Breeding and Seed Production: An Intricate Relationship

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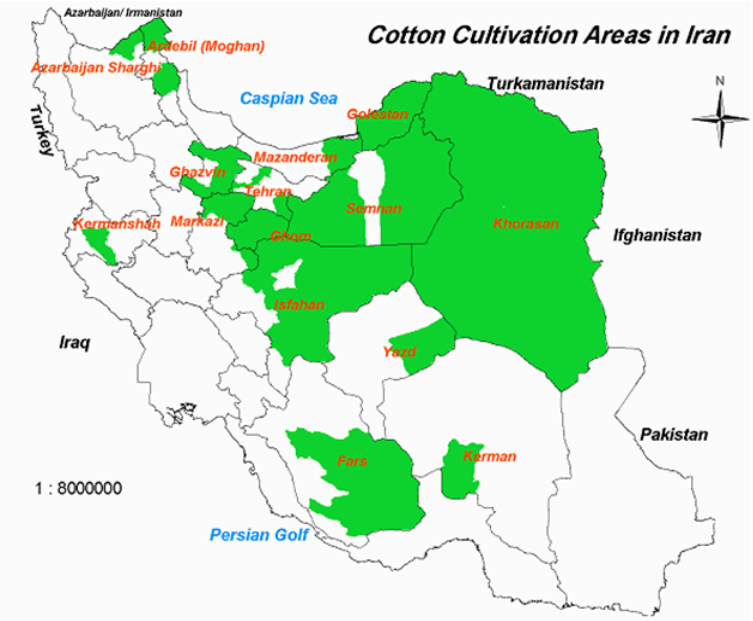
Introduction:

Cotton is the most important textile fiber. Since early 1980, the average cotton yield has increased at the rate of 2% or 10 kg/ha per year. Among the various reasons, new technological developments (hybrid cotton, BT cotton) could be one of the main reasons. It seems that the available technology developed by researchers has been utilized in most countries. In cotton growing countries, the adoption of technology highly depends on the type of farms and farmers. In order to bring significant improvement in cotton yield, researchers have to develop new methods to realize a higher percentage of the genetic potential of the cotton plant.

Cotton in Iran:

Cotton has been cultivating in the country about 88 years ago. In Iran, out of the total 32 provinces, cotton is grown in 18 provinces. Cotton areas are shown in following map.



The importance of Cotton in Iran

- Plays a dominant role in economy of agriculture and industry
- It is the backbone of different industry (ginning, spinning and textile industry, oil extraction factory, health and chemical industry) in Iran.
- Planting is mechanized but harvesting is being done by hand

Almost 30- 40 % of the total cost of production is for harvesting.

Potential of cotton production in Iran

- Low pest and disease population
- Different agro-ecological zones of cotton production in the country
- Improved varieties (high yielding , early and compact genotypes, good quality)
- Well number of dependent industries (3800 spinning and textile industry, 113 ginning factories, 35 oil refining factory and …)
- Relatively high consumption and demand for cotton in domestic market.

Cotton Production in Iran: Challenges

- There is no formal germplasm exchange program
- Small farm size (less than 6 ha)
- Shift of cotton fields to saline soils and low yield areas
- Harvesting by hand (high cost and time consuming)
- Fluctuation in cotton cultivation areas and its production
- Imbalance between cost and price of cotton in compare with the other crops.
- Price fluctuation by international and local policies
- Low efficiency and relatively old cotton processing industry resulting in higher post-harvest costs.

- In order to encourage farmers to grow cotton a set of incentives were approved by government which are: - Guaranteed purchasing price by government
- Financial assistance for land preparation
    - Intensive extension program,
    - Providing technical assistance, high quality seeds, new irrigation system to reduce water consumption etc
- Mechanized harvesting has been started as a major step to reduce production costs.

The Cotton Research Institute has been established in Iran in 1996. The institute has five departments. Cotton breeding department is the most important department. Main role of cotton breeding dep. is release new varieties cotton seed production.

However lack of a nationwide, intense and comprehensive organization, despite of huge labor intensive capacity and high foreign currency absorbing, caused it to receive low attention.

Meanwhile we are observing very year reduction of cotton farm surface and therefore decline of production. All the affairs caused specific concern to cotton authorities and textile industries.

Due to the wide range of activities related to cotton and necessary of coordination activities between Agriculture Ministry as trustee of cotton production, the Ministry of Industry, Trade and Mines as trustee of industry and commerce.

To solve the above stated problems, the need to engage with the private sector, establishing the Coordinating Center for Cotton & Fibrous Plants was transferred to the *Cotton Research Institute of Iran (CRII)*. License issued by the vice president of Science and Technology (VPST) in 2009, then a number of experts in the field of production, trade and the cotton

industry were invited to join the *Science & Industry Coordination center of Cotton & Fiber plants (SICCCF).*

The first and most important focus of SICCCF develop a cotton roadmap. Draft of roadmap was discussed in Coordination council and after ratification was handed to VPST.

Noticing the importance of this plan in macroeconomic policy of the country, it has been decided to approve roadmap through holding *The First International Conference on Science, Industry and Trade of Cotton (ICSITC). With* ratification of the essentials of the conference by Coordination council and financial supporting of VPST, a great effort has been started to held this conference in as appropriate.

New early mature released cotton varieties in I.R.Iran

- Commercial varieties

1-Khordad as a short duration (125-135 days), high yield, medium staple cotton varieties, have been released in 2005 by the CRI (Cotton Research Institute) and General office for Cotton and Oil producing crops in Islamic Republic of Iran.

