Insecticides are applied on 75-80% of the area with tractor mounted sprayers, and with motorized sprayers on 15-20% of the area. Ultra Low Volume spraying is low, up to 5% only. The officially recommended economic thresholds for various pests are as follows:

Helicoverpa armigera	2 larvae per 3 meter row
Pectinophora gossypiella	15% infestation
Bemisia tabaci	6-10 larvae/leaf
Tetranychus urticae	10 mites/leaf
Lygus spp.	3 insects/leaf
Aphis gossypii	50% infestation
Thrips tabaci	15% infestation

Originally, the integrated pest management program was launched for five years with financial help from the World Bank, but now the government has taken over and has started it in all regions with the objective of minimizing insecticide use on

cotton, or to keep it low where already low. Under the program, the staff selects a number of farmers willing to implement the IPM recommendations. The technical staff visits these farmers frequently, and the farmers must follow their recommendations only. Training courses are organized for the identification of useful and harmful insects, threshold levels and other IPM recommendations. New farmers are involved each season, and the experience shows that the project has stimulated project and non-project farmers to adopt IPM recommendations. The program has been very successful compared to traditional practices, which are not only expensive but affect the environment. The main recommendations of the IPM programs in the project areas are as follows:

- In order to minimize bollworm overwintering, farmers are encouraged to cultivate their fields in the spring so that hibernating insects are destroyed.
- To discourage the multiplication of insects, cultural control measures during the season and off-season are followed and strictly implemented.
- Planting seed must be treated against damping-off.
- The use of herbicides for minimum weeds is recommended. If weeds show up at a later stage, the use of post emergence herbicides in addition to cultivation and hand weeding is recommended.
- Participating farmers are permitted to plant varieties resistant to verticillium wilt and mites. In the Aegean region, the recommended variety is Nazilli 84.
- Foliar fertilization, even if desired by farmers, is not permitted.
- It is recommended to apply insecticides only if pest damage or the population has reached an economic threshold.
- The use of specific insecticides that are comparatively safe for biocontrol agents is recommended.
- Insecticide sprays should be started from band application at any evidence of mites so that neighboring fields are not affected. Moreover, rather than the whole field, only the identified hot spots should be treated.
- In areas most affected by pink bollworm, it is strongly recommended to delint seed with acid for killing larvae hiding in infected seed.
- The use of Temik against sucking insects is not recommended.

Weed Problem

Weeds in cotton are a problem in Turkey like anywhere else in the world. According to the work presented at a meeting of the Interregional Cooperative research Network on Cotton for the Mediterranean and Middle East Regions, held in Adana from September 20-24, 2000, 74 different weeds have been recorded in cotton fields. Ten major weeds that exist throughout cotton growing regions are *Cyprus rotundus, Sorghum halepense, Convolvulus arvensis, Cynodon dactylon, Echinochoa colonum, Amaranthus* spp., *Solanum nigrum, Portulaca oleracea, Xanthium strumatium, Physalis angulata* and *Setaria* spp. In the traditional cotton growing area of Çukurova, the distribution and intensity of *Sorghum halepense* and *Cynodon dactylon* has decreased for sometime. The main reason for the decline is the use of specific herbicides targeted to control these two weeds.

Herbicides are commonly used in Turkey to control weeds. Since the start of herbicide use in Turkey, Trifluralin has been used all the time. Farmers are encouraged to use herbicides because clean fields guarantee higher yields. It is anticipated that with rising labor costs more farmers will be inclined to use herbicides.

Herbicide Use in Turkey

Year	% Area Treated
1970	7
1980	46
1990	63
2000	63

Main Concern in Cotton Production

The main concern in cotton production in Turkey is the high cost of labor, particularly for thinning, hoeing and picking. Early labor operations add to the cost of production and labor shortages become a great concern at the time of picking. The need for labor is going to increase with the steady expansion in the GAP area. The lack of labor availability for picking and its high cost is driving Turkey to adopt machine-picking. Work done in Turkey, about 20 years ago, showed that machine-picking was more expensive than hand-picking in addition to causing more trash, lower fiber quality and picking losses. However, the cost of machine-picking may now be lower in Turkey, as is the case in Argentina, which has encouraged its adoption. But there are many other aspects of machine-picking that need to be properly examined before adoption. Thirteen machines have already been imported into Turkey (two have been used in the GAP area), and research is ongoing to analyze the impact of machine-picking on production practices currently followed in Turkey.

As cotton is planted in 30-inch rows, machines suitable for 30-inch row picking have to be adopted. In early stage work already begun some varieties have shown lower pre-harvest and post-harvest losses and were found to be more suitable for machine-picking compared to others. In general, the current varieties were found to be suitable for machine-picking with no need for change. However, the biggest challenge will be to adopt changes in ginning.

