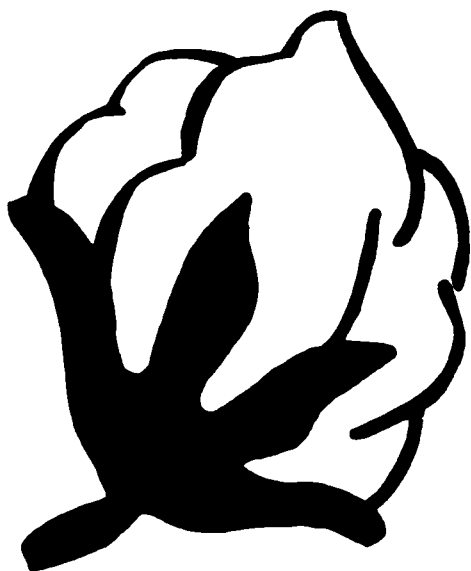




THE ICAC RECORDER

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**

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Introduction

Cotton production in Syria is characterized by a low use of insecticides and high yields. The average lint yield during 1997/98 was 1,479 kg/ha and only 1% of total area was sprayed with insecticides. Since 1990, less than 5% of the total area has been sprayed. The sprayed area usually gets no more than one spray. Area to be planted to cotton is decided by the government. The Ministry of Agriculture strictly controls the use of insecticides and a cotton field cannot be sprayed without a prescription from government authorities. How Syria has managed to maintain a high level of biological control and almost eliminate insecticide use is reported in the first article.

Countries of the Commonwealth of Independent States of the former Soviet Union are going through drastic changes in cotton production and marketing. In Azerbaijan, the government decided to privatize the ginning industry in 1995, which resulted in an entire restructuring of the farming system. All the gins have been sold to private companies and over 98% of the farmland has been privatized. Now, ginners are responsible for providing all inputs to farmers, including credit. Ginners sign a contract with individual farmers to buy their seedcotton, guarantee a minimum price and are responsible for selling lint to local and foreign merchants. More details of the system are given in the second article.

The third article is on the cotton production system in Turkmenistan. Farmland has not been privatized in Turkmenistan and ginneries have not been sold to private companies. The government owns the land but farmers called "renters" are allowed to cultivate it collectively. The government and renters share the cost of inputs on a 50:50 basis. The government is the only source of input supply and farmers sell their produce to the government at a price determined by the government. A government organization, "Turmenpakhta," is responsible for exporting cotton.

Some short notes are given as usual at the end of the three articles.

The Technical Information Section has published a report, *Survey of the Cost of Production of Raw Cotton*. Data for the year 1997/98 from 29 countries include cost of inputs and operations from pre-sowing until harvesting and ginning. Differences in production practices and in the system of estimating cost of production make it difficult to compare the per kg cost among all countries. However, the cost of individual inputs can be compared among many countries and good comparisons can also be made among countries in the same region.

Obtaining High Yields with Minimum Insecticide Use in Syria

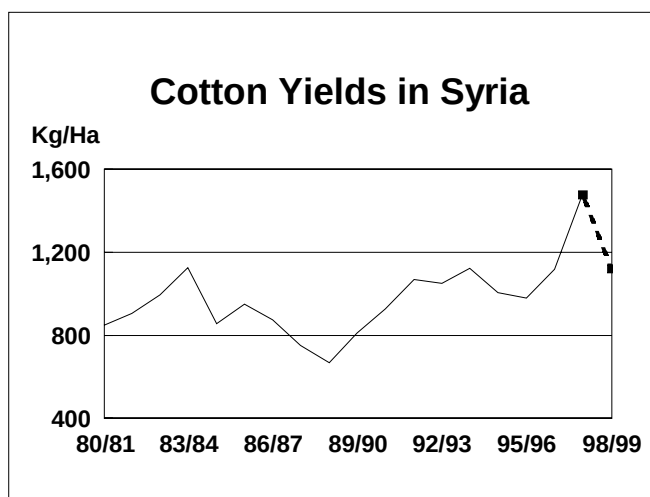
Syria is the only country in the world where cotton yields are over one ton of lint per hectare and almost no insecticides are used. The 1997/98 season was exceptionally good for Syria; the average yield from a total cotton area of 240,000 hectares was 1,479 kg/ha. A variety of insects are known on cotton in Syria but the total area sprayed with insecticides during 1997/98 was only 1%. The sprayed area is generally treated not more than once in the season. No biological insecticides and biocontrol agents are reared and released for insect control. Non-traditional synthetic insecticides are not applied either. During the 1980s, Syria used to apply insecticides on over 50% of the cotton area, but spraying has been reduced to less than 5% since 1990. How Syria has managed to contain insect spread and minimize insecticide use is discussed in this article after reviewing the production system.

Production Planning

In Syria, production planning is systematic and centralized. The Ministry of Agriculture, in consultation with its subordinate offices, prepares a production plan, which is considered and approved by the High Council of Agriculture. The target area and production is allocated by province. Once the plan is approved, it is distributed to the local authorities in each province. Allocation of area to cotton production by farmer in each province is the responsibility of the local authorities.

Overall coordination in the cotton sector is accomplished through an annual "Cotton Congress" attended by 100-120 government officials. Previous year performance is reviewed and policy directions are set for the next year to meet targets. The Cotton Bureau is responsible for formulating recommendations for farmers and making them available through publications and visual aids. The Directorate of Extension also puts out leaflets and bulletins.

The Cotton Marketing Organization (CMO) provides planting seed to the Agriculture Cooperative Bank, from which farmers buy seed. Fuzzy seed is sold and planted as such without delinting and treatment, one of the reasons for a seed rate as high as 80 kg per hectare. Other reasons for the high seed rate are low soil temperature, habit, and a desire to avoid replanting. Cotton is planted in rotation with wheat. Wheat can be planted October to December, after cotton has been picked. But it is harvested in June, too late for planting cotton. Thus,



cotton competes with wheat. In order to keep farmers producing both crops, the government has established that the cotton procurement price must be at least 2.9 times higher than the wheat price/kg.

