

A STUDY ON RATIONAL LOCATION OF THE COTTON PRODUCTION IN CHINA

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ABSTRACT: Cotton is the leading cash crop in China. The cotton sown area accounts for about 30per cent of the total sown area of all the various cash crops. It is the main material used in the textile industry in China. More than 95per cent of textile materials were cotton during the 1950s; and it still occupies 80per cent at present. There are some problems concerning rational location of cotton production in China. In order to solve the problems existing in civil cotton production and supply, in view of strategy, a number of cotton production bases must be selected and built step by step in a planned way. The location of cotton production should be adjusted progressively in accordance with the existing problems. The existing cotton production regions should be consolidated and improved. The cotton production region of the middle and lower reaches of the Huanghe River should be renewed quickly to make it become the largest stable and high-yield cotton production region. In the regions with suitable natural conditions and large water and soil potential, new cotton production regions should be developed in a planned way. In the regions where natural conditions are unsuitable or the competition between grain and cotton is sharp, cotton may be replaced by grain and other crops. In the self-supporting regions one should raise the yield per unit areas, not expanse the fields.

KEY WORDS: cotton production, location of cotton production, cotton production region

I. PRESENT CONDITION OF LOCATION OF COTTON PRODUCTION IN CHINA

Cotton is the leading cash crop in China. The cotton sown area accounts for about 30per cent of the total sown area of all the various cash crops. It is the main material used in the textile industry in China. More than 95per cent of textile materials were cotton dur-

ing the 1950s; and it still occupies 80per cent at present.

Cotton production has made considerable progress since the founding of the People's Republic of China. In 1988, the yield arrived at 4.25 million tons , ranking first in the world. Even with this , there are still some problems that can not be solved satisfactorily . The outstanding problem is imbalance between supply and demand. This expressed as follows:

1) There is a wide gap between the processing capacity and the raw cotton. Since reform and opening, the cotton textile industry has enjoyed an unchecked growth resulting in textile mills being built everywhere. The result is that the cotton processing capacity has been extended to quickly and far exceeded the supply of raw cotton.

2) Civil cotton is short of supplies, especially in the non-cotton production regions.

3) Cotton quality has been improved greatly since liberation, with the rough cotton decreasing and the high-quality cotton holding a dominant position. However, the latter is short of supplies and still needs to be imported from abroad.

There are also some problems concerning rational location of cotton production in China; expressed as follows:

1) The sown area of old production areas has been reduced by a wide margin, and that of the whole nation has decreased notably . The sown area of 15 major cotton production provinces (municipalities, autonomous regions) has decreased by 40.8per cent in 1979 in contrast with that needs of 1956.

2) The location of cotton production tends to be dispersed . The importance of the old areas, especially the northern production bases, has also been greatly reduced. In the meantime, the southern areas have become the main production bases of the nation. When we take the 15 major cotton production provinces (for example in Table 1), it is seen that the standing of the North has been reduced, that of the south has obviously risen. The distribution of the northern old cotton producing areas are scattered, for the cotton producing counties increased as the sown area was decreasing. For instance, Hebei, Shandong, and Henan: the cotton sown area of these three provinces has decreased by one-third to one-half, but the cotton producing counties have increased by a quarter to one-third.

The scattered condition of the northern cotton production area has been somewhat mitigated, but the problem still exists (Fig. 1).

3) The planting of cotton is transferring from the area where the production condition is superior to that where the production condition is inferior. Before 1979, there were about 10 million mu (1 mu = 1 / 15 ha) of cotton fields that were dispersed in the areas that were not suitable; such as the superearly-maturing cotton production areas of Liaoning, northern Hebei, middle Shanxi and eastern Gansu; the early-maturing cotton production areas of Beijing and Tianjin; northern Xinjiang, the Hexi corridor, and other northwestern upland cotton production areas; and the southern red-yellow hilly areas . In these areas, the temperature is relatively low, the growing period is short, and the quantity of heat is

insufficient; or the nature of the soil is inferior and acidic; or it is cloudy and drizzly for days on end. The moisture is sufficient, but the sunshine insufficient. All of these are disadvantageous to cotton growing. So the yield of cotton is low and unstable, and the quality is not good. Because of local needs, the cotton planted is barely enough for self-support, with the loss outweighing the gain.

