Why does India need strategic thinking for National Bioengineered (BE) Crops policy?

India faces a critical challenge in achieving food security due to a growing population and limited natural resources, compounded by climate change and geopolitical tensions. Innovative bio-engineering technologies offer promising solutions. However, concerns about safety and regulation have created obstacles to their adoption. **This report examines the current state of bio-engineered crops in India, the challenges they face, and the safeguards to ensure their safety and effectiveness.**

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India need appropriate technologies for Food Security

Growing population of humans and livestock in India need more food and feed for survival and performance. Land is limited, natural resources are depleting and the climate change threat is increasing.

Food and feed security is a global concern due to various weather-related calamities , wars and other geopolitical issues. Climate change is a most prominent factor which is challenging the food and feed security. Global and country level efforts to address these issues through innovations in research and technologies are increasing. Crop breeders globally develop climate resilient varieties by using new bio-engineered breeding technologies like genetic modification (BE), gene editing, genome sequencing, marker assisted selection and speed breeding, etc.

In 2023, the global area under BE crops increased 1.9% over the previous year to reach 206.3 million hectares; a new record area. Twenty nine countries cultivated a range of 11 different BE crops, with soybean being the most widely planted at 100.9 million hectares; the first time the crop has exceeded 100 million hectares.

Global Growth of BE Technology

BE crops were grown in 6 countries in 1996 and by 2019, BE adoption increased to 29 countries. Following crops and BE traits were released

1. Genetically Modified Corn with Bt. And other genes that are resistant to larval pests.
2. Genetically modified soybeans that are resistant to weed-killers like Roundup.
3. Genetically modified maize – with Bt. And other genes used as animal feed, high-fructose corn syrup
4. Genetically modified cotton – This has been approved in India along with 9 other nations for Bt. gene controlling American bollworm
5. Genetically modified Canola – hybrid seed production technology, for use as cooking oil and as emulsifier in packaged foods.
6. Genetically modified Eggplant- with Bt. Gene for imparting resistance to fruit and shoot borer

Why did countries adopt BE technology?

The purpose to use BE technology is to introgression those genes which can either release toxin proteins to control insects or enhance the gene activities or mask and knock down the activity of gene:

1. Higher yields
2. Enhanced nutritional value
3. Longer shelf life
4. Increase resistance to droughts
5. Increase resistance to insects, pests.
6. Increased resistance to herbicides
7. Reduced farm costs
8. Increased farm profits
9. Safer environment

The major BE crops presently grown are carrying genes for resistance to insects and herbicides.

Which countries use BE technology?

Many countries around the world use genetically modified (BE) technology, including:

- USA (top producer of biotech crops)
- Argentina
- India
- Australia:
- Portugal
- Brazil (second position)
- China
- Canada:
- Spain
- Kenya

Crops using BE technology

BE crops include:

- Potatoes,
- Pumpkins,
- Aubergines,
- Papayas,
- Maize,
- Cotton
- Squash,
- Alfalfa,
- Sugar Beet,
- Oilseed Rape,
- Soya Beans
- many others are in pipeline

Impact of BE technology on productivity

Apart from the economic benefits, usage of BE crops has also contributed to food security, sustainable development, and climate change mitigation. The benefits are:

- BE crops have increased the crop production by 822 million tonnes;
- Conserving biodiversity by saving 231 million hectares of land;
- Adaptation of BE crops has provided a safer environment by saving 776 million kg of pesticides from being released into the environment;
- BE crops have been helpful in reducing CO_2 emissions by 23 billion kg, equivalent to taking 15.3 million cars off the road for one year.
- Helping alleviate poverty through uplifting the economic situation of 16-17 million small farmers, and their families, totalling >65 million people.
- BE introduction on cotton in India during 2002 saved farmers from debt, reduced the pesticide spray round to two from normal use of ten round, not only save the cost but also increased the yield and farmer income.

The second generation BE crops are:

- Non- browning apples
- Non-bruising and low acrylamide potatoes
- Maize varieties with low phytic acid and increased essential amino acids
- Healthier oils from soybeans and Canola

Emerging research areas in BE technology

- Rice enriched with Iron, Vit. A & E and Lysine
- Potato with high starch content and Inulin
- Edible vaccines in Maize, Banana and potatoes
- Allergen free nuts

Challenges of adopting BE crops

The first and foremost challenge is the “FEAR OF UNKNOWNS”. Lots of baseless propaganda has been done by NGOs about the unintended risks and negative impact on human and animal health. At present all scientific studies proved the safety of BE crops both for environment and human and animal health.