Minimum use of insecticides and the level of prices have converted cotton into a more attractive crop to produce. The government keeps control of the cotton area through a permit to be obtained by each farmer. The provincial Department of Agriculture allocates the area that a farmer can plant to cotton. After cotton has been harvested, each farmer takes his production record to the Ministry of Agriculture and declares his production, which is tallied against the area permitted to be planted to cotton. Only after this declaration is made can farmers deliver their seedcotton to the CMO centers.

Research on Cotton

Research on cotton, particularly with reference to breeding, is the sole responsibility of the Cotton Bureau, headquartered in Aleppo. Various other institutions under the Ministry of Agriculture, the Directorates of Scientific Agricultural Research, Plant Protection, Soils and Irrigation and Water Use, carry out about 20% of the total research on cotton in the country. Production is almost 100% mechanized except for picking, but for continuous improvement in practices, a General Mechanization Organization has been created recently. All these organizations work in collaboration with the Cotton Bureau, which consequently makes all recommendations for adoption at the farmer level.

Irrigation

All cotton area in Syria is irrigated with water from main streams, rivers and underground water. The Euphrates River, water shared by Iraq, Syria and

Cotton Producing Regions in Syria

Region	Provinces Included	Share in Production	Average Yield
Central Northern	Aleppo and Hama	25%	1,050-1,150 kg/ha
Eastern	Rakka and Deir ez Zore	45%	850-950 kg/ha*
North Eastern	El Hassaka	30%	1,150-1,200 kg/ha

* Low yield due to hot weather

Turkey, along with the Khabour, meets about 70% of water needs. 69% of the area is flood-irrigated and about 25% furrow-irrigated. Sprinkler irrigation is also applied to a limited area, less than 7%. Plans are to increase furrow irrigation. It has been concluded in Syria that in order to make drip irrigation work economically, at least a 25% increase in yield must be achieved to compensate for the additional cost of installing the system. Cotton is irrigated 8-10 times with an average total water consumption of 7,000-8,000 cubic meters of water every season.

Fertilizer Use

Fertilizer is available only from government sources. Nitrogen and phosphorous are recommended to be applied every year. Potassium is made available only for potato, other vegetables and sugarcane but not for cotton. General nitrogen application rates range from 150-190 kg/ha while it is recommended that phosphorous be added at the rate of 30-75 kg/ha. It is strictly advised that cotton may not be over fertilized or under fertilized. Based on soil analysis, recommendations from the Cotton Bureau, which are generally adhered to, are as follows:

Fertilizer Application Recommendations in Syria			
Nitrogen		Phosphorous	
Soil Availability (ppm)	Recommended Application Rate (kg/ha)	Soil Availability (ppm)	Recommended Application Rate (kg/ha)
1-5	225	1-3	90
5-9	200	4-5	86
10-15	180	6	83
15-19	135	7	75
+20	90	8	56
		9	38
		10	19

All phosphorous and 30% of the total N is applied at the time of planting. 70% of nitrogen is split up in 3 doses: 35 days after thinning (40%), 15 days later (15%), and another 15 days later (15%). Each farmer gets a license to obtain fertilizer from the Agriculture Cooperative Bank, which insures that the amount of fertilizer applied is related to recommendations. The timing of fertilizer applications, a farmer's decision, is still based on visual observations, but plans are to explore and introduce petiole analysis, the evaporation transpiration rate and other more accurate methods to assess the need for water.

Important Pests

Earias insulana, *Helicoverpa armigera*, *Agrotis ipsilon*, *Creontiades pallidus* and *Laphigma exyguia* are important worms and bugs that may show up on cotton. But spiny bollworm and cotton bollworm are more important than other insects. Among sucking insects, although whitefly caused significant losses in yield in 1987, it is not considered to be a pest on cotton except in areas where watermelon is grown in abundance. Aphids, thrips, jassids and mites are observed in all re-

gions but their population only occasionally reaches economic threshold levels. During the 1980s, about 50% of the total area was sprayed and cotton yields were lower than now.

If required, insecticides are used only after a particular insect has reached an economic threshold level. The economic thresholds for various pests are the following: 5% live larvae/square meter for bollworms; 3 live larvae/square meter for cutworms; 10-15 live larvae/100 plants for green worms; 10 infested plants/100 plants for aphids; and 10-20% infested leaves with three moving mites/leaf for mites.

Verticillium wilt caused by *Verticillium albo-atrum* is a major disease throughout production regions. Genetic resistance is a must, and all the currently cultivated varieties have resistance to wilt. Planting cotton in rotation with cereal crops also helps to contain the disease. Damping off caused by *Rhizoctonia solani* may also show up, but usually no control measures are required. Angular leaf spot is another disease that may also show up particularly in areas irrigated by sprinklers. The Cotton Bureau, because of the effects associated with the system, does not support sprinkler irrigation.

1998/99 has been abnormal in Syria due to exceptionally high temperatures at the flowering stage. The critical limits for the Syrian varieties are a maximum temperature of 38°C and a minimum temperature of 21°C. Day temperature over the critical limit and night temperature lower than the critical limit enhance the photorespiration rate thus affecting the net photosynthesis. Due to the hot summer, this year's crop index was through early August and lower yields are expected. But, the established natural biological control balance is so high that the pest situation is not different than any normal season.

Scouting Service

Three organizations are involved in the decision to apply insecticides. The Directorate of Plant Protection of the Ministry of Agriculture has plant protection branches within the provincial Department of Agriculture that play a major role. The plant protection branch, Cotton Bureau and the extension staff must agree to give a go-ahead signal to the grower to use an insecticide. The extension staff of the Department of Agriculture undertakes a weekly scouting of the cotton fields throughout the cotton regions. If some fields are found to have infestation reaching the economic threshold, the level of infestation is reported to the plant protection branch of the provincial Department of Agriculture. A committee of three persons from the Department of Agriculture re-estimates the level of infestation in the

Area Sprayed with Insecticides in Syria

Year	Area Sprayed (%)
1985	25
1986	15
1987	29
1988	4
1989	8
1990	2
1991	5
1992	5
1993	3
1994	3
1995	4
1996	3
1997	1

infested fields and decides whether or not a field should be sprayed.