Table 1 Proportion of cotton field in cultivated land of major cotton production provinces

Provinces	1956		1979	
	Cotton field / total cultivated area (%)	Cotton yield / total cotton yield (%)	Cotton field / total cultivated area (%)	Cotton yield / total cotton yield (%)
Liaoning	4.39	4.67	0.95	0.72
Hebei	13.81	16.27	8.37	5.24
Shaanxi	8.01	6.40	5.62	2.94
Shanxi	7.04	7.22	6.52	4.64
Henan	9.83	11.77	7.78	8.99
Shandong	9.20	15.33	7.47	7.56
Anhui	3.79	1.95	3.65	4.41
Jiangsu	12.50	9.20	12.65	24.09
Shanghai	37.64	0.19	26.37	4.05
Zhejiang	3.71	1.05	4.72	3.15
Jiangxi	2.47	1.29	3.91	1.97
Hubei	13.94	13.84	15.40	20.28
Hunan	2.10	1.37	4.67	4.24
Sichuan	4.13	4.18	3.82	5.04
Xinjiang	6.84	3.80	5.05	2.40
The whole country	5.59	100.00	4.53	100.00

4) The cotton production is transferring from the superior land to the inferior land. For example, for the last 10 years or so, in order to solve the problem of grain supply, some of the old cotton production areas in Hebei Province, have not only cut the cotton sown area, but also used the superior land for planting cereal crops. This has resulted in the cotton being planted in the inferior and nutrient-lacking fields. These conditions greatly reduced the yield per mu. In addition, in order to realize self-support in grain and raising multiple crop index, a lot of cotton production areas adopted intercropping and interplanting grain and cotton, which caused the cotton fields to be insufficient, and affected the cotton yield per mu causing it to be lower.