The Role of Farmers' Cooperatives

Cooperatives are very active in Turkey in helping farmers to produce and market cotton. The three major cooperatives are TARIS in the Aegean region, Çukobirlik in the Çukurova and Southeastern regions and Antbirlik in the Antalya region. Though membership varies from area to area, in general 70-80% of farmers are members of cooperatives and the majority

of them are big farmers. Cooperatives have good financial support from the government, particularly in the form of fertilizers, but they are still run as private organizations. Cooperatives receive financial support from the government and are supposed to transfer it to farmers through lower input prices. Cooperatives also get loans for farmers from the government at lower rates, but now the government has instructed them to fully privatize their operations and run on their own in five years. The main function of these cooperatives is to provide inputs on credit to farmers and assure them a certain minimum price for seed cotton.

Cooperatives were established under a government act and are monitored by the Ministry of Trade at the federal level. Cooperatives function independent from each other but work almost along the same lines. They are full institutions with their own gins, oil extraction plants and also textile mills. TARIS alone has 120,000 members and during a normal season buys an average of 250,000 tons of seed cotton from farmers. During 2000/01, TARIS set a minimum price of 380,000 Turkish liras (US$0.59) per kg of seedcotton. Çukobirlik had a price of 305,000 Turkish liras (US$0.47) per kg of seedcotton for the same year. The difference between the Cotlook A Index and the local price fixed by cooperatives may be wide in some years but, in general, cooperatives have offered comparable prices. There are years when the three cooperatives, TARIS, Antbirlik and Çukobirlik, have purchased up to 59% of the total production in the country but, in general, they buy 20-30% of the total crop. During 1999/00, TARIS, Antbirlik and Çukobirlik purchased 12%, 3% and 7% of the total crop respectively, or 21% of total production in Turkey.

Ginning of Cotton

Ginning in Turkey is in the hands of the private sector operated mostly by individuals and companies. Roller gins are considered to be slow but preferable for extra-fine cotton—though there are small producing countries like Kenya, Myanmar and Thailand that produce only upland cotton and still gin it on roller gins. Among the six largest cotton producing countries in the world, only in Turkey is hirsutum cotton ginned on roller gins. Turkey has the highest number of roller gins in the world. It is estimated that 80-90% of the total production is ginned on roller gins and only 10-20% on saw gins. Most of these roller gins are locally made and quite efficient.

Number of Gins in Turkey

Region	Saw Gins	Roller Gins	Total
Aegean	5	239	244
Çukurova	13	151	164
Southeastern	11	242	253
Antalya	3	5	8
Total	32	637	669

In regard to ginning capacity, the Aegean region is self-sufficient and has the capacity to gin all its production. The Southeastern region produced 46% of total production during 2000/01 but has only 37% of the total ginning machinery in the country. If area under cotton continues to expand, it is expected that there will be a need for ginning machinery in this region. The bulk of seedcotton is ginned on roller gins and if Turkey went ahead with machine-picking, the biggest challenge will be to change ginning, as roller ginning is not suitable for machine-picked cotton. If roller ginning is continued, there will be an urgent need for additional pre- and post-cleaners. Consequently, machine-picking has to be evaluated from all aspects, including the application of defoliants, lower prices to farmers due to higher trash content, higher cost of ginning and the effect on quality.

Findings of the CFC/ICAC Project

Integrated Pest Management for Cotton

The International Cotton Advisory Committee is the recognized International Commodity Body (ICB) for cotton with the Common Fund for Commodities (CFC), which is an international intergovernmental financial institution based in Amsterdam, Netherlands. The Agreement Establishing the Common Fund for Commodities was negotiated in the United Nations Conference on Trade and Development (UNCTAD) in the 1970s, concluded in 1980, and came into force in 1989. The work of the CFC is commodity focused rather than country focused. The functions of the CFC are defined as follows:

- To contribute, through its First Account as hereinafter provided, to the financing of international buffer stocks and internationally coordinated national stocks, all within the framework of International Commodity Agreements (ICAs);
- To finance, through its Second Account, measures in the field of commodities other than stocking, as hereinafter provided;
- To promote coordination and consultation through its Second Account with regard to measures in the field of commodities other than stocking, and their financing, with a view to providing a commodity focus.

As an ICB, ICAC is able to sponsor cotton projects for CFC funding. In the last ten years, eight projects have been sponsored by the ICAC and approved by the Fund. A number of other projects are under consideration by the ICAC. The total cost of approved projects exceeds US$50 million in the form of grants and loans from the CFC and counterpart contributions from participating countries. Projects are run by collaborating institutions in various countries and supervised by the

ICAC for effective implementation of the work programs and the achievement of objectives. One of the collaborators usually serves as the project executing agency responsible for overall coordination among collaborators and reporting to the CFC and ICAC. Two projects have already been completed. The results of the most recently completed project, "Integrated Pest Management for Cotton," are discussed here.

Project Profile

The Cotton Production and Marketing Board Ltd. of Israel initiated a project with the ICAC in 1992, which was approved in late 1992 and sent to the CFC for funding. The Executive Board of the CFC approved the project on March 29, 1994. The project started activities in Sept. 21, 1994 for a period of four years at a total cost of US$5.4 million. The project was extended for one year and concluded activities on September 30, 1999. The Cotton Production and Marketing Board Ltd. of Israel served as the Project Executing Agency. The project sites were located in Egypt, Ethiopia, Israel and Zimbabwe. The following institutions were involved in the implementation of the project in the four countries.

