INTERNATIONAL COTTON ADVISORY COMMITTEE

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Organic Cotton Production - IV

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pact of foreign matter on the textile industry. The publication is available from the ICAC Secretariat. You can send your orders to <publications@icac.org>.

The Pesticides Trust is an independent charity organization addressing the health and environmental problems of pesticides. The Trust, based in the UK, is devoted to minimizing pesticide hazards, promoting effective regulation of pesticides, eliminating trade in hazardous pesticides, reducing pesticide use and advocating sustainable alternatives to chemical pest control. To do this, the Trust works in the areas of research and project development, demonstrating alternatives and information dissemination. On a quarterly basis, the Trust publishes a newsletter called *Pesticides News,* wherein reports on various aspects of pesticide use in agriculture are covered. Since 1995, the Trust has had a number of organic cotton production projects in many countries, particularly in Africa. Based on their own experience with organic cotton production in Benin, Senegal, Zambia, Zimbabwe and elsewhere, the Trust decided to publish a book, *ORGANIC COTTON From Field to Final Product,* which will be out in early 1999. The organic cotton production experience in countries like Egypt, Peru and the USA, where the Trust was not involved directly, has been covered by authors from these countries. The cost of the 234 page book is £14.95 and can be purchased from the following address.

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Organic Cotton Production IV

Cotton is one of the most chemically intensive among all field crops. Cotton is grown on an estimated 3% of the total cultivated area in the world, but uses about 25% of all insecticides consumed in agriculture. Pests are such a serious threat to cotton production that economic yields are almost impossible to achieve without monitoring pests and adopting chemical controls. Plant protection operations have become the crucial aspect of production practices and pesticides that are banned for use on food crops are commonly used on cotton. The table below shows the increase in the number of sprays in Punjab, Pakistan (Punjab produces over 80% of the country's total production). The increase was partly due to stringent efforts to avoid the leaf curl virus disease by controlling the whitefly, and to control the cotton bollworm that has lately emerged as the key pest throughout the cotton belt. In California, USA, the quantity of pesticides used on cotton increased by about 42% from 1991 to 1995 and the quantity of insecticides used on cotton has increased in many countries.

Insect Control in Pakistan

Years	Number of Sprays/Percentage Area							
	Zero	One	Two	Three	Four	Five	Six	Seven
1987	29	20	23	23	4	1	0	0
1988	26	26	21	20	6	1	0	0
1989	9	16	18	26	18	13	0	0
1990	7	3	9	23	39	20	0	0
1991	1	2	2	42	36	17	0	0
1992	0	0	7	26	39	25	2	0
1993	0	3	5	27	29	25	10	0
1994	0	1	5	12	32	33	18	0
1995	0	0	5	14	27	37	12	5
1996	0	0	2	3	10	36	28	9
1997	0	0	0	3	15	41	30	11

Since synthetic fertilizers established their role in meeting production targets, breeders have responded in synthesizing cotton genotypes suitable for higher quantities. Tall-growing conventional types were prone to excessive doses of nitrogenous fertilizers and capped the upper limit of nitrogen quantity. Breeders were able to raise the upper growth limit and increase yields through the introduction of short stature genotypes. Such a process is prominent in wheat and rice, but can also be used for cotton and cotton breeders all over the world have made concerted efforts to develop short stature varieties, suitable for higher doses of fertilizers. Consequently, the use of fertilizers increased.

Weeds harbor insects and share inputs with the commercial crop, and must be removed in order to obtain optimal yields. If fields are not free of weeds, the benefits of using fertilizer and insecticides are reduced. Herbicides were found to be an economical solution to proper weed control. Currently, the quantity of herbicides used is more than double the quantity of insecticides used in the USA in terms of active ingredients. Herbicides are still not popular in some countries, but the US trend is also seen in Brazil, South Africa and many European countries where herbicides are used in manyfold quantities compared to insecticides.

According to the Pesticide Trust (1995), 10% of all agrochemicals are used on cotton as against 25% on all vegetables and 14% on cereals. Rice and maize are substantial consumers of agrochemicals, using about 13 and 11% of all agrochemicals, respectively. But, cotton remains the heaviest consumer of insecticides.

In many countries, especially where cotton is machine picked, herbicides, insecticides, growth regulators and harvest aid chemicals in addition to fertilizers are inte-

Global Agrochemical Use in 1994

By Area	%
North America	30
East Asia	28
West Europe	24
Latin America	9
East Europe	3
Rest of the World	5
By Product Type	
Herbicides	42
Insecticides	29
Fungicides	20
Others	10

gral parts of production practices. Even after harvesting, cotton fabric at textile mills is treated with a variety of chemicals for improving appearance and performance. Cotton fabrics are often processed with toxic dyes and formaldehydes before they reach end users.

