

## Understanding GM mustard: what is it, and how has it been achieved?

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Recently, the Genetic Engineering Appraisal Committee (GEAC) under the Union Ministry of Environment, Forest and Climate Change recommended the “environmental release” of the transgenic hybrid mustard DMH-11 for seed production.



[Ref: BusinessLine]

### Hybrid Mustard:

- Hybridisation involves crossing **two genetically dissimilar plant varieties** that can even be from the same species.
- The **first-generation (F1) offspring** from such crosses tend to have higher yields than what either parent can individually give.
- Such **hybridisation isn't easy in mustard**, as its flowers have both female (pistil) and male (stamen) reproductive organs, making the plants largely self-pollinating.
  - Since the eggs of one plant cannot be fertilised by the pollen grains from another, it limits the scope for developing hybrids — unlike in cotton, maize or tomato, where this can be done through simple emasculation or physical removal of anthers.

### How has hybridisation been achieved in mustard?

- Scientists have **developed the hybrid mustard DMH-11** containing two alien genes isolated **from a soil bacterium called *Bacillus amyloliquefaciens***.
  - The first gene (**'barnase'**) codes for a protein that impairs pollen production and renders the plant into which it is incorporated male-sterile.
  - This plant is then crossed with a fertile parental line containing, in turn, the second **'barstar' gene** that blocks the action of the barnase gene.

- The resultant F1 progeny is both **high-yielding and also capable of producing seed/ grain**, thanks to the barstar gene in the second fertile line.

**GEAC:**

- It is a **body responsible for appraisal of proposals relating to the “release” of GM organisms and products** (ordinarily considered hazardous) into the environment.
- In this case, it has given the green signal for commercial cultivation by farmers, with production of seed material being the first step.
- GEAC has also **recommended the environmental release of DMH-11’s** parental lines (carrying the barnase and barstar genes) for them to be used to develop new hybrids.
  - Such hybrids could give even higher yields than DHM-11.

**Mustard varieties** in India have a **narrow genetic base**.

The barnase-barstar system enables breeding of hybrids from a wider range of mustards, including those of East European origin such as ‘**Heera**’ and ‘**Donskaja**’.

**GM CROPS — A TIMELINE****2002**

- India approves the cultivation of the first genetically modified crop

**2006**

- Bollgard II approved
- Anti-GM activists move Supreme Court against GM crops

**2010**

- Centre blocks field trials of Bt brinjal, makes States NOC must

**2012**

- Parliament panel recommends stopping all field trials

**2013**

- A Supreme Court-appointed panel recommends 10-year moratorium
- Environment Minister Jayanthi Natarajan puts on hold all GM crop trials

**2014**

- Her successor Veerappa Moily clears trials
- GEAC approves field trials for 11 crops
- NDA government allows the field trials in 21 varieties. GEAC rejects 7 of the 28 proposals

**2016**

- GEAC clears field trials of GM mustard, SC stays it
- Monsanto withdraws its application seeking approval for the next generation of cotton

[Ref: BusinessLine]