- The Israel Cotton Production and Marketing Board Ltd., Israel
- Department of Zoology, Faculty of Life Sciences, Tel Aviv University, Israel
- Agricultural Engineering Institute, Israel
- The Granot-Sivan Enterprise D.N., Israel
- Chemistry Department, Institute of Plant Protection, Israel
- Plant Protection Research Institute, Egypt
- Commercial Cotton Growers Association, Zimbabwe
- Institute of Agricultural Research, Ethiopia

Objectives

The project had four main objectives:

1. Develop novel target oriented pesticides to control stickiness-causing insects, whiteflies and aphids. The focus was to try oil formulations for their effectiveness, speed of action, biopersistence, residual activity and toxicity to beneficial insects.

2. Develop a new technology and sprayers for insecticide spraying on the lower surface of leaves as well as for the effective control of sucking insects

3. Understand the biology and dynamics of stickiness-causing insects, particularly whitefly and its natural enemies, to facilitate optimal pest management practices in cotton.

4. Establish new threshold levels for whiteflies and aphids based on the use of oil-based novel formulations, new sprayers developed in the project, and enhanced biological control agents.

The project also had the responsibility of arranging the dissemination of results for implementation, particularly to countries affected by whitefly and stickiness. All the oil-based formulations and most of the spray machinery were developed in Israel. Studies on the small sprayer and biological control were also undertaken in Egypt and Zimbabwe (sprayers only). Most of the work done in Ethiopia and Zimbabwe was limited to testing the spray machinery and novel formulations prepared in Israel.

Development of Novel Insecticides

Many formulations of nine vegetable oils, i.e. canola, castor, coconut, corn, cottonseed, groundnut, soybean, safflower and sunflower were tried in the project. Clean water and untreated plots were also included in the study for comparison purposes. Treatments were made as and when necessary and parameter studies included stability, behavioral activity and toxicological activity on various life stages of the whitefly, activity duration, phytotoxicity tendencies and foliar residue characteristics. After laboratory trials, formulations that were found to be effective and least damaging to beneficials were cleared for field trials.

Characterization of Various Vegetable Oils

All oils included in the study showed similar activity including toxicological and behavioral components. However, different

Bioactivity of Vegetable Oils on *Bemisia tabaci*

Target	Activity Mode	Oil Ranking Order
Adults (residue effect 2-3 days post spray)	Survival	groundnut, cotton>castor>canola>corn>soybean>safflower, sunflower>coconut
	Settling Deterrence	groundnut, cotton>castor>canola>corn>soybean>safflower, sunflower>coconut
	Oviposition Deterrence	groundnut, cotton>castor>canola>corn>soybean>safflower, sunflower>coconut
Adults (residue)	Speed of Action	cotton>(=)soybean>castor
	Biopersistence	castor>groundnut>canola, corn>cotton>soybean>safflower, sunflower
Immature	Residual	castor>groundnut>canola, cotton, corn>safflower, soybean, sunflower
	Direct Spray (larvae)	groundnut>cotton>soybean>castor, canola, corn, safflower, sunflower
	Direct Spray (egg)	groundnut, castor>canola, cotton, corn, safflower, soybean, sunflower

oils varied in potency; speed of action; biopersistence in such parameters as residual activity against aphid adults and *Bemisia*; spray toxicity to larval stages; and modification of adult behavior expressed by settling and oviposition deterrence. Groundnut, castor, and cottonseed oils showed the most significant activities. The project concluded that coconut oil was the most phytotoxic and castor oil the safest to the cotton crop. The following table ranks various oils in terms of their effect on various stages of pest and activity modes.

Other conclusions made regarding oils and their ability to control whitefly are as follows:

- Most oils were safe to the cotton plant with the exception of coconut oil that caused leaf burning. Phytotoxicity of various oils can be ranked as coconut>>groundnut> canola,corn,cotton, safflower,sunflower,soybean>castor. Castor oil caused no damage to the cotton plant.
- An effective concentration range can be associated with a mechanism of "physical barrier" and lack of biochemical toxicity. The data showed that residues of 0.3% oils were non-active on the second day of post spray. However, 3% concentrations resulted in total or nearly total kill of all insects and prevented oviposition.
- Residual activity against adults relied mainly on continuous and persistent settling deterrence, which prevented oviposition and caused adult death due to dehydration and starvation.
- Vegetable oil activities appear to rely on attributes, which are common to oils of different composition and physical properties. The triglyceridic fraction appears to be the main active ingredient.
- Groundnut and cottonseed appeared to be the most effective oils for short term activity on adults and for direct activity on larvae.
- Castor oil followed by groundnut oil produced the longest residual activity against adults and some immature stages as well.
- Cottonseed oil residues are fast acting and result in a high percentage of adult mortality after a few hours of exposure.

