

## **REGIONAL SHIFTS IN CHINA'S COTTON PRODUCTION AND USE**

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### **Abstract**

While overall cotton production was fairly stagnant in recent years, there have been important geographic shifts that are hidden in the total production numbers. This article examines the geographic distribution of cotton production and uses in China.

### **Introduction**

China has maintained its position as the largest producer and consumer of cotton in the world, but growth in cotton production did not keep up with textile output growth during the 1990s. From 1990 to 2000, annual cotton output fluctuated around 4.4 million tons while estimated use of cotton in yarn production (including synthetic fibers) grew 25 percent (figure 1). With textiles expected to be one of the chief beneficiaries of China's accession to the World Trade Organization (WTO), further growth is expected. Since 1998, China has avoided large cotton imports by drawing down domestic cotton stocks and increasing the use of synthetic fibers, but continued growth in textile production expected after WTO accession suggests that imports will have to grow unless domestic production can be expanded.

This article examines the geographic distribution of cotton production in China. While overall cotton production was fairly stagnant in recent years, there have been important geographic shifts that are hidden in the total production numbers. This timely update on the geography of cotton production will help analysts make a better assessment of China's cotton production capacity.

### **Regional Characteristics of China's cotton**

Cotton is grown in most of China's provinces, municipalities, and autonomous regions, from the border areas of southern Yunnan to northeastern Liaoning and northwestern Xinjiang (figure 2). The major producing areas can be divided into three regions: the Yellow River valley, the Yangtze River valley, and the Northwest (figure 3 and table 1).

The Yellow River region encompasses the northern China plain, extending south from the Great Wall in northern Hebei province to the Huai River that flows through central Jiangsu and Anhui. The Yellow River region includes the northern provinces of Shandong, Hebei, Henan, Shanxi, and Shaanxi, and the municipalities of Beijing and Tianjin. In 2000, Henan was the leading cotton-producing province, with 0.7 million tons. The weather is often dry in the spring and irrigation is needed for cotton production (see details in table 1). The major portion of the rainfall comes in summer, while the weather is usually dry in the fall during harvests. Because of its northern location, this region has about 180 days in the growing season and has to adopt early-maturing cotton varieties, which are usually double-cropped with winter wheat. American upland species, especially the early big boll types, were introduced and found to be well-adapted to this region in the 1930s (Shen). Most cotton is shipped by truck or rail to nearby textile mills.

The Yangtze (Changjiang) River originates in Sichuan and flows east through Hubei, Anhui, and Jiangsu provinces. The Yangtze valley cotton area is bordered on the north by the Qinling Mountains in southern Shaanxi and the Huai River. The region includes Jiangsu, Anhui, Hubei, Hunan, Jiangxi, and Zhejiang provinces. Shanghai, a province-level municipality, is geographically within this region, but it has little cotton production, so we exclude Shanghai from the Yangtze cotton region. As we will see below, Shanghai was historically an important yarn production center, but its production fell steeply in the 1990s.

In contrast with the Yellow River and Xinjiang regions, rainfall is relatively abundant in the Yangtze region. Annual rainfall averages more than 1,000 millimeter (or 3.38 feet), over 85 percent of which come during the cotton-growing season. Excessive rainfall in late summer and early fall often hurts cotton quality by fostering cotton pests and diseases. With long growing season, cotton is usually double-cropped with a winter crop (wheat or rapeseed) in the region. Transplanting of seedlings is a common practice in double cropping, which saves about 2 weeks of seed germination and growing time. Jiangsu and Hubei are the two leading cotton-producing provinces in the region, each yielding 0.3 million tons in 2000. The abundant water in the Yangtze region also provides transportation for cotton, both on the river itself and on a network of canals cut through rivers and streams and connected to the Huai and Yangtze rivers. Cotton gins and mills are situated along the rivers largely for the convenience of transportation.

The Northwest region includes primarily the Xinjiang Uighur autonomous region plus northwestern Gansu province. Xinjiang covers one-sixth of the entire area of China and borders Tibet, Mongolia, and Central Asia. The Northwest climate is arid, with annual precipitation below 200 millimeter and wide daily swings in temperature, but dryness has kept pest and disease problems to a minimum. Xinjiang mainly grows upland cotton, with high quality color and fiber length due to its favorable climate conditions compared with eastern regions. Xinjiang has the only long-staple cotton production base in China.