Reasons for Success

Pesticides and Their Use

Rise in Threshold

During the late 1980s the whitefly population was on the rise, which could have turned this insect into a serious pest in Syria. It was a time when insecticide applications against spiny bollworm, *Earias insulana*, and cotton bollworm, *H. armigera*, were recommended as a protective measure at the lower economic threshold of 2% live larvae/square meter. In 1988, the economic threshold was revised to 5% live larvae/square meter. If the low threshold applications against spiny bollworm and cotton bollworm would have continued, it could have triggered whitefly population and helped to establish it as a permanent pest.

Pesticides Used

Experts decide what pesticides are imported by the government. Only a limited number of the most effective insecticides are imported. Because the government is the only source of supply, chances of pesticide adulteration do not exist. A limited quantity of insecticides is imported by the private sector but private companies are not allowed to sell any product to farmers without authorization from the extension service.

Misuse of Insecticides

As farmers cannot buy insecticides on the open market and as they require a prescription to buy insecticides, unnecessary use has been avoided helping to build a sound natural biological control balance. Not only the right product is used, but insecticides are used only in recommended doses.

Agronomic Measures

Early Planting

Early planting, despite low soil temperature in April, is strongly recommended. Emergence of insects from the overwintering population is low and insect populations build up only late in the season. Early planting can easily provide an escape from insects.

No Weed Infestation

The role of weeds in hibernating insects and their competitive effect for nutrition and water do not need emphasis. Syrian cotton growers are very conscious of weeds in their fields. More than 90% of the total area is treated with herbicides; even if herbicides are not used, weeds are removed mechanically. Manual labor is also employed to remove weeds but to a smaller extent. Cotton fields are always clean from weeds.

Plant Density

Though a high seed rate is used in Syria, thinning is properly done to space plants for aeration and to avoid multiplication of sucking insects. It is recommended by the Cotton Bureau that only 8-10 plants per square meter be maintained. More than 90% of the farmers trust the Cotton Bureau recommendations and adopt them.

Rank Growth

Rank growth is avoided through application of only required doses of nitrogen fertilizers. It is particularly recommended that excessive irrigation be avoided.

Legislative Measures

If a field is found to be affected by insects and insecticide application is necessary, growers are required to spray the crop according to recommendations by a committee of the three entities mentioned above. If the farmer does not spray, the extension staff will spray the crop and the farmer will be charged double the cost.

Chemical control of whitefly is forbidden in cotton fields.

Only recommended varieties are planted and no cotton can be planted after mid May. The number of recommended varieties is also limited. Currently, only four varieties are permitted for cultivation, i.e., Aleppo 40, Ark 5, Aleppo 33/1 and Deir El-Zore 22; the first three have high resistance to verticillium wilt.

Bio Control

The following predators and parasites are active in cotton fields:

Predators

Chrysopa spp.
Hydaticoris spp.
Campylomma spp.
Orius spp.
Scymnus spp.
Deracoris spp.

Parasites

Habrobracon spp.
Apanteles spp.
Encarsia spp.

No commercial scale rearing of the natural enemies of cotton pests is done in Syria yet. During 1998, only *Trichogramma*, *Trichogramma principium*, was reared and released on about 300 hectares. As the pest pressure is low it may not be economical to rear and release natural enemies. But, the Cotton Bureau and the Ministry of Agriculture are doing extensive research on rearing capabilities and usefulness of natural enemies to continue reliance on the natural balance in lieu of chemical control as long as possible.

Quarantine Measures

Syria has traditionally grown only locally developed varieties. But, the genetic base of the local varieties has been maintained wide as foreign varieties have been extensively used in the breeding program. Among the four currently cultivated varieties, two are direct selections from US varieties, one is a selection from Tashkent 3, while the most popular variety, Aleppo 40, has 50% Acala SJ1 blood. Aleppo 90, approved for general cultivation to replace Aleppo 40, has also been developed locally.

Syria has frequently imported germplasm from other countries for breeding purposes and vice versa. But, the Syrian authorities strongly insist on having a certification from the sending country that the seed has been treated and it is free of any diseases and pests.

The seed allowed into the country is first tested at research stations under the direct supervision of researchers. The crop is destroyed if there is any doubt that it has symptoms of any disease or insect. In 1997, some varieties were received in quarantine from India but the Cotton Bureau decided not to accept the seed because of leaf curl disease. According to the Bureau, they did not have the capabilities to make sure that the seed was free from viruses causing leaf curl disease, thus the seed was not allowed into the country.

With regard to cotton, the quarantine service, in which the Cotton Bureau is actively involved, is maintaining three lists of insect pests: Insect pests found in Syria; insect pests rarely found in Syria; and a list of insect pests not reported to exist in Syria. Import of seed is strictly monitored according to the three lists.

Breeding Priorities

As the insect pressure is not high, all breeding emphasis is on yield and quality improvement. Communications with the breeders confirm that they are not under pressure to include insect tolerance in their varieties.

Marketing of Seedcotton

All the cotton produced is sold individually by farmers to the Cotton Marketing Organization. In the beginning of the season, taking into consideration the cost of individual inputs to the farmer, a base price is fixed by the government. The base price is announced prior to the planting season, giving growers sufficient time to decide how much area they plan to bring un-

der cotton. Though it should serve as a critical factor in the total area planted to cotton, the current level of the base price has practically no impact on the cotton area.

CMO has designated points where seedcotton can be delivered. Farmers put their produce in sacks normally weighing from 150-160 kgs. Most of the centers are located at gins, also owned by the CMO. In cases where farmers are too far from gins, for their convenience, collection centers are established closer to the production areas, and CMO undertakes to transport seedcotton to gins.