Chemicals added to the cost of production and reduced cotton industry profitability during the 1980s, and cotton farmers in many countries started thinking of alternate means of growing cotton. Farmers also became concerned about the aggregate health effects of chemicals and considered switching to traditional, natural methods for controlling pests and weeds and for preparing cotton for harvesting. These methods, combined with modern technology, were applied to organic production to make it competitive with chemically grown cotton.

What is Organic Farming?

Growing cotton without synthetic fertilizers and other chemicals has been termed green, environment friendly, biodynamic, etc., but organic production is the most popular name used in the cotton industry. There is no accepted single definition for organic cotton, and there is not only one reason for going into organic production. Organic cotton production is a system of growing cotton without synthetic chemical fertilizers, herbicides, conventional synthetic insecticides, growth regulators, growth stimulators, boll openers or defoliants. It is a system that contributes to healthy soils and/or people. The organic system promotes enhanced biological activity, encourages sustainability and commands proactive management of production systems.

The use of synthetic pesticides and fertilizers is not very old in the history of agriculture. Until about 50 years ago, all farming was done with natural inputs like farm yard manure, weeding through cultivation, rotating crops to maintain fertility, etc. But modern organic farming is not returning to obsolete cultivation methods. Soils have become exhausted and pest pressure has increased to the extent that 50-year-old methods will not work. Organic farming is a farming system that relies on natural inputs only. Modern organic cotton production requires much more intensive and innovative management.

Reasons for Organic Production

Organic production is also a consumer driven initiative. But, producers quickly adopted organic production because initially it seemed to be a feasible proposition. There may be more reasons, but the combined effect of the following factors resulted in the initiation of organic cotton production.

- Concern for the environment – Fertilizers and all pre-emergence herbicides are applied to the soil, but all the chemicals are not taken up by the cotton plant. Some elements are released into the environment while others leach into the soil and also pollute water.
- Concern for family health – In many countries, particularly where insecticides are sprayed with back mounted sprayers, spray-men do not use protective equipment thus creating a danger of insecticide inhalation. In tractor mounted sprayers, wind drift can lead to inhalation.
- Secure long-term viability for their properties – Chemical control of insects, particularly when insecticides were introduced, was the cheapest and most efficient way. However, "cheapest" and "efficient" do not seem true characteristics anymore because of increases in the number of sprays required and insect resistance.
- Life style – Some people were interested in insecticide-free cotton apparel due to allergies.
- To reduce input prices – Insecticide use changed the insect complex in many countries. Some minor insects became major and certain new insects were introduced. Consequently, there was an increase in the consumption of insecticides. Some countries, particularly in Central America, had to abandon cotton production. In many countries, the cost of insecticides is the most important factor in determining the economics of cotton production.
- Conventional farming systems were not working – Because of the high cost of plant protection operations and resistance to insecticides, highly chemical intensive conventional production practices were not working, and farmers decided to get away from traditional farming.
- Possibility of price premiums – It was also assumed that organic products would fetch premium prices, thus enhancing farmers' income from cotton production.

Organic Cotton Area in the USA

Organic production was started at the same time in a number of countries, but commercial production was adopted first in the USA in 1990/91. A number of international environmental agencies became active in other countries and tried to introduce organic production without considering what growing conditions were feasible for organic production. Technically supervised and financially motivated programs were started in many developing countries, including countries where cotton yields were the world's lowest. While on the one hand low input use was a reason to sustain the current yield level, a further reduction was not affordable economically. It can rightly be claimed that organic production other than in the USA was all on an experimental basis.

Organic production and certification was started in the USA with three certifying agencies. The Texas Department of Agriculture had one of the most successful and popular programs.

Organic Cotton Area in the USA

Year	Area (ha)
1990	365
1991	1,330
1992	2,550
1993	5,020
1994	6,416
1995	9,965
1996	4,362
1997	3,662
1998 (Est.)	4,068

As organic cotton area started increasing, a number of other companies introduced their certification programs, most of them limited to US conditions. Quickly, a chain of producers, certifying companies, spinning and weaving mills, apparel manufacturers and retail sellers was established.

Organic Production

Organic cotton farming is not just the elimination of undesirable chemicals, but it is a complex system that results in a bale of cotton free of hazardous substances. Customer demand for organically grown cotton is not a residue-free issue. If conventionally grown cotton is tested for hazardous substances and found free of chemical residues, an organic label cannot be slapped on the bale. It is not only illegal: it entirely undermines the efforts of environmentalists. Environmentalists deserve credit for innovation by encouraging organic producers. Organic production has the characteristics discussed below.