Xinjiang's remote location makes transportation vital. More than 70 percent of Xinjiang's cotton crop is shipped to eastern provinces or to foreign destinations. Xinjiang's capital, Urumqi, is linked to the Chinese rail network by a dual-track system to Lanzhou in Gansu province, a hub that connects with China's main east-west rail network. To the west and south of Urumqi, transportation is mainly by highways and segmented single-track railroads. Farmers use mules and light trucks for shipping cotton from their farms to local gins.

### **Varving Yellow River Production**

Except for a brief period in the late 1970s and early 1980s, China's cotton production has not shown an upward trend, but there were important regional changes, including wide year-to-year swings in production in the Yellow River region and gradual but steady growth in Northwest production (figure 4).

Expansion of cotton production in the late 1970s and early 1980s took place primarily in the Yellow River region. Prior to that time, the Yangtze region was the primary production base and production in the Northwest was insignificant. Encouraged by government support policies, the Yellow River region's share of production rose dramatically from 30 percent in 1978 to over 60 percent in 1984, when China's cotton production peaked at over 6 million tons. However, production in the Yellow River region fell again in subsequent years before peaking again in 1991 at over 3 million tons. Production in the Yellow River region then plunged again to 1.4 million tons two years later, in 1993. This was largely due to a severe bollworm infestation, as well as increased labor costs in the region and changes in relative crop returns.

In the late 1990s, transgenic bollworm-resistant cotton varieties -- also referred as *Bacillus thuringiensis* (Bt) cotton -- became available to farmers in Hebei and Shandong provinces, reviving production in the region (Hsu and Gale). Area planted to Bt cotton (mostly in these two provinces) increased from 100,000 hectares in 1998 to more than 1 million hectares in 2000 (Du). Bt cotton's share of total cotton area increased from 2.2 percent in 1998 to 28 percent in 2000. In addition to controlling bollworms, the new varieties reduce labor requirements and health hazards by cutting the number of sprayings of dangerous agricultural chemicals from 10 times to twice a year. While the cost of Bt cotton seeds is 5-6 times that of non-Bt seeds, the reduced costs and higher yields far exceed the difference in seed cost. Farmers in Shandong and Hebei eagerly adopted Bt cotton, even though the government in 1999 stopped guaranteeing that the cotton would be sold at a "protected" (support) price.

Bt cotton has led to a modest recovery in the Yellow River region's cotton production share. The share bottomed out at 32 percent in 1997 and rose to 38 percent by 2000, and was estimated even higher in 2001, but that was still well below the 60-percent share produced in the Yellow River region during the late 1980s.

Cotton production in the Yellow River region is sensitive to prices of competing crops. Data from China's agricultural census indicate that the average Yellow River region cotton farm devoted only 12.8 percent of its acreage to cotton in 1996 (table 2). About 43 percent of the average cotton farm's area was devoted to wheat, often winter wheat double-cropped with cotton. (On average, in this region about 70 percent of a farm's area was planted in two crops per year.) In the Yellow River region, corn is the chief crop competing for cotton acreage. Corn accounted for 22 percent of the average Yellow River cotton grower's sown area in 1996. Soybeans, peanuts, and vegetables each accounted for about 5 percent or less of the average cotton farm's acreage in this region.

Farmers' cotton planting decisions are influenced by profitability of competing crops. During the 1980s and early 1990s, cotton production in Zouping county in Shandong province was usually well below government-set cotton production quotas because cotton procurement prices were not high enough to make growing cotton as profitable as growing other crops (Sicular). In years when cotton procurement prices were raised, farmers raised production.

In 1990s, the cost of high labor and pesticide requirements also reduced the relative profitability of cotton production. In addition to its pest resistance, Bt cotton's lower labor and pesticide requirements have played a major role in encouraging cotton production in the Yellow River region since 1999.

### **Steady Rise in Northwest**

Northwestern production has steadily increased and now accounts for about a third of national production. Xinjiang accounted for only 2.5 percent of production in 1978, but is now the largest producer, with 1.46 million tons in 2000. Gansu's

production was less than 1,000 tons annually prior to 1991, but rose to 5,700 tons by 2000. High yields, low production costs, improved transportation, relatively few pest problems, and a strong government-led push to develop Western provinces have combined to encourage production. Compared with farmers in other regions, northwestern farmers have fewer alternatives to cotton, which accounted for 42 percent of the average northwestern cotton farm's acreage in 1996 (table 2). Wheat and corn account for most of the remaining area.