In order to encourage production of better quality, the farmer's price is decided by the CMO based on seed cotton grades. There are four main seedcotton grades 0, 1, 2 and 3. Farmers are also paid on the basis of staple length, ginning outturn and humidity in the seedcotton. High ginning outturn varieties are grown in Syria and normally GOT ranges from 36-39. There are premium and discounts on over 39% and below 36% respectively. Though commercial gins are saw gins, a one-kg seedcotton sample is tested on small experimental roller gins to fix the price for the farmer. Similarly, seedcotton weight is adjusted on the basis of humidity below or above 8%.

Availability of Technology to Other Countries

The technology adopted in Syria is available for other countries through the Cotton Bureau. Lately, Egypt has adopted some of the recommendations and significantly reduced insecticide use.

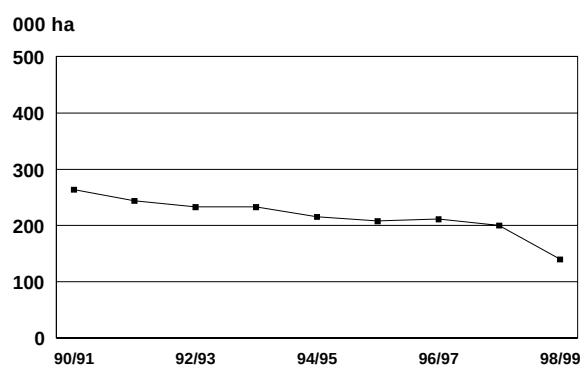
Cotton Growing Conditions in Azerbaijan

In Azerbaijan, out of the total area of 86,000 square kilometers, 18% is arable land. Perennial crops are established on 4% of the total area while 25% of the area is under pasture. Irrigation facilities are available for 14,000 square kilometers. About 32% of the work force is engaged in agriculture. Cotton is one

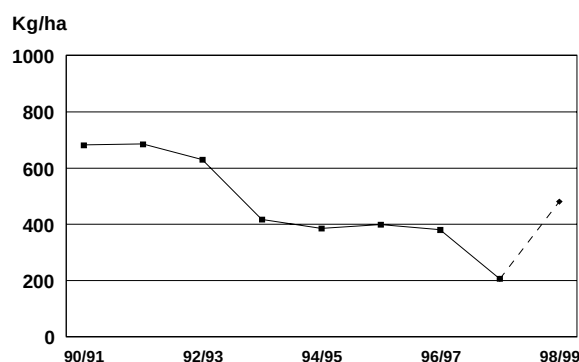
of the main crops, but Azerbaijan is rich in natural resources and the main sources of foreign exchange earnings are oil and gas followed by chemicals and then cotton.

In 1990/91, cotton was grown on 264,000 hectares with a total production of 180,000 tons. In the last nine years since

Cotton Area in Azerbaijan



Cotton Yields in Azerbaijan



Azerbaijan became an independent country changes have occurred in the production system that have significantly affected the cotton area, production and yields. While cotton area dropped steadily to 140,000 hectares during 1998/99, by 1994/95 cotton yields dropped by 40% from the level during the early 90s. The average yield during 1997/98 dropped to 207 kg/ha as against 682 in 1990/91. The reasons for lower yields are a change from a large-scale farming system to small-scale private ownership, lack of credit facilities, no assurance for a good price and lack of input supply due to transitional changes occurring in the country.

Cotton Producing Regions

Cotton is grown in about twenty different regions. During the 70s Barda, the largest cotton area, produced more than 50% of what is being produced in the country today. Agdzhabedi and Saatli are comparatively less productive areas due to poor soil fertility. Planting is early and the crop also matures early in the Barda, Sabirabad and Neftechala regions. Weather conditions are similar in all regions; however, soil conditions are greatly different. Sabirabad has particularly heavy soils, while salinity is a problem in other regions.

Cotton Producing Regions in Azerbaijan

Region	Share in Production (%)	Major Variety
Barda	10-15	Mugan – 395
Sabirabad	10-15	AZ – 317
Agdzhabedi	10-12	Mugan 30/38
Beilagan	8-12	AZ Nihi – 33
Geokchay	8-12	AZ Nihi – 104
Saatli	6-8	Agdash – 3
Agdash	5-7	Agdash – 3
Salyan	<5	AZ Nihi – 170
Neftechala	<5	Agdash – 3

Variety Development

All varieties have been developed locally from genotypes of local origin. Lately, some Acala types were tried but they took about 170 days to mature as against 130-140 days in case of local varieties.

Breeding work is undertaken at three institutes: The Cotton Research Institute at Ganja, the Institute of Genetics in Baku and the Agriculture Department of the Academy of Sciences of Azerbaijan in Baku. No formal surveys are undertaken to estimate the area planted to each variety but it is estimated that seven varieties are planted by farmers. Azerbaijan-317 and Agdash-3, developed by the Institute of Genetics, are estimated to be planted on at least 50% of the total area. AZ Nihi-104, AZ Nihi-170, AZ Nihi-33, Mugan-395 and Mugan-30/38 have been developed at the Cotton Research Institute whose main responsibilities are to develop new varieties. The Institute of Genetics has the responsibility of collection and exploitation

of germplasm. Wild species were also maintained at the Institute of Genetics but due to recent changes many of them have been lost; however, about ten of them including some diploids have survived. The Department of Technical Plants of the Academy of Sciences, which is supposed to deal with many crops, has practically concentrated only on cotton in recent years.

All varieties have similar fiber properties with a ginning outturn of over 36% and have been adopted in different regions. All of them measure at least 26 mm in staple length and 23-24 g/tex in strength. Micronaire ranges from 4.8 to 5.5, which is considered to be high. Breeding efforts are being made to lower the micronaire.