Preparation of Formulations

To express their fullest potential against pests and achieve the highest phytotoxicity, vegetable oils were sprayed in different formulations that were prepared from environmentally friendly materials, making sure that they were stable, consistent, and delivered good dilution for easy dispense and application. Two formulations, one excluding (optimized) and the other including the auxiliary components (stabilized), gave the most promising results for all tested vegetable oils, but large scale production of preparations without auxiliary components could be very expensive. On the other hand, formulation properties are affected by process and composition variables when auxiliary ingredients are added. The process includes equipment used to prepare mixers, mixing speed and duration, temperature programming and addition of ingredients mode. Composition variables include type and concentration of emulsifiers, co-emulsifiers (chemicals that reduce interfacial tension during emulsification and ensure long lasting surface films on the oil droplets), consistency increasing agents (polymers for stabilizing emulsions both by being absorbed by oil droplets and by controlling viscosity), solvents and chemical stabilizers.

In the course of the project, 66 novel preparations of various oils were tested and it was observed that the ingredients used in the preparation of formulations could also affect the performance of oils. Twenty-one formulations were rejected at early stages due to high phytotoxicity. Castor oil could be a good candidate for optimized technique while sunflower and cottonseed oils exhibited better performance in stabilized form. As far as the ingredients in the stabilized form are concerned, Tween-80 was found to be the best emulsifier while acetyl alcohol resulted in the maximum stability characterized by low phytotoxicity and high resistance to aging effects.

Field Testing

The project recommended that because oils are heterogeneous mixtures varying from one producer to another and even among batches, oil formulations must be tested in the laboratory before taking them to field conditions. The project tested 45 materials for their effectiveness to control whitefly and aphids. Eighteen preparations based on eight oils were selected for testing in Egypt, Ethiopia and Zimbabwe, in addition to Israel. Experiments carried out in Egypt in 1996 indicated reddening of leaves, flowers, bolls and new branches when the cottonseed oil and stabilized cottonseed oil were sprayed. The effect increased with the second spray. Sunflower, castor and soybean oils also showed similar reactions, but these observations were limited to Egypt and only for one year.

Various spray methods were used. In 1997, two applications were given at two-week intervals, and changed to three biweekly to four 10 day intervals in subsequent years. Several oils were found to be efficient against whitefly and aphids, including cotton, castor, canola and soybean, but cotton oil excelled in performance over others. Formulation No. III prepared from castor oil and formulation No. 4 from cottonseed oil gave the most efficient whitefly control for three years from 1997-99. These formulations were comparatively simple to prepare, retained their stability and efficacy for several months and had no phytotoxic effects on the cotton plant. Efficacy of different formulations was different with different sprayers and the strategy for different countries could also be different. In regions having low whitefly infestation, only two treatments with formulation III may be enough to reduce the population by 56%. In areas having a high infestation four treatments may be necessary, but the efficacy will improve to 74% control compared to 86% in the case of conventional pesticide control.

Formulation No. III

The following table presents the composition of the emulsion concentrate No. III. The emulsion concentrate is prepared with the help of an organo-silicon as a stabilizer and spreading agent.

Composition of Formulation No. III	
Compounds	**Unit Weight**
Dibutyl succinate	5
Castor oil	30
Tween 80	2
Organo modified dimethylsiloxane	5
Deionized water	60

The dibutyl succinate purity should be at least of synthetic grade, b.p. >273-275°C. The organo-modified dimethylsiloxane is a clear oil soluble liquid. Tween 80 (polyxyethylene sorbitan monooleate) is syrup having a number-average molecular weight of 1.31. Castor oil should be of pharmaceutical grade DAB 96, iodine value less than 87 and unsaponifiable matter less than 0.16% with viscosity ca 1,000 mPa x s at room temperature. It can be employed without further purification. The ingredients should be blended or homogenized together to produce a stable emulsion concentrate. The emulsion concentrate No. III should be diluted with tap water to obtain an emulsion of desired concentration, e.g. 0.5% on the basis of dibutyl succinate.

Formulation No. 4

The following table presents the composition of emulsion concentrate No. 4. The emulsion is prepared without auxiliary ingredients, except one surfactant.

The lauryl alcohol (1-dodecanol) purity should be at least practical ≥95% (Gas chromatography), bp>280°C. Tween 80 (polyoxyethylene sorbitan monooleate) is a syrup having a number average molecular weight of 1.31. The cottonseed oil should be of food or pharmaceutical grade and can be used without further purification. The substances should be blended or homogenized together to produce a stable emulsion concentrate. The emulsion concentrate No.4 should be diluted with tap water to obtain an emulsion of desired concentration, e.g. 1% on the basis of lauryl alcohol.

New Spray Machinery

The project tried a number of options in the design of spray machines for optimum spreading of the novel insecticides on the plant at the same density. It was necessary for oil formulations to be sprayed uniformly and in high volumes of liquid and active material, otherwise the novel formulations could fail to show their expected efficacy. The optimum droplet size for effective control of the whitefly ranged from 73 to 136 µm with 105 µm as an average. The project also found that the novel insecticides could provide a better control if 400 liters of water and 16 litters per hectare of the active ingredient were used.