Production in the Yangtze River region has been more stable than in other regions. Production has varied between 1.2 million and 1.9 million tons since 1978. This region's share of national production has been cut in half from about 60 percent in the late 1970s to 27 percent in 2000. Based on China's cost of production surveys in 1998, the Yangtze River region has the least seed use per hectare (33.2 kg). But, average labor input in Yangtze River area, per mu basis (15 mu = 1 hectare = 2.471 acres), was the highest among the three regions with 442 yuan in 1999.

Rice is the primary crop in the Yangtze region. Cotton's share of acreage on Yangtze River region farms was 13 percent, the same as that of Yellow River farms. However, Yangtze farms had a much higher share of land devoted to rice (29 percent in 1996), which generally does not compete with cotton for land since it is a staple food crop and is grown in irrigated paddies. Farms in this region devoted 23 percent of land to wheat, 10 percent to rapeseed, 8 percent to vegetables, and 6 percent to corn. This region has the highest multiple cropping index, reflecting the intensive use of land in this region.

### **Textile Industry Concentrates in Yangtze River Region**

Yarn-spinning and cloth-weaving industries are primarily located in cotton-producing provinces. In 1999, 45 percent of yarn production was in the Yangtze region, 35.7 percent was in the Yellow River region, and 5.4 percent was in the Northwest. Only 11 percent of yarn was spun outside the main cotton-producing provinces. The leading provinces in yarn production are Jiangsu (over 1 million tons in 1999), a coastal province in the Yangtze region, and its northern neighbor, Shandong (790,000 tons), in the Yellow River region. Two neighboring central cotton-growing provinces, Henan (Yellow River) and Hubei (Yangtze River), also produced over 500,000 tons of yarn each.

Comparison of regional shares of yarn and cotton production for 1999 indicates that most Northwestern cotton is shipped eastward for spinning, while the Yangtze region spins a significant quantity of cotton produced in other regions (figure 5). Note that China's cotton imports were negligible in 1999. The Yangtze River region's share of yarn production (47.2 percent) far exceeds its share of cotton production (27.3 percent), since that a large share of the yarn produced there is made from cotton shipped in from other regions. (Note: Shanghai, an important yarn-producing area, is excluded from the Yangtze River region since it is not a major cotton-producing area and Shanghai's trend differed from that in neighboring provinces). Conversely, the Northwest's share of cotton production (33 percent) far exceeds its share of yarn production (5.4 percent), indicating that most of the Northwest's cotton is shipped outside the region for spinning. The Yellow River shares of yarn and cotton production were similar, suggesting that most cotton produced there is also spun within the region. The share of yarn production in other regions (13.9 percent) exceeded the share of cotton produced outside the 3 major regions (2 percent), since that some cotton is shipped out of the major growing regions to be processed elsewhere, primarily in Guangdong, Fujian, and Shanghai.

From 1990 to 1999, three-fourths of the increase in yarn production occurred in the Yangtze River region, primarily in Jiangsu (340,000 tons), Hubei (180,000 tons), and Zhejiang (120,000 tons). The Yangtze River region's share of yarn production rose from 38 percent to 45 percent between 1990 and 1999. While the Northwest continued to ship most of its cotton to other regions for spinning, its yarn production more than doubled, from 130,000 tons to 310,000 tons. The Northwest's share of yarn production also doubled from 2.8 percent to 5.4 percent. Yarn production in the Yellow River region also increased, but at less than the national rate, and its share of national production fell slightly.

Yarn production outside the three main cotton regions fell. This was primarily due to a decrease of 220,000 tons in Shanghai, as production apparently shifted to lower-cost inland locations in neighboring provinces. In other provinces outside the three major cotton regions, yarn production was roughly constant between 1990 and 1999.

### **Conclusion**

Many observers expect China's textile and garment exports to continue rising after WTO accession, which will likely boost cotton demand to feed the growing textile and apparel industries. A geographic view of China's cotton production and use points out several issues.