Insect Pests

Important insects are *Helicoverpa armigera*, *Segetum schiff*, *Tetranychus talarus*, *Spodoptera exigua* and *Thrips tabaci*. Mites along with thrips are the first to appear on cotton. Normally 3-4 sprays are given every year for good control against insects. Sprays are always required against the cotton bollworm and cutworm. Like in Uzbekistan, biological control has been traditionally the main approach to control insects. But, for the last ten years, Trichogramma release has decreased and reliance on chemical control has increased significantly. More recently, changes in the production system have put farmers entirely at the mercy of insecticides. It is thought that the high rate of insecticide use and little change in the spray machinery will quickly lead to greater insecticide use and to the ill effects of under and over dosing.

Verticillium wilt is a great threat and all varieties must have natural resistance to the disease. Though the degree of infestation varies among regions, 12-18% of all varieties shows disease symptoms under normal conditions. Angular leaf spot caused by *Xanthomonas campestris* pv. *malvacearum* is also a noted disease but does not cause any significant losses in production.

Agronomic Management

In Azerbaijan, rains are received during October and November but may continue up to March. Efforts are made to plant wheat before the rainy season starts. Wheat is harvested in July and about 50% of cotton is planted in the area previously occupied by wheat. Cotton is usually planted on the same land for three years, alfalfa for two years and wheat for one year.

After the harvest of wheat, a rotavator is used and the soil is left bare. A second lighter rotavator is used in October or November followed by leveling. Then, the soil is left to conserve moisture during winter. In most cases, a pre-soaking irrigation is applied in the second week of March, particularly if rains stop early. Small furrows are made in March to drain water from late rains, if any. However, cotton planting starts by mid April. Sorghum is an alternate crop for the majority of the farmers, but alfalfa and vegetables can also be grown if cotton is not grown.

Ten years ago, herbicides were used on a large area but currently herbicides are not applied to cotton. It is desired to have a plant stand of 7-8 plants/meter with 80,000 plants per hectare, producing 10-12 bolls per plant.

Fertilizer application rates have been almost constant for many years. Nitrogen is applied at the rate of 100 kg N per hectare while phosphorous is given at the rate of 150 kg P₂O₅. 80% of the N fertilizer is applied at the time of planting, while 20% is applied at peak flowering stage. Previously, soil analysis showed that there is no need for K but now it is assumed that this recommendation needs to be updated. Potassium deficiencies have been noted in many regions.

Cotton is all irrigated, mostly from river water. About 8-10% of water needs are met from underground water. Water shortages have been experienced. Current availability is enough for 2-3 irrigations, while cotton in Azerbaijan would normally require 4-5 irrigations.

By the end of the Soviet regime, 50-60% of the total area was picked with machines. As maintenance became a problem and the government started distributing land among farmers, hand-picking had to be adopted. Now it is assumed that virtually all cotton is handpicked. A ginner-dominated privatization also played a major role in popularizing handpicking.

Privatization of the Ginning Industry

Previously, the Ministry of Agriculture was in charge of production and also responsible for making new production technology available to farmers. In a centrally controlled production system, the government was also responsible for providing credit to the cotton growers. The privatization of land coincided with the inability of the government to provide finances, consequently weakening the ability of farmers to grow cotton. More recently, the government withdrew the staff responsible for extension services.

In 1995, the government decided to privatize the ginning industry. In total, there are twenty gins now owned by eight companies, MKT, owning five factories, being the largest. However, MKT is currently managing fourteen gins owned by four companies including MKT. When credit facilities and extension service were still responsibilities of the government, gin-

ners bought cotton from farmers on a cash basis. Farmers would bring cotton to collection centers and would be paid on the spot. With the withdrawal of government assistance, cotton yields dipped to less than 30% of those in 1990/91. Farmers were discouraged from cotton cultivation, and cotton was planted on 155,000 hectares in 1998 as against 200,000 hectares in 1997/98. Low yields and declining trend in the area is a great challenge for ginners to survive.

Ginners have decided to provide inputs, credit and advisory services to growers, and 1998/99 is the first year when farmers were provided with these facilities. Ginners also decided to provide a guaranteed minimum price for the first time. Though ginners still prefer being involved in only buying and ginning, they had to get involved in the supply of inputs and advisory services if farmers were to continue growing cotton. Now they are involved in all production operations including provision of all inputs, i.e., seed, insecticides, sprayers, fertilizers, etc., and contracts are signed on a farmer-by-farmer basis.

Agroincom, owned by the government, used to procure cotton from farmers and arrange its export. With the privatization of the ginning industry, Agroincom has been abolished and ginners are free to sell cotton wherever they want. Thus ginners also have to work as exporters.

Initial observations show that farmers are satisfied with the provision of inputs including credit by ginners, and high yields of over 600 kg/ha are expected during 1998/99. If such yields are achieved, the cotton area will definitely increase significantly next year.

The role of the Ministry of Agriculture has been restricted to fundamental research, development of varieties, production of first generation seed for multiplication, formulation of production technology and coordination of research done by 21 institutes on all disciplines of production research and technology.

All farmers pay 15,000 manats/ha as a tax to the government. The ginners pay 20% of the sale price as a tax to the government.

The data on the area planted to cotton and other statistical information remains the responsibility of the Statistical Bureau directly under the central government.

Cotton Production System in Turkmenistan

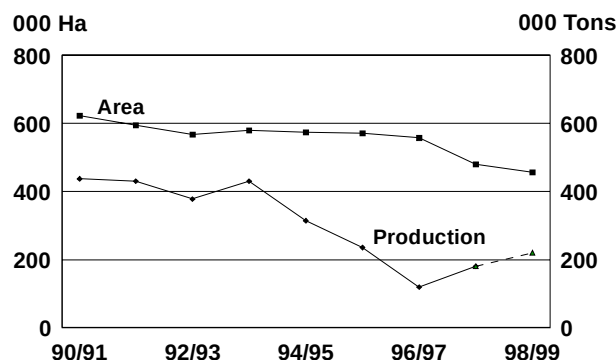
Turkmenistan is the second largest cotton producing country in the Commonwealth of Independent States. By area, Turkmenistan is the ninth largest cotton growing country in the world. In addition to five major producing countries that share three-quarters of total cotton area in the world, only Argentina, Brazil and Turkey have grown more area to cotton in the past than Turkmenistan.