- Conventional production relies heavily on synthetic fertilizers that permit cultivation of cotton on a variety of soils because nutrient needs can be met through the addition of various fertilizers. Organic cotton can only be grown on specially prepared land through green manuring/cover crops. A quick shift in area is not possible, and unlike conventional production organic cannot be grown on all types of soils.
- Certification from a recognized certifying agency is a must, unless there is high mutual confidence between the producer and the buyer. There is usually a cost associated with certification services. Full organic production requires completion of the transitional period, which is usually two years of production without prohibited chemicals.
- Microorganism activities in the soil must be maintained at a high level to sustain high soil fertility.
- As no conventional insecticide is permitted on organic production, there must be a heavy reliance on biological control. Though certain special substances are permitted on organic cotton, predator and parasite activities must be maximized through agronomic measures and suitable production systems.
- Agrochemicals pollute the environment including soil, water and air. Organic cotton is environmentally safe to produce.
- The cost of products permitted for application on an organic crop is usually lower than synthetic insecticides and fertilizers.
- Lower yields are expected in organic production. But how much lower depends greatly on each farmers' skills growing cotton without inorganic fertilizers and insecticides.
- The cost of production may be higher, particularly in countries like the USA, due to manual picking and non-chemical removal of weeds.
- In order to compensate for low yields and higher costs of production, organic cotton farmers need to receive premium prices.
- Demand is limited for organic cotton and there is no assured market.

Organic Certification

Today's pesticides are designed to persist for shorter periods in the environment and are less lethal than in the early days of calcium arsenate and DDT. The Bremen Cotton Exchange, Bremen, Germany, undertook a study of chemical residues on cotton including insecticides and defoliants. The studies were done in 1991, 1992, 1993, 1996 and in 1998. Samples of conventionally grown cotton from many countries with diverse production practices were collected and analyzed. Results indicated that no chemical was above the threshold level during any year.

The International Federation of Organic Agriculture Farming (IFOAM) at the First International Conference on Organic Cotton, held in Cairo, Egypt, from September 23-25, 1993, considered setting standards for pesticide residue on cotton. The idea was to set a standard and use it in the issuance of a certificate for organic products. As there are so many potential ways to misrepresent a bale of cotton as being organic, the recommendation was dropped from consideration. This is one of the reasons that third party certifying agencies stepped in from the very beginning of organic cotton production. The objective was to assure customers that organic cotton meets a minimum set of standards.

Although certification has become an integral part of organic production, organic cotton has been produced without formal certification at least in Brazil. An association of small producers in Fortaleza, Ceara, in the northeast of Brazil has been producing organic cotton for its customers thousands of kilometers away from the production area. Another example of self-certification is SEKEM Farms, a private enterprise in Egypt that has produced organic cotton and exported it to European countries, particularly Germany.

Some fundamental requirements of certification were discussed in the June 1994 issue of the *ICAC RECORDER*. In order to carry the organic condition through to the end product, it is necessary that not only production operations be organic but that subsequent operations also be certified as organic. Other segments of the organic cotton industry include certification of gins where the organic cotton is processed and the warehouses

where it is stored. All operations at the spinning and weaving mills also need to be certified to complete the chain.

Quantity of Organic Cotton Produced in the World

There is not a single agency keeping track of organic production in the world. Data in the table below have been collected from more than one source and do not reflect official statistics from any government.

Organic Cotton Production (tons)

Country	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98
Argentina	NA	NA	81	2	75	75	132	70
Australia	NA	NA	479	500	750	400	500	400
Benin								5
Brazil				2	8	1	5	5
Egypt			38	141	598	600	650	630
Greece					450	500	475	400
India			206	268	398	929	900	930
Israel						100	100	50
Mozambique						90	90	50
Nicaragua					16	20	20	20
Paraguay				100	75	50	50	50
Peru			400	700	924	1,516	1,500	650
Senegal						2	30	20
Tanzania				15	33	100	100	200
Turkey	5	60	120	198	610	720	750	800
Uganda				16	150	250	300	800
USA	330	820	2,155	4,274	5,365	7,425	3,396	2,852
Zambia						35	30	30
Zimbabwe						20	NA	5
Total			**3,479**	**6,216**	**9,452**	**12,833**	**9,028**	**7,967**

The table shows that organic cotton has been tried in at least 19 countries. Organic cotton production reached its peak in most countries in 1995/96, after cotton priced reached record levels. In the two seasons since 1995/96, organic cotton production has decreased in almost all countries except Tanzania and Uganda. There was also a slight increase in production in India and Turkey. In the USA, the largest producer of organic cotton in the world, organic production in 1997/98 was only one-third the level of 1995/96. During 1998/99, an estimated 4,062 hectares were planted under organic conditions in the USA, but only one-fourth may have been harvested. Thus, US organic cotton production will be significantly lower than in 1997/98 and may be less than 15% of production in 1995/96. The reasons for lower production in the USA in 1998/99 are the same as for conventional production, cool rainy weather in the West and dry weather in the Southwest. Organic production is also expected to be lower in most other countries in 1998/99.