One issue is the importance of transportation. Much of China's growth in cotton production has been in China's remote northwest corner, which now accounts for a third of all cotton production. Textile manufacturing has boomed primarily in eastern and central provinces. China's improved transportation network has facilitated this geographic separation of

production and use. Rail shipments of cotton rose from 1.4 million tons in 1990 to 2.27 million tons in 1999. The average rail shipping distance for cotton was over 3,000 km in 1999, longer than for any other major commodity and up from 1,755 km in 1989. Can the transportation network handle even more production? Are subsidies necessary to make northwestern cotton cost-competitive on China's east coast, either at mills or ports? The spinning industry in Xinjiang has grown rapidly, and there is currently a focus on economic development in western provinces. Processing of cotton may increase, but yarn or other products must eventually be shipped eastward, since the final market in the northwest is limited in size by the region's relatively modest population and low average income.

We also note the year-to-year variability in cotton production in the Yellow River region, which accounts for the largest share of production. In this region, cotton competes with other dryland crops, so cotton plantings are probably more sensitive to prices of grain, oilseeds, fruits, and vegetables that compete for cotton land. In the Northwest there are few other crops that can be grown profitably and in the Yangtze River valley the main crop is rice, which probably does not directly compete with cotton for land on a year-to-year basis. Thus, a rise in cotton prices would be required to bring forth more production in the Yellow River region, but that seems unlikely since domestic prices are currently above world levels.

Bt cotton has played a role in reviving production in the Yellow River region. Some observers estimate that nearly all cotton in Shandong and Hebei was in Bt varieties by 2001. The low labor requirements could encourage widespread adoption in other provinces as well, helping to boost production in the region.

Water resources may be a limiting factor on production growth in the Yellow River and Northwest regions. Falling water tables and unreliable surface water in the Yellow River region are becoming a serious problem. Lack of irrigation water may prevent cotton acreage from growing in this region. Cotton in the arid Northwest is heavily reliant on irrigation. Growth in Northwest cotton production will depend on whether water resources are adequate to support even more production and maintenance of irrigation infrastructure.

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Table 1- Characteristics of China's major cotton-growing regions

Characteristic	Region		
	Yellow River	Yangtze River	Northwest
Provinces, major	Shandong, Henan, Hebei, Shanxi, Shaanxi	Jiangsu, Anhui, Hubei, Hunan, Jiangxi, Sichuan, Zhejiang	Xinjiang, Gansu
Production, 1996-2000 /1	7.52 million tons	7.49 million tons	6.52 million tons
Production, 2000 /1	1.69 million tons	1.21 million tons	1.51 million tons
Yield, average 1995-99 /1	810 kg/hectare	947 kg/hectare	1,393 kg/hectare
Seed use, 1998	74.4 kg/hectare	33.2 kg/ hectare	110.7 kg/hectare
Average net returns, after tax, 1999	-17 yuan/mu	-74 yuan/mu	134 yuan/mu
Varieties	Early maturing, upland varieties from America	Upland cotton	Upland cotton, long-staple varieties from Egypt
Bt cotton	Estimated 1 million hectares in 2000	Limited area in Anhui province	None
Cropping pattern	Double-cropping with winter wheat, or intercropped with corn	Double-cropping with winter wheat or rapeseed	Single crop, high-density
Alternative crops	Corn, soybeans, peanuts, fruit trees	Rice, oilseeds, vegetables	Corn, tomato
Average temperature for growing period	19-22 Celsius	21-24 Celsius	18-25 Celsius, plastic films used to protect seedlings
Rainfall, annual	500-800 mm, frequent drought and water shortages	1,000-1,600 mm, frequent floods	Below 200 mm, arid
Days of temperature higher than 10 Celsius	195-220	220-270	South, 185-230 North, 160-190
Sunshine duration	2,200-3,000 hours	1,500-2,500 hours	2,700-3,500 hours
Pests	Bollworm, aphids	Pink bollworm, mites	Aphids, spider mites
Diseases	Fusarium wilt (Damping off), root rot, anthracnose	Boll rot	Blight, leaf-spot
Shipping	Railroad and trucks	Waterways, trucks, and railroad	Railroad and trucks
Proximity to end users	Excellent	Excellent	Remote
Special notes	Has major cotton auction market in Beijing and wholesale market in Xiajin, Shandong	Vulnerable to typhoon in coastal provinces	Production Corps /2 using advanced irrigation technology and mechanized planting

Note:

1. Only major cotton-producing provinces are included in the classification.
2. Xinjiang Production and Construction Corps (Bingtuan) is a Chinese word literally meaning "Group of Soldiers." During peacetime, the Bingtuan members primarily engage in farming, mining, and industrial production.