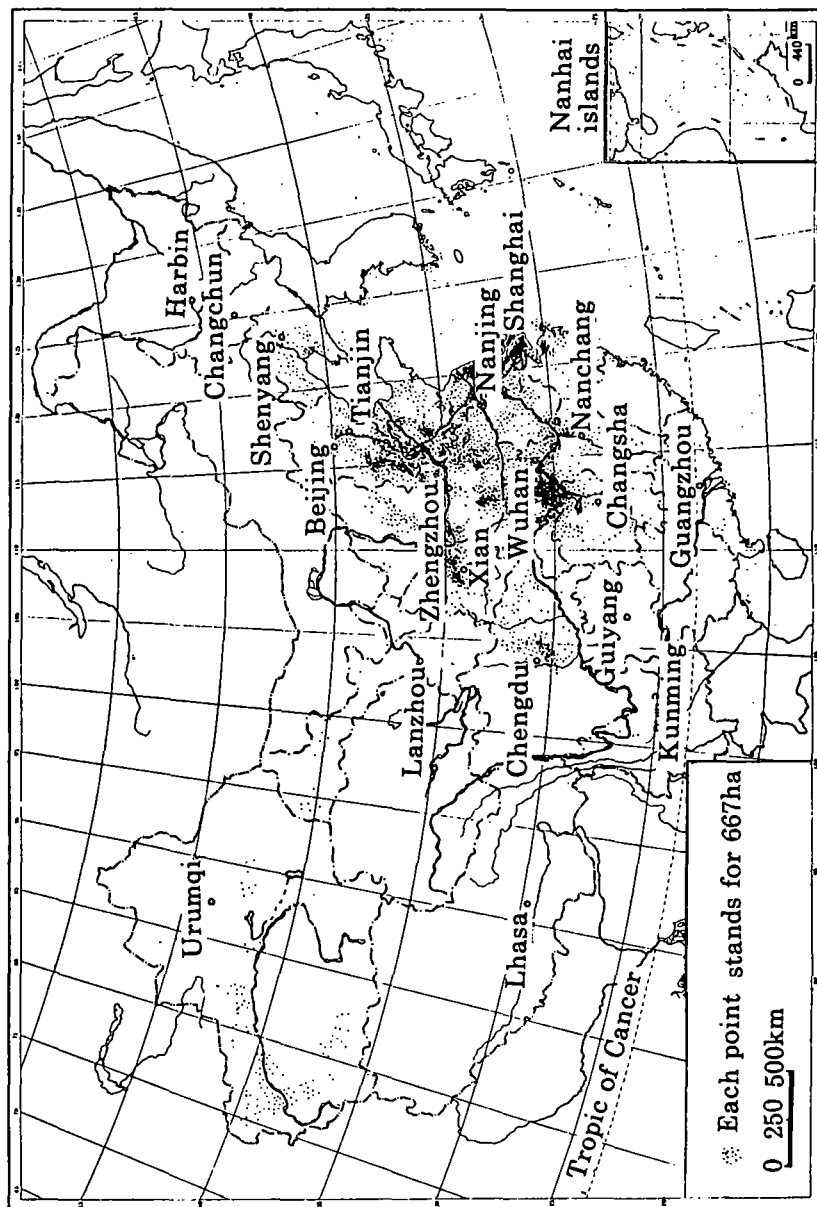


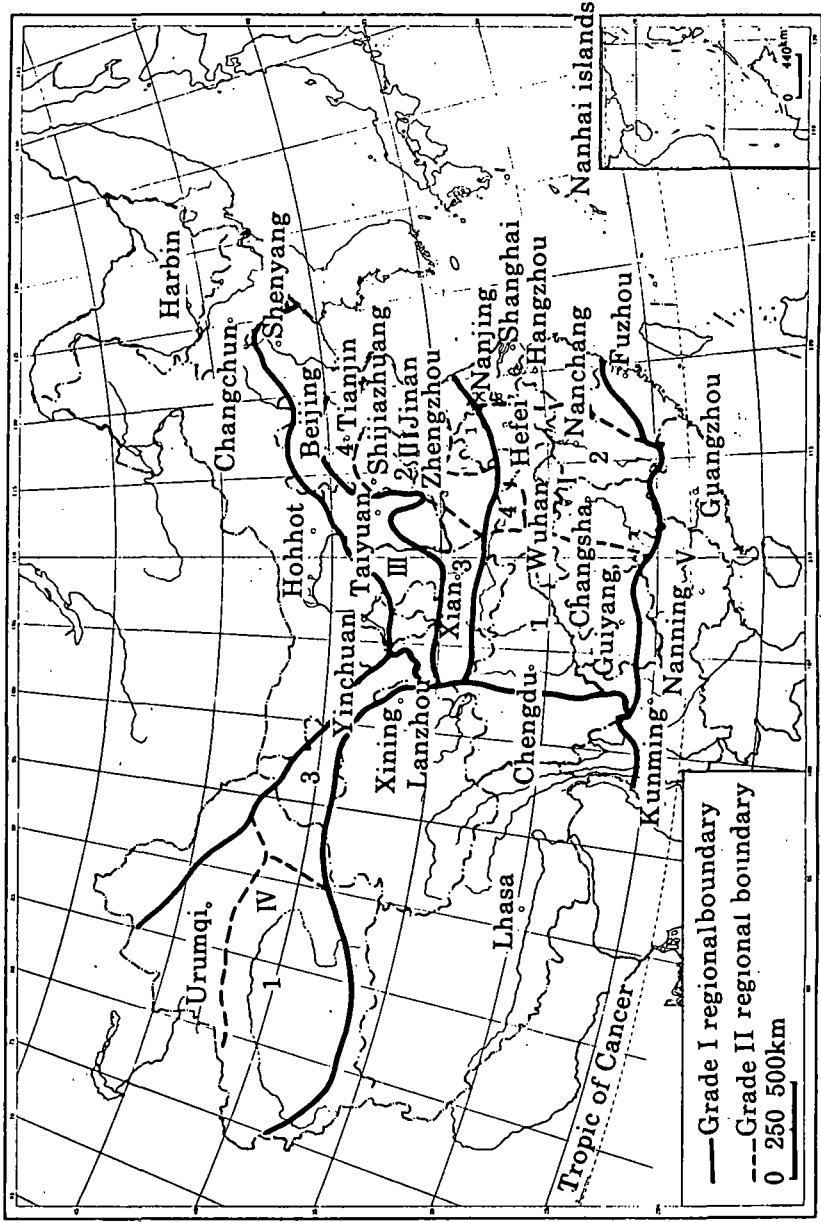
Fig. 1 Distribution of cotton field in China