Composition of Formulation No. 4	
Compounds	**Unit Weight**
Lauryl alcohol	10
Cottonseed oil	30
Tween 80	2
Deionized water	60

Drop-tube Knapsack Sprayer

Three teams, one each in Egypt, Israel and Zimbabwe, worked simultaneously on the development of a sprayer for small growers. Egypt and Zimbabwe worked on the motorized sprayers while Israel focused on an electrically powered sprayer for the same purpose. Locally, the team in Israel tried the idea of vibrating air stream. A knapsack motorized radial blower supplied air through a vertical tube to a 160 cm long tube with a 20 cm wide slit directed downward, but the system did not work. Closer to the end of the project the focus increased on a drop-tube knapsack sprayer called Prototype No. II, which employed six rotating discs to form the droplets. A 12-volt battery was used to provide power to the atomizers and to a blower mounted on the top of a perforated hollow tube. Small holes in the tube served as an air curtain and directed the streams towards rows on both sides until deposited on leaves. The sprayer is adjusted to deliver 940 ml of the liquid per minute or 56.4 liters per hour. At an average walking speed of 2 km/hour, the knapsack sprayer delivered 282 liters per hectare, 16 liters of the formulation and 266 liters of water. The Prototype No. II knapsack sprayer developed by the project is shown on the next page.

Tractor Mounted Sprayer

The project worked mainly on two tractor-mounted sprayers, Mark I and Mark II. The Mark I sprayer had long drop tubes and provided highly uniform coverage on the plant and consistent droplet density. But it had a low ground clearance of only 12 cm and the drop tubes damaged branches while moving in between the rows. *G. barbadense* varieties were affected more than upland types, but taller upland crops could also be damaged. The damage to the crop was such that the sprayer required modifications in the drop tubes to provide higher ground clearance, which came in the form of Mark II. The problem was noted during the first year and work on the new sprayer was started.

The second drop tube sprayer was tested during the third year of the project, in 1997, with no operative problems, both on Acala and Pima types. However, the cover density on the underside of the leaf decreased to approximately 250 droplets per square centimeter. This density was no doubt much lower than Mark I but it was still much higher than conventional sprayers and sufficient to effectively control whitefly. In the Mark II Prototype Tornado sprayer, ground clearance was increased to 60 cms and the drop tubes applied oil formulations in air-assisted streams. For providing cover from the ground up to 60 cm above the ground the technology was almost similar to the knapsack sprayer. The air streams from two adjacent drop tubes were made to hit the ground and split in two, each aiming at the hitting point of the air streams from the neighboring drop tubes, creating an upward current that carried spray droplets that were deposited on the lower surface of leaves. Raising the ground clearance eliminated damage to spreading branches. In 1998, it was found that the sprayer did not deliver sufficient coverage

on the top part of the cotton plant. An additional spraying boom was tried first on the top back of the sprayer and then moved to the front side of the system. Results were compared to the conventional tractor mounted air sleeve sprayer. Mark II shown on the next page is the final development from the project for large farmers who use tractor mounted spraying.

Biological Control

Studies were undertaken to understand the population dynamics and biology of pests as well as parasitoids and predators, the effect of insecticides and novel formulations on pests and beneficials, and to assess the impact of neighboring crops on cotton in respect of pests.

Whitefly persisted throughout the cotton growing season in the project countries. In general the population was low on the young crop, increasing as the crop developed, reaching a peak in late July or August in Egypt and Israel. Very different populations could be found at two different locations during the same year. *Encarsia lutea* and *Eretmocerus mundus* were found to be dominant parasitoids in Egypt and Israel. In both countries parasitization often reached 90% with a four year average of 65-70%. In Zimbabwe, *Encarsia transvena* and *Eretmocerus mundus* were found parasitizing whitefly. Many predator species were also found to occur on cotton but most of them did not show any correlation with the whitefly population with the exception of the species of *Orius*. However, it was found that predators were more sensitive to insecticides than parasites. Formulations No. III and 4 were also tested in fields having enough predators and parasites. Formulation No. 4 was found to cause minimum damage to useful insects while Formulation No. III showed detrimental effects in the lab as well as in the field. However, the negative effect was short-lived. As far as neighboring crops were concerned, only corn and sunflower were tried. Growing corn next to cotton did not show any positive impact on cotton and though *Orius* spp. was found to exist on corn no indications of its movement to cotton was recorded. Sunflower did harbor a lot of whiteflies but did not seem to affect the whitefly population on cotton in the neighborhood. The project recommended that sunflower could not be relied upon as a refuge to harbor natural enemies of whitefly.

Economic Thresholds

The economic threshold is different for different production conditions. Factors that affect threshold are not limited to but include the size of the insect population, rate of multiplication, target yield, rate of migration into the cotton field, etc. The project recommended that if there is a slow rate of multiplication, a threshold of 15-20 whitefly larvae and pupae could be observed. It is certain that the use of novel pesticides with the tornado sprayer developed in the project, and additional knowledge about the biological control agents, would require a review of the economic thresholds in various countries and production conditions.

Note: The project's work has been published by collaborators in the form of annual reports from 1995-99, a final report (Technical Paper No. 10 in English, French and Spanish), and a guidelines manual. Material for this article has been taken from these reports. The reports are available from the ICAC and the CFC in electronic form at http://www.icac.org/icac/english/projects.html. Only conclusions of the extensive work undertaken by various teams in the four project countries have been included here. It is recommended to consult all the reports for detailed information.