Table 2- Characteristics of Chinese cotton farms by region, 1996 Agricultural Census

<b>Crop</b>	<b>Yellow River</b>	<b>Yangtze River</b>	<b>Northwest</b>
Number of farms with Cotton production /1	10.8	16.2	1.1
	<b>Million</b>		
Average farm size	1.2	0.9	2.2
	<b>Acres</b>		
Percent acreage irrigated /2	25	42	12
	<b>Percent</b>		
Total sown area	100.0	100.0	100.0
Cotton	12.8	12.9	42.3
Rice	2.0	29.4	1.4
Wheat	42.7	23.1	28.4
Corn	22.3	5.8	21.6
Rapeseed	1.0	10.1	0.3
Peanuts	3.6	1.3	0
Soybeans and other beans	6.3	3.6	.2
Vegetables, melons, tubers	5.7	8.3	1.6
Other crops	3.6	5.6	4.3
Multiple cropping index /3	1.7	1.9	1.3

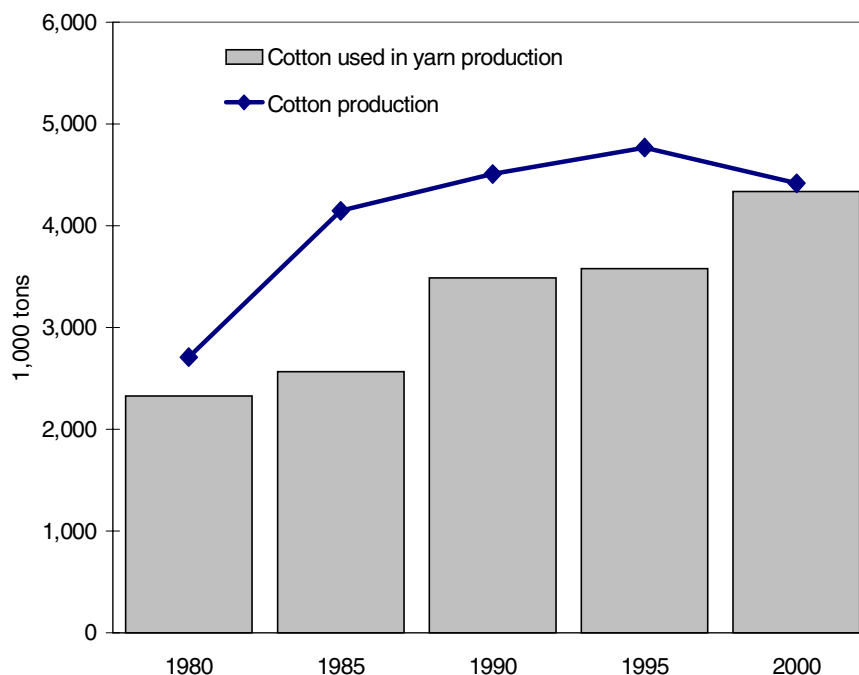
Note: Table shows share of sown area devoted to each crop for household-operated farms that grew cotton in 1996. Sown area generally exceeds the amount of cultivated land available since some land is typically sown two or more times through multiple cropping and inter-cropping. Note that cotton is often double-cropped or inter-cropped with wheat, corn and other crops.

1/ Household farms only. Data for other types of farms were not available.

2/ Electro-mechanically irrigated area excludes channeled water.

3/ Ratio of sown area to cultivated area.