The second challenge is the regulatory cost and uncertainty of timelines for release. The court cases and delay due to political intervention forcing seed companies to put the BE technology and products in cold storage.

Controversies related to BE crops

Since scientists and research organizations are facing issues raised by NGOs and others for risk assessment of BE crops and BE food. The cost and timelines for developing BE crops are so uncertain that most of the BE research has been put to halt since a decade back.

Now scientists and research organizations are opting for Gene Editing Technologies where they knock out a gene or over expression of genes to develop better crop traits with accuracy in a short span of time. The regulations are simple. For SDN (Site Directed Nuclease) 1 and SDN 2, where no new gene sequence is inserted are only for information sharing and no other regulatory requirements are there. While if you go for insertion of the gene in SDN3, then regulatory clearance is required as per the BE guidelines.

Regulatory Safeguard for health and environment

These New Breeding Technologies are developed keeping in mind the safety of everybody including the environment. The regulatory systems to evaluate the risks of these technologies are robust and most of the “FEAR OF KNOWNS” are well taken care of and even after more than two decades, there is hardly any negative report published. Large

number of risk assessment studies shows that BE crops and food are equivalent to mother nature food. The threat to biodiversity in agriculture is due to human activities and animal grazing and not due to BE crops. In Mexico, a lot of studies have been done with BE corn and wild species of corn like Teosinte. There was no gene flow reported between these two diverse species.

Bio-engineering based (BE) technology has positive impacts which are now well established. Regarding negative impacts on the environment and human health, still there is no concrete evidence which establishes the linkage with technology.

Arguments against BE technology

Environmental concerns

- Some say BE crops can have unintended consequences, such as:
  - *Herbicide use:* BE crops can increase the use of herbicides and lead to the growth of weeds that are resistant to herbicides.

    This is a natural phenomenon of adaptation and natural mutations
  - *Biodiversity:* BE crops can lead to the erosion of biodiversity and pollute the gene pools of endangered plant species.

    This is just a fear of the unknown and even after more than three decades of BE crops released in the environment, no evidence of loss of biodiversity was generated.
  - *Cross-pollination:* Cross-pollination can lead to the development of resistant weeds that are difficult to eradicate.

    In Biological material, this challenge will be continuous and new innovations always find the new solutions

Health concerns:

- Some say BE foods can have harmful effects on the human body, such as:
- Antibiotic resistance: Some BEOs are resistant to certain antibiotics, and the genes from these plants could enter humans or animals when they eat them.

  This is a history now and nobody presently uses antibiotic markers. The natural resistance to antibiotics is taken care of by new generation antibiotics.
- Long-term effects: Not much is known about the long-term effects of BE foods on humans.

  After three decades of release of BE crops , till now no negative impact has been demonstrated. The use of electronic gadgets has similar questions about long term impacts but still everybody adapted them today.

Ethical Public concerns:

- Many people are uncomfortable with the idea of transferring animal genes into plants and vice versa.

  There are many genes that have common functions between humans and animals. So sequence transfer and its products are fully evaluated to be safe.

Foreign Corporate control on IPR

- The markets for BEOs are dominated by a few large MNC companies, which can lead to higher prices on Genetically modified (BE) technology.

There is a huge cost of innovation and development of these technologies. The regulatory costs are also high. So only those companies are successful who are investing huge money in R&D. Naturally the IPR control will be always with them

Arguments supporting BE technology

Supporters of Bio-technology extends the following arguments that can BE technology be can beneficial for India in several ways, including:

- Food security: BE crops can help India ensure food security and reduce its reliance on imports. India's growing population and shrinking cultivable land mean it needs to adopt more efficient farming methods.
- Reduced chemical pesticide use: BE crops can reduce chemical pesticide use by up to 37%.

- Increased crop yields: BE crops can increase crop yields by up to 22%.
- Increased farmer profits: BE crops can increase farmer profits by up to 68%.
- Reduced carbon dioxide emissions: BE crops can reduce carbon dioxide emissions by 24.5 million kg per year.
- Improved financial health for farmers: BE crops can improve the mental health of farmers, especially in India, by reducing the stress of potential crop failure.
- Reduced suicide rates: BE crops have contributed to a reduction in suicide rates among Indian farmers due to better income.
- Public funded research: The development of BE mustard seeds in India is an example of public funded research that can open up the possibility of genetic engineering research in the country to address IPR issues.

Trade Implication of BE technology for India

1. India will not be able to stop subsidised low cost BE products from the world market
2. Exports from India will be under scrutiny by non-BE buyers in the world market.
3. MSP policy in India put the crop from BE technology in a disadvantaged position due to world market dynamics.
4. Higher yield with BE technology may address domestic inflation issues.