The project was supposed to develop only up to the prototype stage and additional steps are required in order to commercialize the novel pesticide formulations and sprayers.

On behalf of the Project Executing Agency and collaborators in the participating countries, ICAC would like once again to acknowledge the contributions of the Common Fund for Commodities.

Short Notes

Transgenic Cotton Highlights

○ Transgenic cotton production expanded in the U.S. during 2000/01. Area under transgenic cotton, including both insect and herbicide resistant varieties, increased to 72% of upland cotton in the country. Cotton was planted on 5.74 million hectares in the U.S. during 2000/01, which means that over four million hectares were planted to transgenic cotton. Some of the transgenic varieties grown on at least 5% of the total area in the U.S. are DP 451 B/RR, NuCOTN 33 B, PM 2326 RR, PM 1218 BG/RR, PM 2200 RR and BXN 47.

○ Monsanto will use the gene Cry2Ab owned by the Ecogen Gene Company Ltd. to develop new insect-resistant transgenic cotton varieties.

○ The U.S. Patent and Trademark Office is revising guidelines for submitting requests and approval of patents. The new guidelines will make it tougher to patent genes.

○ In the U.S., the toxins carried by plants for defense against pests will be called "plant-incorporated protectants" instead of "plant-pesticides."

○ Australia started growing transgenic cotton in 1996/97 but only insect-resistant varieties were allowed. Now the government of Australia has approved commercial cultivation of Roundup Ready transgenic cotton, in addition to Bt cotton.

○ The Genetic Engineering Approval Committee of the government of India permitted supervised large-scale trials of Bt cotton during 2000/01. This is a significant step toward commercial cultivation of genetically engineered varieties of cotton in the largest cotton growing country (by area) in the world. Preliminary indications show higher yields and a reduction in pesticide use with Bt varieties compared to conventional varieties.

○ Currently, China (Mainland) is the only country in Asia which has gone into commercial production of genetically engineered crops, particularly cotton. The Bt varieties grown in China (Mainland) include a Bt gene of their own investigation, in addition to the gene used in the USA and other countries. Many other countries in the region, including India, Indonesia, the Philippines, Thailand and Vietnam may commercialize transgenic crops, including cotton, in the next few years.

○ Australia is set to evaluate the impact of growing transgenic crops on the environment. Genetically engineered varieties of cotton, canola and clover are grown on a commercial scale in Australia. Currently, genetically engineered varieties of cotton comprise up to 30% of the total cotton planted in New South Wales and Queensland.

Organic Cotton Production

ICAC has published a number of reports on organic cotton production, in addition to presenting papers at international forums. Efforts have been made to continue updating organic cotton production statistics in the world. Production estimates for various countries up to 1997/98 were published in the December 1998 issue of *THE ICAC RECORDER*. Recently, the Technical Information Section contacted the countries in the list below to get statistics for 1998/99 and 1999/00, but data were not available from all countries. The main reason for the lack of complete information on organic cotton is the unwillingness of growers and certifying companies to share that information with others. The sources of the data given below are many, and the efforts of

Organic Cotton Production

Country	Lint Production in Tons	
	1998/99	1999/00
Argentina	0	0
Australia	25	0
Benin	15	20
Brazil	7	8
China (Mainland)	0	0
Egypt	81	71
Greece	267	234
India	NA	1,169
Israel	70	120
Mozambique	NA	0
Nicaragua	1	6
Paraguay	0	0
Peru	NA	565
Senegal	172	220
Tanzania	100	106
Turkey	NA	6,082
Uganda	235	185
USA	1,878	2,955
Zimbabwe	5	2
Total	**2,856**	**11,743**

Note: China (Mainland) started producing organic cotton in 2000/01. Estimated area is 133 hectares.

the Pesticide Action Network, UK, are particularly acknowledged.

● World Cotton Production in 2000/01

Cotton was planted on an estimated 32.8 million hectares during 2000/01 in about 70 countries. The latest ICAC estimates suggest that production will be 18.6 million tons, 300,000 tons less that in 1999/2000 and 1.4 million tons less than in 1998/99. While production is expected to decline in 2000/01, consumption is expected to increase to 19.8 million tons, compared with 19.7 million the previous year. In the last three years, production has declined while consumption has increased. Current estimates suggest that production will increase in 20001/02 to 19.7 million tons, but production will still be short of world consumption by 575,000 tons. Consumption is expected to surpass 20 million tons for the first time in 2001/02. In the last three years, average yields in the world have ranged from 563 to 581 kg/ha and are expected to be 568 kg/ha in 2000/01. It is also expected that the average yield will increase to 580 kg/ha in 2001/02. Increased consumption is affecting international cotton prices. The average Cotlook A Index during 2000/01 is estimated at 66 U.S. cents per pound of lint, 13 U.S. cents more than in the previous season. Even though production is expected to increase in 2001/02, a further rise in consumption is expected to place additional upward pressure on international cotton prices. Currently, the ICAC estimate for the Cotlook A Index for 2001/02 is 73 U.S. cents per pound of lint.