Centralized production is better than decentralized production. Let's take a comparison between the Changjiang valley cotton production region and the Huanghe valley cotton production region. During the early 1950s, the difference between the two regions was not too great, but from then on, the difference has been getting more and more noticeable. When the yield per mu of Hebei, Shandong, Henan, Shanxi, and Shaanxi was fluctuating between 10 to 20kg, that of Jiangsu, Zhejiang and Hubei had risen to 25 to 30kg. After the 1960s, some of the five northern provinces remained at the original levels, and some even dropped. On the contrary, the southern provinces continued rising, among which Shanghai, Zhejiang, Jiangsu and Hubei had joined the ranks of 50kg provinces one after another. In the 1980s the north caught up with the south in yield per mu. This change shows that the cotton yield is affected by centralized or decentralized locating. In the 1950s, the cotton field of the northern cotton producing counties made up 30 to 35 per cent of the total cultivated area, some even reaching 70 per cent. Then in the 1970s, however, it had dropped to 15 per cent. On the contrary, the south just amounted to 15 to 25 per cent in the 1950s, the major regions only reaching 40 per cent. In the 1970s, the south accounted for 20 per cent, the major regions reached 40 to 60 per cent; with few counties exceeding 70 per cent.

It is important to find a way to raise the yield of cotton so that the regional advantages are brought into full play, and to make sure that most suitable regions to plant cotton and build the production bases are selected. The experiences of the leading cotton production countries have proved that when the superior cotton production regions replace the inferior ones the cotton yield will rise greatly. Take the United States of America as an example, where the old cotton production regions were distributed originally in the rainy southwest, with poor amounts of sunshine, many diseases and insects, the outcome of the yield was low and unstable. Since the 1940s, however, the old regions were gradually replaced by the arid and sunshiny southwest irrigated regions, causing the yield to rise greatly. Now take the Soviet Union as another example, where the cotton was originally distributed in Ukrainian and southern Russia, lacking heat and irrigation, the yield again low. Since the 1950s, the cotton fields were gradually concentrated towards Transcaucasia and Central Asia. Because of the arid climate, full sunshine, and abundant irrigation, the cotton yield also increased rapidly, so much so, that the Soviet Union has become one of the high-yield cotton-producing countries of the world.