The way forward on BE technology requirements and regulations

1. The **Supreme court of India** has directed the national government to come out with a national policy of BE Crops.
2. For feed and energy needs, this can be handled by a BE technology because last 30 years' experience can be considered.
3. Government should adopt an open consultation approach based on available scientific evidence and facts.
4. All stakeholders should be asked to share the facts to avoid opinions, myths and perceptions to avoid hidden agenda against national food and feed security.
5. Wherever required safeguards should be introduced to win the confidence of the society on BE crops.
6. The food crops can be dealt with **gene editing and other new technologies** which are fast and equally good to achieve the results.
7. There must be wider debates based on facts to address misleading perceptions, if any.

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IIMA Alumnus & Advocate, Supreme Court of India, NGT & Delhi High Court; Spl. in Techno-legal, IPR & Contracts Matters; Corporate Governance Trainer for Independent Directors; Member-Corporate Boards & Expert Committees

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Anil Ghanwat (B.Sc. Agriculture), 63 years old, is a farmer from SriGonda in Ahmednagar district in Maharashtra. Since 1985 he has been involved with the Shetkari Sanghatana

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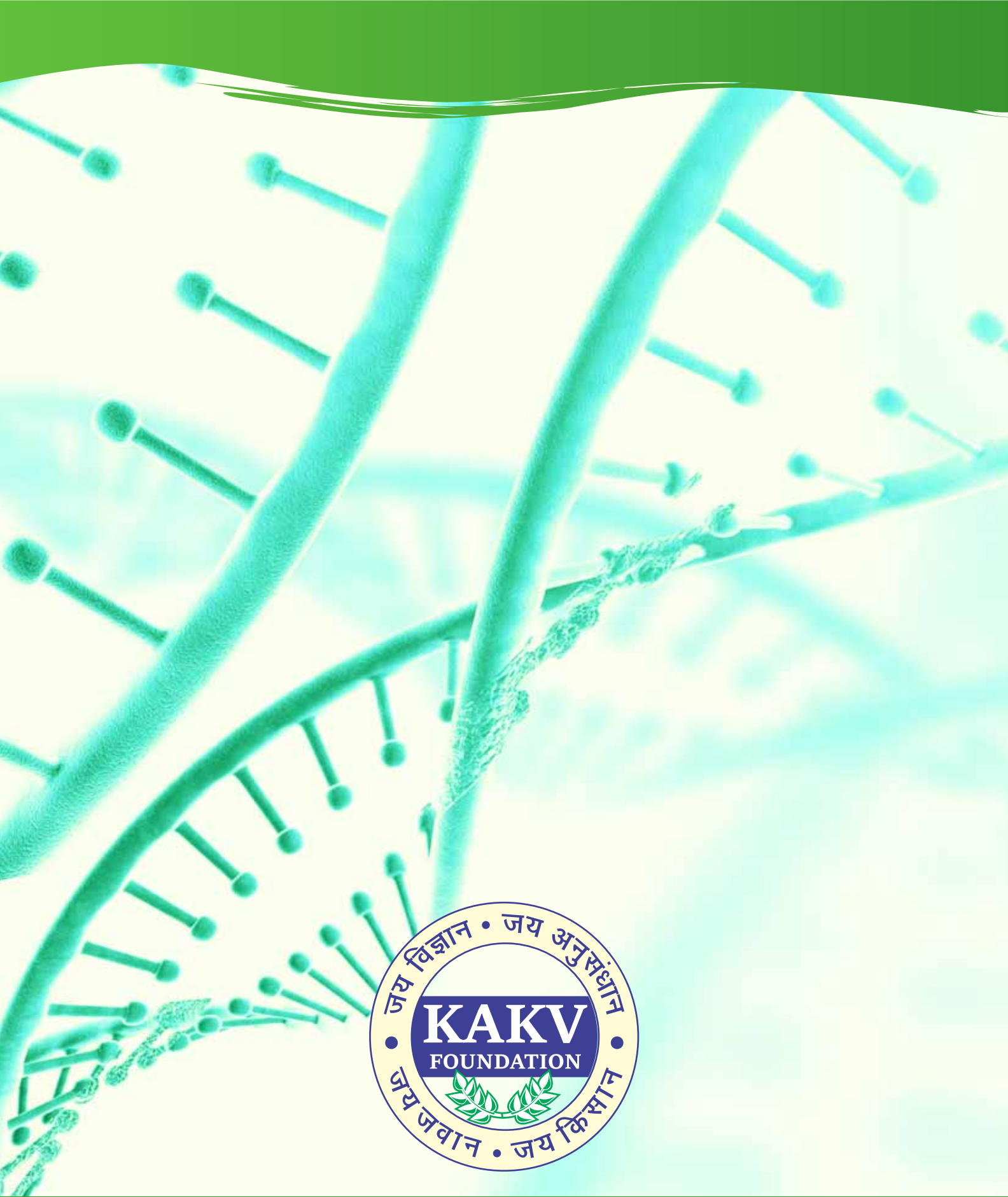