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Caption title: "An Economic Research Service report; March 1996."
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Publication Year: 1996
Publisher: National Cotton Council, Memphis, TN, USA
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Subfile: USDA (US DEPT. AGR); 1; ERS
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U.S. Cotton Ginning Laboratory, ARS, USDA, Stoneville, MS.
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Paper presented at The 1994 International Summer Meeting sponsored by The American Society of Agricultural Engineers, June 19-22, 1994, Kansas City, Missouri. Issue numbers not consecutive.
Includes references
Place of Publication: Michigan
Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76); AR-MSA
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Experiences with gin process control in the midsouth and west
Anthony, W.S. Byler, R.K.; Deavenport, L. and Scamardo, D.M.
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Government Source: Federal
Subfile: USDA (US DEPT. AGR)
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Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)
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Status: Currently published. Frequency: Annual
Uniform Title: Cotton ginnings annual report (online) URL: http://usda.mannlib.cornell.edu/reports/nassr/field/pcg-bban/
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Place of Publication: District of Columbia
Government Source: Federal
Subfile: USDA (US DEPT. AGR); NASS
Document Type: Series, Periodical

ICAC PUBLICATIONS CONTENTS

COTTON TODAY!
Current Estimates of World Cotton Supply and Distribution. (Updated **daily**, Internet only, US$1,500 per year)

COTTON THIS MONTH
This 8-to-10 page report, sent at the beginning of each month, provides information on the latest events affecting the world cotton market and presents up-to-date supply, demand and price projections. (In English, French or Spanish; **Monthly**, by fax US$275 per year; Internet, US$225 per year)

COTTON: Review of the World Situation
Detailed examination of the world cotton market. Provides projections of world supply and demand by country and international cotton prices. Includes review articles on different producing and consuming countries and topics related to the world cotton industry. Projections for 2000 and 2001. (In English, French, or Spanish, **bi-monthly**, hard copy, US$175 per year; Internet, US$150 per year)

THE ICAC RECORDER
Latest scientific and technological developments in cotton production. Easy-to-read articles and analysis about cotton technology. Bibliographies of published reports of research on cotton. (In English, French and Spanish, **quarterly**, hard copy, US$160 per year; Internet, US$125 per year)

COTTON: WORLD STATISTICS
World cotton supply/demand statistics since 1940/41 and by country since 1980/81. Includes production, area, yield, consumption, imports, exports and stocks. Projections for 1999/00 through 2002/03. Monthly and season average prices of cotton and polyester in North Europe; comparisons of ICAC forecasts since 1988 with actual results. (Hard copy in **October**, US$175; Internet, tables updated only in **October** and **April**, US$150)

WORLD TEXTILE DEMAND
Comprehensive analyses and projections of world end-use consumption of textiles, mill use and production of cotton and chemical yarn and fabric for over 100 countries. Provides analysis of the events that have an impact on world textile demand and cotton's share of textile market. World textile end-use demand projections for 1998 and 1999 as well as projections to 2005. Yarn and fabric projections for 1999 and 2000. (**Hard copy** in **October**, US$300; **Internet**, updated only in **October** and **April**, US$275)

WORLD COTTON TRADE
Trade developments in raw cotton since 1980. Analysis of world trade by region. Import/export projections by country. Matrices of trade flows. Seasonal estimates of export commitments to date. (**Hard copy** in **October**, US$175; **Internet**, tables updated only in **October** and **April**, US$150)

THE OUTLOOK FOR COTTON SUPPLY
Provides an overview of factors affecting world cotton prices, including the outlook for production and consumption in major countries, changes in world stocks and government policies affecting trade in cotton and textiles. The publication provides statistics on aggregate world cotton supply and use, with forecasts of average prices for 2000/01. The publication also provides separate estimates of supply and use for each of the six major types of cotton and notes the likely quantity of each type available for export. (**Hard copy** in **October**, US$125; **Internet**, US$100.)

ICAC documents on CD-ROM
Includes all issues of *Cotton: Review of the World Situation* in English, French and Spanish (up to March 2000), *Cotton This Month* in English, French, and Spanish (up to May 2000) and *THE ICAC RECORDER* (March 1989 to March 2000, English; March 1994 to March 2000, French and Spanish) and all statistics appearing in *COTTON: WORLD STATISTICS* (1924 to present), *WORLD TEXTILE DEMAND* (1970 to present), *WORLD COTTON TRADE* (1970 to present). Includes proceedings (English, French and Spanish), Country Statements and Technical Seminars (English) from the Plenary Meetings from 1989 to 1999. Also includes two studies: *Survey of the Cost of Production of Raw Cotton* and *Survey of Cotton Production Practices*. (**Annual**, June 2000, US$395)

Proceedings
Summaries of all deliberations of the ICAC Plenary Meeting. (In English, French and Spanish, **October**, hard copy, US$50; Internet, US$25)