Reasons for Reduction in Organic Production

The reasons for starting organic production, as mentioned above, are still valid and yet organic production is not increasing. Organic production started because there seemed to be a demand for it and it was hoped that the demand for organic products would increase. The following factors may have contributed to a reduction in organic cotton production area.

- For organic farmers who successfully raise a crop, the system seemed to be attractive. But the fact of the matter is that organic production was started without any systematic research. It was assumed that the elimination of synthetic insecticides and fertilizers would simplify production technology and that everyone interested in producing organic cotton would be able to do so. No systematic research was undertaken. Consequently, farmers failed to produce organic cotton economically, and some have quit.
- Because production started without any research, sufficient technical transfer of technology support was not available to organic producers.
- One of the significant factors in organic production is the suitability of varieties to organic conditions. It was assumed that all varieties were suitable for organic production. Thus, conventionally grown varieties in all countries were put to organic production, one of the reasons for low productivity. Under organic conditions, cotton must have the ability to resist insect pest pressure and maintain high yields without inorganic nitrogenous fertilizers.
- Under most conditions, cotton is grown as part of a production system. Due to high pressure to produce food crops, cropping intensity has increased to over 200% in many countries. Organic cotton production affects cropping intensity, thus affecting farm income.
- Organic production yields are expected to be lower than those in conventional production. The loss in yields can be related to the need for insecticides and fertilizers used under conventional production. If insect pressure is high, more loss is expected in the absence of insecticides. The loss in yield has been so high that it is not economical to produce organic cotton.
- The loss in yield could be offset by premium prices. Higher prices were expected, but organic farmers have not received sufficient premiums. Organic prices ranged from a discount, due to spots on account of insect attack, to premiums. Or-

ganic producers could not continue producing organic cotton at no/low premium.

- The lack of coordination among organic producers and consumers is also a factor for discouraging both segments of the industry.
- With the exceptions of Australia, Israel and the USA, in most countries organic production was started as a project by an international agency, and in some countries growers were compensated for the loss in yields. However, the end of foreign support resulted in termination of projects.

Despite past difficulties getting the organic industry off the ground, it cannot be concluded that organic production is not a feasible proposition. However, organic production may not be suitable for all types of production conditions in all countries. Perhaps many of the initial problems in starting a bona fide organic cotton industry can be placed on research and development costs, which had to be borne by pioneers in all sectors. Now, both the farming and manufacturing ends of the business have worked through many of these problems. Organic production definitely requires more skill and determination, compared to conventional production. Those farmers who have managed to hold on through this tumultuous start-up phase will be disappointed if proper systematic work is not undertaken for the development of a technology package and its dissemination to organic producers.

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The Cost of Producing Cotton

The Secretariat of the International Cotton Advisory Committee has undertaken surveys on the cost of cotton production since 1971. The data was updated irregularly, every one or two years at the beginning. But since 1983, reports on the cost of production have been published every three years, at the time of plenary meetings. The latest report was published in October 1998 and is based on data for the year 1997/98. For the sake of consistency, since 1992 the same questionnaire has been used to collect information from countries. In the report prepared for the 57th Plenary Meeting, held in Bolivia from October 12-16, 1998, data are available for 29 countries. Many countries provided data for various regions or sets of production practices, thus the total number of entries is 55.

Knowing that production practices differ greatly among countries, the questionnaire has been designed to accommodate wide variations in production systems and input costs. The data covers all operations from presowing to harvesting and ginning. It also includes economic and fixed costs.

It is not possible to compare all countries and all entries in this paper, thus ten selected countries representing the major cotton producers and production regions are discussed in detail. The countries and the legends used in the charts are as follows:

Countries and Legends

Argentina (Santiago del Estero, irrigated)	ARG
Australia (New South Wales, irrigated)	AUS
Bolivia	BOL
China (Mainland)	CHN
India (Central South rainfed)	IND
Pakistan (Punjab)	PAK
Syria	SYR
Turkey (Çukurova Region)	TUR
USA (national average)	USA
Zimbabwe	ZWE

Weed Control

Weeds can be controlled manually, mechanically or chemically. Herbicides are used extensively in Colombia, Greece, Israel, Spain, Syria and the USA. In China, India and Pakistan herbi-