II. EVALUATION OF THE NATURAL CONDITIONS OF COTTON PRODUCTION IN CHINA

The first thing to adjust the location of the cotton production and select cotton bases is to analyze the natural conditions of each region according to the ecological conditions of cotton growth and production. China can be divided into five regions(Fig. 2). Their suitability for cotton production and producing characteristics can be summarized as follows:



- I. The Changjiang valley cotton production region.
 - 1. The upper reaches of the Changjiang River
 - 2. The middle reaches of the Changjiang River
 - 3. The lower reaches of the Changjiang River
 - 4. The Nanxiang Basin
- II. The Huanghe valley cotton production region
 - 1. The Huaibei Plain
 - 2. The North China Plain
 - 3. The Loess Plateau
 - 4. The northern superearly-maturing cotton region
- III. The northern superearly-maturing cotton region
- IV. The northwest upland cotton production region
 - 1. South Xinjiang
 - 2. North Xinjiang
 - 3. East Xinjiang and Hexi corridor
- V. South China cotton production region

Fig. 2 Cotton production regions in China

1. The Changjiang Valley Cotton Production Region

Including four subregions—the upper reaches, the middle reaches and the lower reaches of the Changjiang River, and the Nanxiang Basin. The greater part concentrates in the Changjiang River Delta, along the Changjiang River, along the coast, and in the Jiangnan Plain.

The Changjiang valley cotton production region is the largest high-yield region in China. With its cotton field accounting for about 44 per cent of the total area of the country and yield per mu more than 50kg, it is one of the main cotton production regions in China.

This region is warm and has a long growth period. The $\geq 10^{\circ}\text{C}$ accumulated temperature reaches 4,500 to 5,500 $^{\circ}\text{C}$, that of $\geq 15^{\circ}\text{C}$ reaching 4,000 to 5,000 $^{\circ}\text{C}$, the frost-free period lasting from 220 to 300 days. The average temperature in April is 13 to 15 $^{\circ}\text{C}$, then in October is over 15 $^{\circ}\text{C}$. This is favorable to cotton growth and maturity. In addition, there is seldom frostbite, and it is rich in sunshine on those days. All this helps to get more summer and autumn cotton bolls and plays an important role to ensure high cotton yield and high quality. However a disadvantage to growing cotton, found in this region, is that the air temperature rises very slowly during late spring and early summer. The cotton sowing time of most of the regions is often until the last ten days of April, so the young plants grow slowly and there is little cotton bolls in the hot summer days. Besides, the hot summer drought is unfavorable to cotton blossom and boll.

Precipitation reaches 800 to 1,500mm, so there is plenty of water, and irrigation is generally not needed. However, the rainfall is slightly more than what the cotton needs, particularly in the early summer (the last ten days of April to the first ten days of July) in the middle and lower reaches of the Changjiang River. The light rains are prevalent during this time of year, and it is cloudy and drizzly for days on end. The air temperature is low, the humidity is heavy, the sunshine time is little (1,200 hours per year in Sichuan, 2,000 to 2,200 hours in the middle and lower reaches of the Changjiang River) and the sunshine percentage is low (30 per cent in Sichuan and about 50 per cent in the middle and lower reaches of the Changjiang River). All these factors may easily cause waterlogging and drainage of floodwaters, rotting the seed and causing disease. The final affect being a full stand of cotton shoots. There is often hot summer drought (spring drought in Sichuan) during the boll time in July and August, this being unfavorable to cotton blossom and boll. In autumn there are more cloudy and rainy days, and less sunny days. The poor sunshine affects the normal opening of bolls and also gives rise to its rotting and dropping off. However, there are also droughts that sometimes check the cotton growth, too. Because of high temperatures and abundance of rainfall, the diseases and insects are also more. Because of the abundance of rainwater, the cotton field needs to ditch and dike, requiring a lot of labor. Because of the hot summer drought (the spring drought in Sichuan) and autumn drought, the cotton fields must be irrigated. In addition, the frequency of drainage caused

by floods or waterlogging happens in the middle reaches of the Changjiang River reaching 50 to 60 per cent, which is a great threat against the cotton growth along the Changjiang River and the coast.

The cotton is distributed mainly along the Changjiang River and other rivers, lake shore and flatland and alluvial plains along the coast. The quality of soil is good and the grade of fertility is high in these regions. However, there are considerable cotton fields distributed in red and yellow soil hills and mounds. The soil is clayey and barren and the grade of fertility is low. It is also liable to drought, so the yield is low and unstable. In addition, the salt content of the cotton fields along the coast is a disadvantage.