Cotton is the most valuable agricultural crop for Turkmenistan. According to the latest ICAC estimates, during 1998/99 cotton

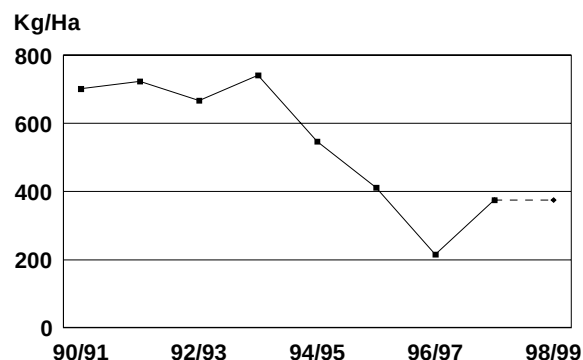
was planted on 456,000 hectares in Turkmenistan. In 1990/91, cotton was planted on 623,000 hectares but since cotton area has been steadily declining. In nine years, cotton area has declined by over 150,000 hectares. The main reason for the decline in area is lower yields. Unless the yield trend is changed, it may be difficult to arrest the declining trend.

The current yield is only 50% of that in the early 90s. In 1997/98, a yield level of 375 kg lint/ha was achieved, a large increase over the previous year. It is estimated that the same yield

Cotton Area and Production in Turkmenistan



Cotton Yields in Turkmenistan



level will be sustained during the current year. Turkmenistan has the varieties, technology and know-how to produce over 700 kg/ha lint. But, current transitional changes are limiting cotton production. The plan to build and upgrade irrigation facilities along the Kara Kum Canal in the South and the Tashauz Canal in the North could provide a big boost to cotton production in Turkmenistan.

In the last nine years production has fallen to 180,000 tons in 1997/98, from 437,000 tons in 1990/91. Production of 220,000 tons is expected during the current season.

Of the 49.4 million hectares of land in the country, over 80% is classified as suitable for agricultural production. But, much of the land is desert pasture and only 1.74 million hectares are irrigated arable and used in intensive cultivation. Thus, cotton is planted on about one-third of the total irrigated area. Raw cotton exports usually account for more revenue than all other agricultural products together. Agricultural production in total accounts for about 50% of Gross Domestic Product.

Cotton Producing Regions

Turkmenistan is divided into five administrative regions called welayatys; cotton is mainly grown in four welayatys. Unlike in some other countries, upland and barbadense areas are not isolated in Turkmenistan. Almost all producing areas are suitable for barbadense but at a lower yield potential. Mary and Dashhowuz welayatys remain the main extra-fine cotton grow-

ing areas. Lately there has been a tendency to grow more upland varieties in these areas as well.

In Turkmenistan, the rainy season usually ends by the end of March. Cotton planting starts at the beginning of April and is normally completed by the end of the third week of April. Early picking starts in September but most picking is completed before the end of October, particularly in upland varieties.

Growing Conditions

Applying fertilizer at the rate of 170 kg of pure nitrogen, 125 kg of pure phosphorous and 100 kg pure potassium per hectare is recommended. All phosphorous and potassium fertilizers are applied at the time of planting. 40% of the recommended N dose is applied at the time of first irrigation, 40% at early flowering stage, and the remaining 20% at peak flowering stage. In addition to synthetic fertilizers, farmyard manure is commonly used.

High maximum temperatures slow down the rate of fruit formation (there may be fruit shedding, particularly in July) and a part of the fruit energy is used in vegetative overgrowth. Nitrogen seems to be used in doses higher than required to maintain the optimum rate of growth. In order to save late-formed bolls, topping is commonly done. Farmers go through the field and manually clip the top of the plant, so that the bolls already formed will have a healthy growth. The only other country where topping is commonly done is China (Mainland). In the Yellow and Yangtze River valleys of China (Mainland), the economic benefits of topping have been proven.

Nitrogen is applied to all the area and its needs are perfectly met. But, due to limited supplies of imported phosphorous and potassium fertilizers, P and K are usually not applied in the recommended quantities. Potassium that has not been applied to certain areas for years could be responsible for the yield decline.

If cotton is not planted, farmers can plant wheat, corn, sugarbeets, rice in a limited area and a variety of vegetables. There are no short-term crop rotations. The most popular crop

Cotton Producing Regions in Turkmenistan

Region	Share in Production	Special Features
Mary	35%	Hot and dry climate with maximum temperature reaching 45-47°C
Dashhowuz	30%	Climate similar to Mary Welayaty but sowing starts earlier and ends by May 15-20
Lebap	25%	Soil salinity is a problem
Ahal	10%	Soil salinity is a problem
Balkan	< 5%	Cotton is a new crop in this area

rotation is alfalfa for three years, cotton for five years and vegetables or corn for only one year. Almost all the cotton area is defoliated, though only 25% of the area is machine picked.

Irrigation Water

Developing better irrigation water facilities is a key to the growth of the agriculture industry in Turkmenistan. Water is shared from the four international rivers: the Amu Darya, the Mongrab, the Tedgin, and the Atrok. Water is further distributed within the country by the Kara Kum Canal, linking the Amu Darya and the Caspian Sea over 1,400 kilometers. A furrow irrigation system is used.

On average, cotton is irrigated from three to five times during the season. The number of irrigations depends on the availability of and not the need for water. Though water is in limited supply, cotton usually does not suffer as the planting area is regulated based on the amount of water available for a specific farm.

Seed is planted on ridges. Thinning is properly done, following a recommendation to maintain a plant stand of 10-12 plants per meter and a total population of 100-120,000 plants per hectare. Weeds are removed manually and mechanically, with only 10-12% of the total area being treated with herbicides.