Khordad has been released through introduction breeding method with numerous trails after ten years. The variety as an early mature cotton variety was introduced mainly for double cropping system for Khorasan and central part of country. The achievement has been resulted in wheat grain yield increments by planting wheat, right after cotton harvesting.

Economic characteristic of new introduced cotton varieties is as follow:

Year of Release: 2007

Ginning turnout (%): 38.9

Staple Length (mm): 30

Micronaire (µg inch-1): 4.4

Yield potential: 4800 kg/h

2- Sepid, as a early maturity, high yield, okra leaf, medium staple cotton varieties, have been released in 2004 by the CRI (Cotton Research Institute).

3- Golestan is an early mature variety (130-135 days), high yield, medium staple which was released in 2008 for north part of country (Golestan-province). The achievement has been caused double cropping system improvement in this region. This is first commercial cotton variety which has been jointly released and propagated by CRI (Cotton Research Institute) and privet cotton company.

Economic characteristic of new introduced cotton varieties is as follow:

Year of Release: 2007

Ginning turnout (%): 41.16

Staple Length (mm): 30.3

Micronaire (µg inch-1): 4.1

Yield potential: 5300 kg/h

3- Armaghan is an early mature variety, high yield, medium staple which was released in 2008 for north part of country (Golestan-province).

Hybrids:

In cotton, different types of hybrids are developed for commercial cultivation which can be classified into various groups on the basis of species involved (intraspecific and intersepcific), ploidy level or chromosome number (tetraploid and diploid), and method of hybrid seed production (conventional and male sterility based hybrids). A brief description of different types of hybrids is given below:

Intraspecific hybrids: A hybrid between genetically different genotypes of the same species is referred to as intraspecific hybrid. Intraspecific hybrids are always fertile.

Interspecific Hybrids: the F1 progeny between two different species of the same genus is referred to as interspecific hybrid. In cotton, interspecific hybrids are fully fertile between *G.hirsutum* and *G.barbadense* and between *G.herbaceum* and *G.arboreum*.

Hybrids are produced by hand emasculation and pollination method in Iran. Majority of cotton hybrids are developed by conventional method.

Commercial F1 hybrid seeds for length staple cotton production

Due to interest of textile industrial for having long staple varieties, Cotton Research Institute of Islamic Republic of Iran started to produce inter specific hybrid between *G. barbadence* and *G. hirsutum*. In spite of having long staple characteristic in *G. barbadence*, low productivity of seed cotton yield, have been made a limitation for farmer to cultivate this varieties. One way to meet this requirement is commercial F1 hybrid seed production. Therefore production of F1 seeds with long staple and high yield productivity is an urgent task for country. Hybrid cotton is an optimistic approach for significant improvement in genetic potential for yield and fiber quality.

Economic characteristic of new introduced F1 hybrid cotton varieties

1- Hybrid "Hyb86SB "

Year of Release: 2007

Ginning turnout (%): 41

Staple Length (mm): 36.7

Micronaire (µg inch-1): 4.1

Yield performance: 4175 kg/h

Seed supply:

Cotton varieties improve by introduction, selection, mutagenesis, crosses and hybrid cotton seed in Iran. Method of hybrid cotton

production and crosses is conventional hybrid, i.e., by hand emasculation and pollination in Iran.

Commercial varieties lines of cotton included two separate parts, followed by new combination of the selected lines, and comparing the new combination with previous combination of lines. Selected lines were performed on the bases of morphological characteristics in the field, yield, lint percentage and finally fiber quality in lab.

Cotton seeds by high germination ability are planted in Iran. Isolation distance is considered for production of nucleus and super elite seeds. Nucleus seed is genetically and physically pure. Cotton seeds are free from weed seeds, other crop seeds and foreign matter. Purity test is conducted to determine physical purity of seed. As ISTA rules, the seed samples are separated into the three components including: pure seeds, inert matter and other seeds.

- Pure seeds; it refer to the seeds of variety under testing
- Inert matter; it is included broken or damaged seeds, leaf bits, soil particles, etc.
- Other seeds; it is included seeds of other variety, other crop seeds and weed seeds.

Topic aims of Iranian cotton breeders:

1. High yield varieties
2. Improvement in Fiber Quality
3. Insect and Disease Resistance
4. Earliness
5. Adaptability
6. Abiotic (drought and salt) stress tolerance

Future research:

- Development of male sterility for producing hybrids.
- Development of short duration tetraploid with high of seed cotton yield.
- Development of hybrids and varieties suitable for machine picking.
- Development of hybrids and cultivars resistant to biotic and abiotic stress conditions.
- Development of transgenic cotton varieties resistant to bollworms and verticillium wilt using B.T gene.
- Development of cotton cultivars suitable for late sowing.
- Development of cotton hybrids and cultivars with wide adaptability.
- Development of *G.barbadense* varieties for Razavi Khorasan province.

Conclusions:

- There is a good scientific potential for introducing new technology in the country
- The cotton farmer technical information are going up for acceptance of new cotton growing technology
- There is no commercialized GM cotton in Iran yet, but there is a demand and potential for production of cultivation of Bt cotton.
- The breeding achievement improved the cotton yield about 40 %. This will have a significant impact on the national production when the sufficient supply of seed is available.
- There are private sectors involved in seed production and mechanization in Iran willing for international collaboration.

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