In a word, the disadvantages of cotton production in the Changjiang valley are much more than the advantage. However, the region has a long history of cotton production and rich experience, particularly with more people and less land and intensive cultivation. Moreover, with excellent water conservation facilities, it creates the favorable factors for producing high yield. In respect of distribution, the location of cotton field is relatively concentric, the cotton fields of the main cotton production regions accounting for almost 30 to 50 per cent of the total cultivated area, a few regions reaching 50 to 60 per cent, with very few over 70 per cent. Concentration contributes to the improvement of technology and the accumulation of experience and becomes the key factor of high yield. The reason why the cotton fields can be concentrated is that the competition between grain and cotton is not too sharp. Besides, because the cotton production region is close to the eastern grain production region, the supply of grain is secure.

2. The Huanghe Valley Cotton Production Region

Including four subregions—the Hubei Plain, the Huanghai Plain, the Loess Plateau and the North China Plain. It has the largest cotton-growing area in China, amounting to 50 per cent of the total cotton fields of the whole nation.

The conditions of cotton planting in the Huanghe valley are superior to that of the Changjiang valley. Although the heat condition is inferior to that of the Changjiang valley, the growing requirements of middle-maturing upland cotton can be satisfied. In this region the annual average temperature reaches 11–14°C, and during the growth period (from April to October it is 19 to 22°C). The temperature goes up fast again in the spring, the average temperature in April being over 12°C, in May 20°C, and in July 26°C. Therefore, the heat is satisfactory for cotton growth. The $\geq 10^\circ\text{C}$ accumulated temperature reaches 4,000 to 4,500°C, lasting 200 to 230 days. That of $\geq 15^\circ\text{C}$ reaches 3,500 to 4,000°C, so the ripeness requirement of middle-maturing upland cotton can be met. However, there are also some problems, such as the temperature between seeding and emergence being unstable; the cotton is often damaged by the low temperature. And there is a marked drop in temperature during the later period of cotton growth. The temperature of the area to the north of the Huanghe River drops to 10°C during the first ten-day period of October, below the suitable temperature for the ripeness of cotton fibre. In addition, the frequent autumn frost is

unfavorable to the ripeness and gathering of cotton, and the over abundant frostbitten bolls affect the yield and quality.

The annual rainfall reaches 500 to 850 mm and there is 400 to 650mm of precipitation during the growing period, so the rainwater is not sufficient enough. Because the annual precipitation varies, the seasonal distribution of precipitation is inbalanced, the period between seeding and emergence (from April to May) is dry. The precipitation of most areas only accounts for 10 per cent of the total rainfall. Moreover, because it is windy in the spring, and the temperature has goes up fast , the amount of evaporation threatened spring drought (in the area to the north of the Huanghe River). This extends into the early summer and there is always a fight for protecting the young cotton through seceding and irrigation . The precipitation is distributed mainly in July and August, amounting to 50 to 60 per cent of the total annual rainfall. In addition, the rain and the heat are distributed at the same time, and it is rich in sunshine. All these help accelerate the cotton growth and meet the water requirements of blossoming and bearing bolls. However, the overcentralized rainfall sometimes gives rise to damage caused by flood or waterlogging. In the low-lying land such as Huaibei, the superabundance of rainfall causes the soil moisture to be in a saturated condition and the bolls to be rotted and dropped. Little precipitation is distributed in September and October, amounting to 20 per cent of the total annual rainfall, but it is moderate. The autumn sky is clear and the air is crisp at this time, which contributes to cotton growing and boll opening. In addition, the cotton is mainly planted in the alluvial plain, in which the deep and loose soil and the smooth terrain facilitate tractor-plowing. In a word, the advantages of cotton production in the Huanghe valley are much more than the disadvantages; in a sense it is superior to the Changjiang valley. So long as the competition between grain and cotton is solved, and the rational location of cotton production is realized, the potentiality of cotton production is realized, the potentiality of cotton production will still be great in this region.