INSECTICIDE RESISTANCE AND ITS MANAGEMENT IN COTTON INSECTS
ICAC Review article on Cotton Production Research No. 5. (55 pages, hard copy, March 1999, US$75)

AGROCHEMICALS USED ON COTTON
The Technical Information Section undertook a detailed survey on the use of fertilizers, insecticides, herbicides and growth regulators on cotton. In addition to the use of these chemicals per hectare and area, changes in the insect pattern, insecticide resistance and expected trends in the use of these chemicals are given in the report. Farmers' understanding of agrochemical application, particularly application of insecticides, is also covered. (28 pages, hard copy, October 1995, US$25)

BALE SURVEY
The current report includes data on bale size, shape, weight, wrapping specifications, information given on the bale, sampling procedures, and impediments and suggestions for improving the standardization of bales. Information on 42 countries is available in the report. (23 pages, hard copy, October 1995, US$25)

CLASSING AND GRADING OF COTTON
Classing and grading systems in various countries are reviewed in this report. Local seedcotton and lint standards have been compared to universal standards. HVI use and futures plans are also included. (38 pages, hard copy, October 1998, US$50; Internet, US$25)

CURRENT RESEARCH PROJECTS IN COTTON
Contains detailed information on the structure of research in several countries, institutions involved in cotton research, their contact persons and addresses and the source of funding for cotton research in each country. The publication includes detailed descriptions of current projects by discipline of research (agronomy, breeding, biotechnology, etc.) and the researchers responsible for these projects. (Hard copy, October 2000, US$75)

GROWING ORGANIC COTTON
Since 1993, the ICAC Secretariat has published a number of reports on organic cotton in addition to papers presented at international meetings. All these articles have been compiled and published in English, French and Spanish. (81 pages, October 1996, hard copy, US$50; Internet, US $25)

Technical Seminars Papers of the ICAC Plenary Meetings
A Technical Seminar on a selected topic is held every year during the Plenary Meeting.
New Sources of Genetic Resistance To Cotton Pests Short Season Cotton: How Far Can It Go? ($25), 1995; Common Fund Projects ($25), 1996; Summaries of the WCRC-2 and Cotton Contamination, ($25), 1998; Fiber Quality Needs of the Modern Spinning Industry and Advances in Ginning Research ($75), 1999; Global Challenges: Environment, Field Production and Processing of Cotton ($75), 2000

SURVEY OF THE COST OF PRODUCTION OF RAW COTTON
The current report has data on 29 countries for the 1997/98 season. Many countries have reported data by region or type of cotton. The total number of entries by country and region is 55. The costs of all field operations starting from pre-sowing to harvesting and ginning and economic and fixed costs have been determined and computed to determine the cost of production of cotton per hectare and per kilogram. (109 pages, October 1998, US$150)

SURVEY OF COTTON PRODUCTION PRACTICES
Cotton growing conditions vary from country to country and sometimes even from region to region within a country. The report contains data on climatic conditions, area under each variety and their fiber characteristics, insects, diseases, weeds and the methods used to control them, use of fertilizers, farm size, rotations and ginning methods. (October 1999, hard copy, US$150, Internet, US$100)

THE WORLD COTTON MARKET: PROJECTION TO 2005
Results of a joint ICAC-FAO econometric study to forecast developments in cotton supply and demand to 2005. Includes projections by country of cotton production, mill consumption of cotton, final end-use of cotton, cotton market share, end use of all textile fibers, cotton exports and imports and net imports of cotton manufactures. (62 pages, September 1999, hard copy or Internet, US$75)

Statements
Statements of the Plenary Meeting during the plenary sessions. Also contains official statements of most of ICAC member countries regarding the domestic cotton and textile situation. (Hard copy, **October**, US$150; Internet, US $100)

INTERNATIONAL COTTON ADVISORY COMMITTEE

The International Cotton Advisory Committee is an association of governments having an interest in the production, export, import and consumption of cotton. It is an organization designed to promote cooperation in the solution of cotton problems, particularly those of international scope and significance.

The functions of the International Cotton Advisory Committee, as defined in the Rules and Regulations are

- To observe and keep in close touch with developments affecting the world cotton situation
- To collect and disseminate complete, authentic and timely statistics on world cotton production, trade, consumption, stocks and prices
- To suggest, as and when advisable, to the goverments represented, any measures the Advisory Committee considers suitable and practicable for the furtherance of international collaboration directed towards developing and maintaining a sound world cotton economy
- To be the forum for international discussions on matters related to cotton prices

Membership of the Committee, which represents the bulk of the world's production, trade and consumption of cotton, now comprises the following forty-three governments:

Argentina
Australia
Belgium
Bolivia
Brazil
Burkina Faso
Cameroon
Chad
China (Taiwan)
Colombia
Côte d'Ivoire
Egypt
Finland
France
Germany
Greece
India
Iran
Israel
Italy
Japan
Korea, Rep. of
Mali
Netherlands
Nigeria
Pakistan
Paraguay
Philippines
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Russia
South Africa
Spain
Sudan
Switzerland
Syria
Tanzania
Togo
Turkey
Uganda
United Kingdom
United States of America
Uzbekistan
Zimbabwe

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