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Date: 30th November 2024

Dear Industry Members, Associations, and Government Representatives,

On behalf of the Kisan-Vigyan Foundation (KAKV), I would like to express our gratitude for the Ministry's proactive steps toward addressing India's agricultural challenges.

On November 12, 2024, the Kisan-Vigyan Foundation hosted a roundtable discussion titled *"Drafting the National Policy on Bioengineered Crops: Food Security Challenges and Way Forward"* with PHD Chambers of Commerce & Industry (PHDCCI) and lead seed industry association (FSSI). The event brought together leading experts and stakeholders to discuss the role of bioengineered (BE) crops in addressing India's food security, ecological sustainability, and farmers' welfare.

The discussion was graced by eminent speakers, including:

- **Mr. P.K. Singh**, Agriculture Commissioner, Ministry of Agriculture (Chief Guest)
- **Prof. K.C. Bansal**, Former Director, ICAR-National Bureau of Plant Genetic Resources (NBPGR)
- **Mr. Vijay Sardana**, Chairman, Kisan-Vigyan Foundation
- **Dr. Arvind Kapoor,** Distinguished Fellow, Sustainable Agriculture, The Energy and Resource Institute (TERI)

Key Outcomes and Actionable Recommendations

The roundtable emphasized the need for a comprehensive policy framework that ensures a balanced adoption of BE crops. The recommendations below reflect actionable insights from the deliberations:

Key Recommendations for Bioengineered Crops Policy Round Table

1. Strategic Policy Development (Government Centric)

- **Mandate Policy Prioritization**: Include specific provisions for reducing India's dependency on imported edible oils and essential crops by setting measurable goals with BE crops for self-sufficiency within five years.
- **Resource Allocation Plans**: Create a centralized framework for prioritizing critical crops based on national food security needs and export potential like done for cotton in the past.

2. Crop Prioritization Framework (Government Centric)

- **Define Categorization Criteria**: Prioritize crops under categories such as food security, fodder security, and fibre production, with a focus on indigenous crops like millets and pulses.
- **Economic Feasibility Studies**: Conduct cost-benefit analyses for each category to align BE crop promotion with farmer profitability and market demand.

3. Farmer and Consumer Engagement (Government & Private Sector)

- **Launch a National Awareness Campaign**: Run public outreach programs to dispel misconceptions about BE technologies and promote informed decision-making.
- **Implement Farmer Training Programs**: Establish region-specific capacity-building initiatives to educate small and marginal farmers on BE crop benefits and best practices.

4. Economic Viability and Inclusivity (Government & Private Sector)

- **Develop a BE-Specific MSP Framework**: Incorporate bioengineered crops into the Minimum Support Price (MSP) system to encourage adoption among small farmers.
- **Public-Private Partnerships (PPP)**: Establish PPP models for technology development and seed distribution, ensuring affordability and accessibility by all farmers.

5. Research and Development - R&D (Government Centric)

- **Launch a National Gene Mining Initiative**: Develop programs to utilize India's about 4.8 lakh germplasm accessions, supported by targeted funding and partnerships with research institutions.
- **R&D Incentives**: Offer financial incentives and tax breaks for domestic companies engaged in advanced molecular research to promote indigenous bioengineering capabilities and IPR generation.

6. Regulatory and Policy Infrastructure (Government Centric)

- **Establish a Unified Regulatory Body**: Form a National Bioengineering Crop Authority to oversee approvals, testing, and compliance within defined timelines.
- **Harmonize our Risk-Assessment Framework with BE cultivating nations**: Allow data portability for health and safety studies from countries with successful BE crop adoption.

7. Capacity Building (Government & Private Sector)

- **Expand Training Infrastructure**: Set up advanced molecular biology and gene-editing laboratories in agricultural universities nationwide.
- **Promote Educational Reforms**: Integrate BE crop studies into agriculture and biotechnology curriculums at undergraduate and postgraduate levels.

We look forward to your recommendations to be added to the draft above. Further the same will be shared with the ministry as recommendations to the policy in discussion.

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