3. The Other Regions

Including the northern superearly-maturing cotton production region, the northwest upland cotton production region and the South China cotton production region. The environment of the cotton growth of the northern superearly-maturing region is inferior, in which insufficient heat is the dominant factor. The annual average temperature between April and October reaches 8 to 10°C; and the average temperature between April and October reaches 17 to 18°C. The $\geq 10^{\circ}\text{C}$ accumulated temperature reaches 3,200 to 3,600°C, lasting 170 to 180 days, that of $\geq 15^{\circ}\text{C}$ reaches 2,600 to 3,100°C, lasting less than 150 days. They have no alternative but early-maturing and superearly-maturing upland cotton, with the safety coefficient being low. The temperature is so low in the spring that it is not until May that it is more than 10°C, and by this time there are a lot of dead seedlings and the field is short of needed seedlings. The high temperature period is short, and the temperature drops so fast in autumn that it drops to 15°C until the last ten days of September. Therefore

the cotton is liable to be damaged by the low temperature. In addition, the precipitation is also insufficient; the annual rainfall being only 400–800mm. The east is rich in rainfall and the west is poor, so drought appears mainly in the west. One advantage is that it is rich in sunshine and the temperature varies greatly between day and night, which helps bear more summer bolls and reduce diseases and pest insects, but it is still hard to fill the gap in heat. Moreover, the southern part of the northeast is one of the industrial bases in China, with great urban population and great requirements for commodity grain and non-staple foods, which affects the development in these areas.

The south China cotton production region is rich in heat, the $\geq 15^{\circ}\text{C}$ accumulated temperature reaches 5,200 to 7,500 $^{\circ}\text{C}$, so it is suitable for the growth of middle or late-maturing island cotton. Because of superabundant rainfall, burning hot, great humidity, little sunshine, more diseases and pest insects, clayey and acid soil, and all varieties of cash crops, it has more disadvantages of the cotton production than the other areas.

The northwest upland cotton production region includes the Hexi corridor, east Xinjiang, north Xinjiang and south Xinjiang. The Hexi corridor and north Xinjiang are poor in heat, the yield is low and unstable, so they are unsuitable for further development of cotton production. The cotton field of east Xinjiang is distributed mainly in the Turpan Depression which is rich in heat and the $\geq 10^{\circ}\text{C}$ accumulated temperature is over 5,000 $^{\circ}\text{C}$, and it is the important production base of middle-maturing island cotton of the whole country. South Xinjiang is rich in heat, the $\geq 10^{\circ}\text{C}$ accumulated temperature reaches 5,000 $^{\circ}\text{C}$, lasting 215 days, that of $\geq 15^{\circ}\text{C}$ reaches 4,900 $^{\circ}\text{C}$; the average temperature between April and October is 25 $^{\circ}\text{C}$, so the requirement of middle-and early-maturing island cotton growth can be satisfied, and the sufficient sunshine (2,700 to 3,000 hours) is especially favorable for cotton growth. The greatest problem is the arid climate and small amount of rainwater, but the snow melt of the Tianshan Mountain and the Kunlun Mountains can be diverted to irrigate, and there is large amount of uncultivated land to be developed, therefore, the potential of the development of cotton production in this area is great.

III. ADJUSTMENT OF LOCATION OF COTTON PRODUCTION AND SELECTION OF PRODUCTION BASES

In order to solve the problems existing in civil cotton production and supply, in view of strategy, a number of cotton production bases must be selected and built step by step in a planned way. For this reason, we should adjust the location of cotton production and build cotton bases step by step, managing to suit measures to local conditions and concentrate production properly. While selecting and building cotton bases, we should take note of the following:

- 1) Make full use of natural advantages, and select the most suitable areas to concentrate cotton production according to its biological nature, avoiding dispersed production.