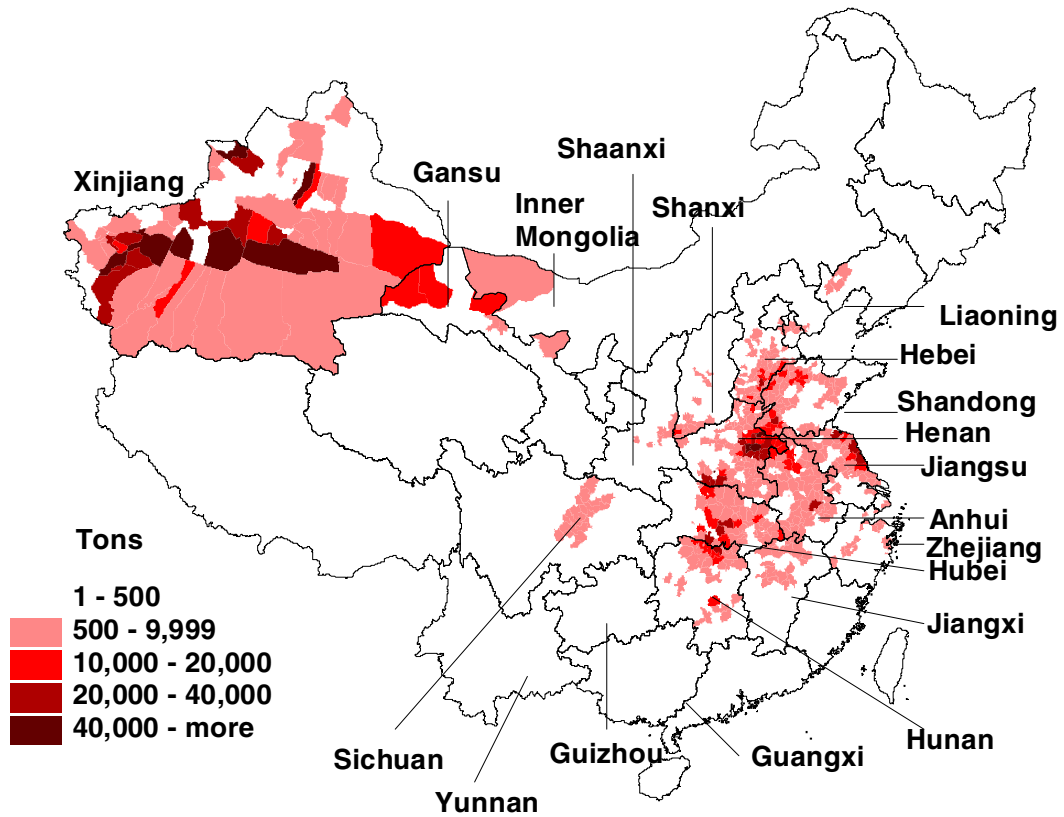
Source: ERS tabulation of 1-percent sample of data from China's 1997 Agricultural Census.



Note: Cotton use in yarn production estimated by China Cotton Textile Association.

Source: *China Statistical Yearbook 2000* and *China Statistical Abstract 2001*.

Figure 1. China, cotton production and use, 1980-2000.



Source: *China Rural Statistical Yearbook 2000*.

Figure 2. China, cotton production by county, 1999.