Insects have not been important in Turkmenistan, but for the last few years whitefly has become an extremely important pest. It is not sure if it is a sweetpotato whitefly *Bemisia tabaci* (biotype A) or a silverleaf whitefly *Bemisia argentifolii* (biotype B). The whitefly population starts building up in early July and may require at least three consecutive sprays to keep it below threshold levels. Currently, less than 50% of total production is affected by whitefly but the whitefly population is building up year after year. 1998/99 has been particularly bad because the whitefly population has exceeded the economic threshold level for longer time than usual. Hot and dry weather is favorable for insect multiplication, and there are no barriers for the fly to move from one area to the other. It seems that the natural parasites and predators balance against the whitefly has been seriously disturbed. No parasites and predators—*Encarsia lutea*, *Eretmocerus mundus*, *Coccinella carnea*, *Coccinella undecimpunctata*, *Coccinella septempunctata*, *Scymnus* spp., *Chrysopa carnea* and *Orius albidipennis*—seem to be working in Turkmen cotton fields. No other non-chemical efforts are being made. Because the currently adopted protective approach is the use of insecticides when whitefly emerges, it is feared that all production area in Turkmenistan may be affected with whitefly in the next few years.

Cotton bollworm, *Helicoverpa armigera*, is another pest that may

occasionally require an insecticide spraying. The number of sprays against bollworms is not more than one; no spray was needed against bollworms in 1998/99.

Medium staple and extra-fine varieties are affected by verticillium wilt and fusarium wilt respectively. Verticillium is not serious and no control measures need to be adopted. However, fusarium wilt may cause significant losses in plant stand. Compensating loss in plant stand through a higher seed rate is being tried.

Varieties Grown

The commercially grown varieties have been developed locally as well as adopted from other Republics of the former Soviet Union. Most of the varieties in production were developed before Turkmenistan became an independent country, some as old as twenty years. The Cotton Division of the Turkmenistan Academy of Agricultural Science is responsible for breeding new varieties and the development of technology. The Academy is based in Ashgabad but the cotton research staff and fields are located about fifty kilometers outside Ashgabad. The Breeding and Seed Production Institute at Yoloton in the Mary welayaty is another important cotton research facility. Planting seed production from pre-basic, called "Elite" in Turkmenistan, to basic and certified stages is the responsibility of the government. Undelinted seed is used for planting.

Privatization of Cotton Production

Since 1996, the cotton production system in Turkmenistan has changed to private farming. Land is still owned by the government but it is cultivated collectively by a group of farmers. The farmers, called "arandator" meaning renter, pay 50% of the cost of inputs and the remaining 50% is born by the government. The government has signed contracts with renters for ten years but contract conditions, particularly seedcotton price and service charges, are renewed every year.

Through a centralized management, renters decide the quantity of fertilizer to be applied to cotton. Cotton is grown in large blocks and it is not possible to apply fertilizer to two or three hectares cultivated by an individual renter. Thus all fertilizer

Cotton Varieties Grown in Turkmenistan						
Varieties	Growing Duration (days)	Boll Weight (grams)	GOT (%)	Staple Length (mm)	Strength (g/tex)	Cotton Type
Medium Staple						
133	130	6.7	32.5	28.6	24.0	IV
149 F	128	6.5	34.6	27.5	22.5	IV
C - 4727	115	5.6	34.2	26.1	23.0	V
AW - 36C	120	6.5	34.6	29.4	24.0	IV
Extrafine						
AW - 25	131	3.4	34.4	32.2	24.5	I
9871 - E	130	3.3	30.0	30.2	24.0	I
AW - 97	122	3.0	36.0	31.4	23.0	I

application is done collectively, although requisitions are formally prepared by individual renters. A similar practice is followed regarding insecticides and other inputs.

Every renter is entitled for credit from the government equivalent to about 30% of the value of his produce. If so desired, each renter is issued a checkbook to pay for the input costs. He is free to use this advance for other needs but he cannot refuse to apply inputs to cotton. It is not possible to differentiate one renter's area from another and most field operations are done collectively except picking. Each renter picks his own cotton to avoid charges for machine picking.

Khopkhoprom, through its management offices in the production areas, is responsible for the procurement of inputs and production of cotton. Khopkhoprom is also responsible for buying cotton from farmers. During 1997/98, renters were paid at the

rate of 1,000 manats/kg seedcotton for upland and 1,500 manats for extra-fine varieties. The price may remain the same during 1998/99. The cost of inputs and other collective operations is deducted from income and the rest is paid to the renter. Seedcotton thus purchased is the property of Turkmenpakhta, also a government organization that is responsible for exporting cotton.

Plan

Government plans are to achieve a total production of 2 million tons of seedcotton. It is planned to increase yields and extend irrigation facilities to grow 650,000 hectares of cotton. It is assumed that it would not be a problem to achieve 2 million tons of seedcotton if Turkmenistan were able to grow 650,000 hectares.

Short Notes

• Changes in the US Ginning Industry

In the last three decades, the US ginning industry has undergone significant changes in different directions:

Gin consolidation

The US ginning industry has been consolidating for the last eight decades. The process of consolidation continued at a higher rate during the last three decades. In 1968, 4,210 gins operated in the US, but in 1988 the total number of gins had been reduced to only 1,645. The number of active gins decreased to 1,157 in 1996, a 30% reduction in gin number in eight years. The trend toward larger gins has still not reached its end and the consolidation process will continue, perhaps at a slower rate. The 73% reduction in the number of gins in the last three decades has not lowered ginning capacity. Average annual gin volume has increased 560 tons of lint to about 3,225 tons per gin.

Universal Density

Due to variations in bale dimensions and bale weight, only a small percentage of world production is packed in Universal Density Bales. In the USA, the percentage of total production that is pressed and packed in Universal Density reached 99% in 1996, as against 41% in 1981. Concentration of the ginning process and incentives from warehousing facilities triggered the shift to Universal Density.

Moduling Seedcotton

More recent data are not available, but four years ago about 78% of the total seedcotton was stored in modules at farms. It is estimated that now about 85% of total seedcotton production will arrive at gins in modules.