2) Take note of the solutions for competition between grain and cotton.

3) Select the old regions that have considerable bases to concentrate production.

4) Although some new regions are poor in existing foundation, they are rich in natural conditions and have great potential, therefore, should adopt vigorous measures and regard them as bases to be developed;

5) Give first place to cotton planting in the concentrated cotton production regions or bases; preventing other crops from striving for ground, labor, water and fertility with cotton. Any area that has sharp competition between cotton and other crops which is not liable to solve should not be selected as cotton base.

6) Adjust the purchasing base and price for cotton as the occasion demands, ensuring benefits to cotton farmers.

According to the Comprehensive Agricultural Regionalization of China, we select five large parts of national marketable cotton bases and seven parts of local commodity bases. The former includes the Jiangnan Plain, the lower reaches of the Changjiang River along the coast and the River, the northwest Shandong and the middle-south Hebei and north Henan Plain, the Huanghuai Plain and south Xinjiang. The latter contains the Sichuan Basin, the Guanzhong Plain, the south Shanxi Plain, the Nanxiang Basin, the Dongtinghu Plain, the Poyanghu Plain and the Anhui Plain along the Changjiang River.

In general, the selected bases are suitable, but there are several questions worth considering:

1) Whether the scope of marketable cotton base counties and the cotton field is narrow or not, in terms of cotton field, there is only 28.73 million mu, and the yield is only 18.7 million dan (1 dan = 50 kg). On the supposition that the commodity rate is 96 per cent, there are 17 million dan of marketable cotton that can be sold to the state, and we still have a long way to go in contrast to the national requirements.

2) We should study the rational solution of competition between cotton and grain which hinders the concentration of cotton fields.

3) It seems desirable to build the long - staple cotton base in south Xinjiang from a long - term point of view, but it is unsuitable to develop on a large scale, because there are still several problems to be solved, such as staple food supply, communications and transportation, competition between farming and animal husbandry, capital construction or farmland, and so on.

In order to create favorable conditions for the founding of cotton production bases, the location of cotton production should be adjusted progressively in accordance with the existing problems:

1) Consolidate and improve the existing cotton production regions; especially the Jiangnan Plain and the lower reaches of the Changjiang River along the coast and the River that are the high-yield cotton regions in China (but where the yield is unstable). For this reason, we must develop the new early-maturing and high-yield varieties and begin sowing

in good time on the one hand; on the other hand, we must reinforce construction of water conservation facilities and farmland capital construction to strengthen the capacity of flood, waterlogging and preventing drought.

2) Speed up the renewal of the lower reaches of the Huanghe River and make it become the largest stable and high — yield cotton production region of the nation. The key is to adjust the location of crops, turning decentralized production into appropriately centralized production and enhance the proportion of cotton fields in the whole cultivated land.

3) On the basis of detailed prospecting and total programming, develop new cotton production regions step by step in a planned way where the natural condition is suitable and the water and soil capacity is large, such as the lower reaches of the Changjiang River along the coast, Huaibei, and south and east Xinjiang.

4) Firmly compress cotton fields and replant grain or other crops where the natural conditions are unsuitable or the competition between grain and cotton are sharp and difficult to solve at the present time; such as the northern superearly—maturing cotton region, Beijing, Tianjin and Tangshan regions, the Loess Plateau, the Hexi corridor and northern Xinjiang, and the southern red and yellow soil hilly lands.

5) Because it is close to cotton textile centers, and because of local requirements for cotton, the self—supporting regions such as the Sichuan Basin, the Guanzhong Plain, the Dongtinghu Plain, the Poyanghu Plain and the Anhui Plain along the River, should not only remain but should also be improved. However, the first place should be given to enhancing the yield per unit areas, and not to expanding the fields, so as not to affect the construction of commodity grain bases.