India’s Cotton Story

This article is based on **“The flawed spin to India’s cotton story”** which was published in The Hindu on 23/01/2020. It highlights the problems faced by the Indian farmers due to the use of hybrid seed model for cotton production.

The **pest-resistant Genetically Modified (GM) Bt cotton hybrids** have captured the Indian market (covering over **95%** of the area under cotton) since their **introduction in 2002.** Their role in increasing India’s cotton production has been instrumental, however, at the same time, it is argued that Bt cotton hybrids have negatively impacted the livelihoods of the farmers (especially the resource-poor farmers) and has contributed to the **agrarian distress.**

Note:

Cotton- fibre, oil and protein yielding crop of global significance.

- **Temperature:** Between 21-30°C
- **Rainfall:** Around 50-100cm.
- **Soil Type:** Well drained black cotton soil of Deccan Plateau.
- **Top Cotton Producing States:** Gujarat > Maharashtra > Telangana > Andhra Pradesh > Rajasthan.

Hybrid Cotton: Cotton made by crossing **two parent strains** that have different genetic characters. Hybrids are often spontaneously and randomly created in nature when open-pollinated plants naturally cross-pollinate with other related varieties.

Varieties Cotton: Cotton produced by **process of self-fertilization/autogamy** (fusion of two gametes that come from one individual).

Bt Cotton: It is a **genetically modified organism** or genetically modified pest resistant variety of cotton.

Hybrid Cotton: Experience & Performance so far

- India is expected to be the **world's largest cotton producer** in terms of the produced output surpassing China (in 2019).
    - India's cotton production in 2019 is projected at **354 lakh bales** (the highest ever) because of which it has been argued for extending **GM technology** to other areas so as to increase food crop yield.
- India is the **only country** that **grows cotton in the form of hybrids.** Also, India was the **first to develop hybrid cotton** back in 1970.
    - However, India's **productivity (yield per unit area)** is **much lower** (around **one-third**) than other major cotton-producing countries. This implies that in order to be the largest producer, a much **larger area is used for cotton production** in India.

Hybrid Cotton Versus Varieties Cotton

Sr. No.	Parameter	Hybrid Cotton	Varieties Cotton
1.	Formation Technology	Made by crossing **two parent** strains having different genetic characters.	Seeds for this type of cotton are produced by **self-fertilization.**
2.	Sowing Area	Hybrids in India are planted at ten-fold **lower plantation density** (0.5 kg seeds/acre).	**High-Density Planting (HDP):** These plants are planted at high density (5 kg seeds/acre).

3.	Reusability	Hybrid seeds have to be **remade for each planting season** by crossing the parents. Hence, farmers must **purchase seeds for each planting.**	Varieties can be **propagated over successive generations** by collecting seeds from one **planting and using them for the next planting** season.
4.	Productivity	• These plants have **more biomass** than both parents and hence have the capacity **for greater yields.** • But their plantation in per acre area is less (due to its size) as compared to the Varieties Cotton. The lower **boll production** by compact varieties (5-10 bolls per plant) as compared to hybrids (20-100 bolls/plant) is compensated by their ten-fold greater planting density.	• Using **HDP technique,** compact varieties have been found to outperform hybrids at the field level. • Their productivity is **more than twice** the productivity of hybrid cotton.
5.	Production Duration	Bushy and **long duration** (i.e. take more time to grow).	**Compact** and **short duration.**

6.	Manufacturing Unit & Price Control	Hybrids give pricing control to the **seed company** thereby ensuring a continuous market. These seeds are **produced entirely** by the **private sector.**	There lies **no concept of pricing control** by any seed company.
7.	Irrigation/Water requirement	They require **more water.** As **cotton** is a dryland crop, around 65% of the area under cotton in India is **rain-fed.**	**Less water** requirement.
8.	Fertilizer requirement	They require **more fertilizers.**	They require **half the fertilizer as compared to hybrids.**

9.	Risks Involved	Farmers with • **insufficient access to groundwater** • in the growing areas are entirely dependent on the rain. Also, its • **longer duration** makes it **more prone to pest attacks** and thus involves **high risks.**	• Their **shorter duration** reduces dependence on irrigation (particularly late in the growing season when soil moisture drops following the **monsoon's withdrawal,** as this is the period when bolls develop and water requirement is the highest). • Also, it faces less vulnerability to damage from insect pests due to a shorter field duration. Hence, **low risks are there.**
10.	Economic Cost	• **Expensive,** requiring manual crossing. In India, low cost of manual labour makes it economically sustainable. • Also, **increased yield from a hybrid** is supposed to justify the high cost of hybrid seeds in India.	**Low-cost** solution.

India's Policy for Hybrid Cotton

There have been two phases of policy:

Phase-1: Pre-GM cotton: This phase of the policy ranges from **1980-2002** when India persisted with hybrids while other countries shifted to HDP (High-density Planting).

The Cotton research centres & Public sector institutions ignored such a significant innovation (in the form of HDP) in cotton breeding in India.

Phase-2: Post-GM: This phase began post-2002 when Bt cotton was being considered for **introduction** into India. In this phase, the deliberation of hybrids versus compact varieties could have been undertaken which could have led to the introduction of the HDP technology in India.

- However, the **scope of evaluation** by the GM regulatory process in India was **narrow** and did not take the **agro-economic conditions** prevalent in India into account.
- Therefore, the hybrid seed model for cotton in India persisted for many years even after benefits of compact varieties became clear from global experience.
    - For example, there was a steep increase in **productivity for Brazil,** from 400 to 1,000 kg/hectare **lint** (yield of cotton fibre after **ginning,** i.e, after separating cotton fibres from their seeds) between 1994 and 2000- the period which coincides with large-scale shift of the world to a **non-GM compact variety.**

Impact of Policy

- **Market Capture:** Commercial Bt hybrids have **overshadowed the market,** accompanied by the **rollback of public sector cottonseed production.** Hence, the Indian cotton farmers are left with little choice but to use Bt hybrid seed produced by **private seed** companies.
- **Farmers Distress:** Due to the combination of high input and high risk, agricultural distress is **extremely high** among hybrid cotton cultivating farmers. Compact varieties would have significantly reduced this distress as well as increased yield.

Way Forward

- **Impact Assessment:** Before extending GM technology to increase food crop yield it is mandatory to **assess its impact** on livelihood, agrarian distress, etc. Hence, the outcome of deploying a technology must be evaluated in a particular context.
    - If the technology does not **prioritize the needs** of the principal stakeholders (farmers), it can have significant negative fallouts, especially in India which has a high proportion of marginal and subsistence farmers.
- **Integrated Policy-framing:** There is a **need for better consultation** in policy, be it agriculture as a whole or crop-wise. For e.g., the policy-framers in India could have deliberated upon the **inclusion of socio-economic considerations** being a signatory to international treaties on GMO regulation (the **Convention on Biological Diversity**, and the Cartagena Protocol on Biosafety). These treaties specifically provide for such considerations in GMO risk assessment.

- It is important to recognise that the adoption of any new technology (such as Bt Cotton) is a **choice and not an imperative.** Lessons could be learnt from **Brazil and Turkey** which achieved high productivity without using GM cotton but by using alternative pest-management approaches.

Drishti Mains Question

How can compact varieties of seed model help sustain cotton production in India.