Seed Storage

There is a continuous increase in the capacity to store higher quantities of cottonseed for a longer period of time. Consequently, the percentage of seed fed directly to livestock increased to 45% in 1995, from only 13% in 1979.

Lint Storage

There is an increasing trend for gins to own warehouses for bale storage.

Ownership

More and more farmers are becoming involved in the ginning business.

Machinery Changes

As in other countries, there is no change in the fundamentals of ginning. Roller ginning and saw ginning are still the only ways to separate lint from seed. A number of new ginning systems have been tried, but the only one going beyond the experimental stage is cage ginning. The Templeton Rotary Gin, developed in the UK, is being tried on a commercial scale in the USA. Seedcotton and lint cleaning processes have reached a peak in the USA. US gins have installed module feeders at a higher rate for cost savings.

Ginning Charges

Thirty years ago, in 1967, ginning charges per bale of 218-kg lint were US\$18.60. The cost of ginning, which is born by the farmer, more than doubled by 1980. Since 1980, though ginning charges have slightly fluctuated from year to year, the cost of ginning has not increased in the US. In 1995, farmers paid an average of US\$42.37 as ginning charges for every bale of lint.

IntelliGin

Conventionally, all cotton goes through the same process of drying and cleaning irrespective of the amount of trash and moisture contents. A computerized system of on-line measurement of trash and moisture has recently been developed for making adjustments in the drying and cleaning processes. The system called "IntelliGin" has been licensed to a private company and because of savings in both processes and higher lint recovery it is expected to be adopted quickly. Efforts are also underway for on-line measurement of more

characters. (Source: *The Cotton Gin and Oil Mill PRESS*, Vol. 99, No. 13, 1998)

• ICAC/CFC Project on Leaf Curl Virus

The cotton leaf curl virus (CLCuV) has been a devastating problem for cotton in Pakistan since 1992. The disease has greatly affected the socioeconomic potential of the country due to a marked decrease in foreign exchange earnings from exports of raw cotton and cotton goods. A number of national and international cotton groups have been working on investigating and finding solutions to eradicate the disease. One such effort is a project sponsored by the International Cotton Advisory Committee and funded by the Common Fund for Commodities. The National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad, Pakistan; the University of Arizona, Tucson, USA; and the John Innes Centre, Norwich, UK, are working together on the project. The main objectives of the project are biological and genetic characterization of whitefly transmitted geminiviruses of cotton, development of in-vitro transformation systems for cotton and development of geminivirus resistant genotypes of cotton by conventional breeding and genetic engineering.

Geminiviruses infect several plant species and the typical symptoms include leaf curling, mosaic pattern and stunted plant growth. The cotton leaf curl disease (CLCu) is characterized by leaf curling, thickening of veins, enations (secondary leaves) on the lower side of the leaf and stunted plant growth. Yield is drastically reduced.

The tripartite project started its activities in January 1996 and will continue for five years. So far the project has accumulated substantial information on various aspects of the disease, its causal organism and control.

Molecular characterization of whitefly transmitted geminiviruses of cotton occurring in both the Old and New World is almost complete. Several genomic sequences have been deposited in various data banks. Biological characterization of CLCuV is also being carried out by establishing efficient systems of a host pathogen vector system. Sensitive and easy diagnostic tools for identification of CLCuV in cotton and its alternate hosts, and in the vector, have been developed.

Development of virus resistant cotton through conventional breeding and genetic engineering is another important feature of the project. The Cotton Research Institute, Faisalabad, Pakistan, incorporated several exotic genes in their breeding program for developing virus resistant cotton. The breeding material is already at advanced stages. Cotton transformation (genetic engineering) has been very well established at NIBGE, Pakistan, and is being routinely carried out. Various DNA constructs derived from the virus genome are used by employing anti-sense RNA technology for imparting virus resistance. A biolistic gene gun is used to introduce foreign genes to cotton. A special procedure has been developed for this purpose. Several transgenic lines of cotton have been developed and are being evaluated in a containment facility especially developed for this purpose keeping in mind all the biosafety requirements. (*Contributed by the Project Executing Agency, NIBGE, Pakistan*)

TIS Publications

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)

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 future plans are also included. (October 1998, US\$50.00)

CURRENT RESEARCH PROJECTS IN COTTON

Contains detailed information on the structure of research in 47 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. (192 pages, October 1997, US\$100)

SURVEY OF COTTON PRODUCTION PRACTICES

Cotton growing conditions vary from country to country and sometimes even from region to region within a country. The 95 page report contains data from 34 countries 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. (95 pages, October 1996, 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 or Spanish. (81 pages, October 1996, hard copy, US\$75; Internet, US\$50)

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, 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, October 1995, US\$25)

COMMON FUND PROJECTS

Technical Seminar at the 56th Plenary Meeting. Papers by international experts include: The Common Fund for Commodities-Cooperation for Development; Integrated Pest Management for Whitefly in Cotton; Integrated Management of Cotton Sucking Insect Pests in Egypt; ICAC/CFC Whitefly Project Activities in Zimbabwe; Integrated Pest Management of the Cotton Boll Weevil in Argentina, Brazil and Paraguay; Argentinean Research in the Context of the Project "Integrated Management Program of the Cotton Boll Weevil in Argentina, Brazil and Paraguay;" Development and Validation of Strategies for Integrated Management of the Boll Weevil, (*Anthonomus grandis*, Boh., 1843) in Brazil; Boll Weevil Population Dynamics in Paraguay; Incidence and Parasitization Studies of *Anthonomus grandis* Boh. in Paraguay; Cotton Leaf Curl Virus Epidemic in Pakistan: Virus Characterization, Diagnosis and Development of Virus Resistant Cotton through Genetic Engineering; Global Diversity and Distribution of Cotton-Infecting Geminiviruses: An Essential Requisite to Developing Sustainable Disease Resistance; Improvement of the Marketability of Cotton Produced in Zones Affected by Stickiness. (52 Pages, October 1997, hard copy, US\$75; Internet, US\$50)

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 governments 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-two governments:

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

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