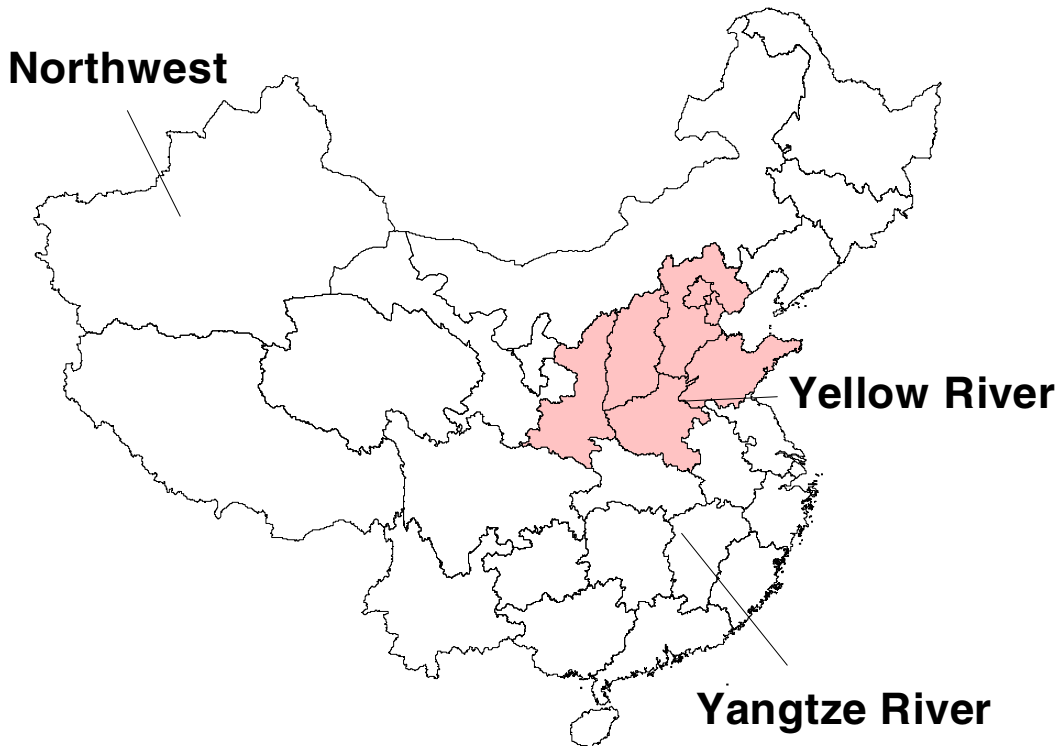
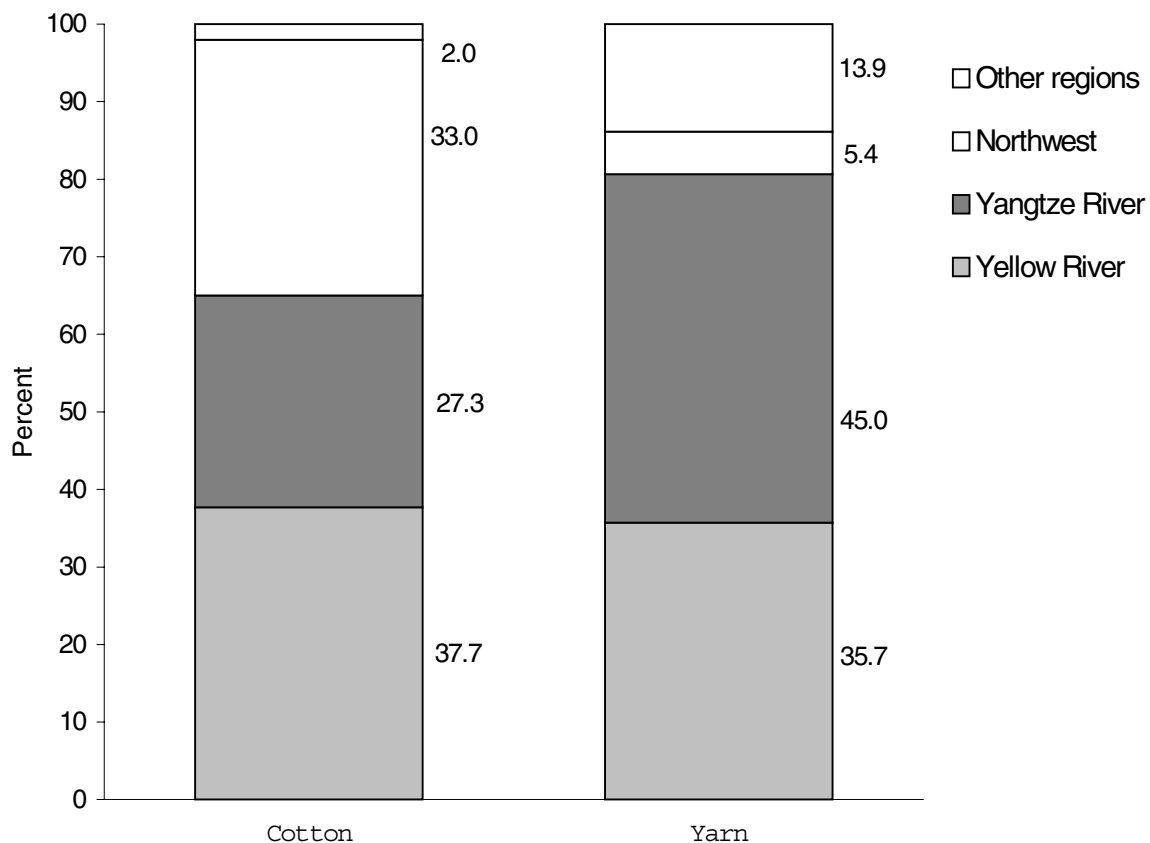


Figure 3. Primary cotton-producing regions in China



Source: China National Bureau of Statistics, *New China 50-Year Agricultural Statistics Tabulations* and *China Statistical Abstract 2001*.

Figure 4. China cotton production by region, 1978-2000.



Note: Shanghai is included in "other regions" because it is not a major cotton-producing region.

Source: *China Statistical Yearbook 2000*.

Figure 5. Regional shares of China's cotton and yarn production, 1999.