



# Agricultural INPUTS Part II

## Seeds and Pesticides: Essential Consumable Inputs

### *Introduction*

The use of high yielding variety seeds and pesticides over the years has helped Indian farmers immensely to provide nutritional security to the nation at large. However, today issues like sustainable environmental practice and food safety have forced us to take a hard look at the current practices with regard to these two essential and fundamental inputs.

In this part, we will attempt to analyse various facets of seeds and pesticides with regard to their usage, development, economies and their impact on environment and its surroundings. As a corollary to this analysis, we will also try to delineate how the burgeoning issue of climate change is interacting with natural agricultural inputs i.e., soil, water, seeds and pesticides.

# SEEDS

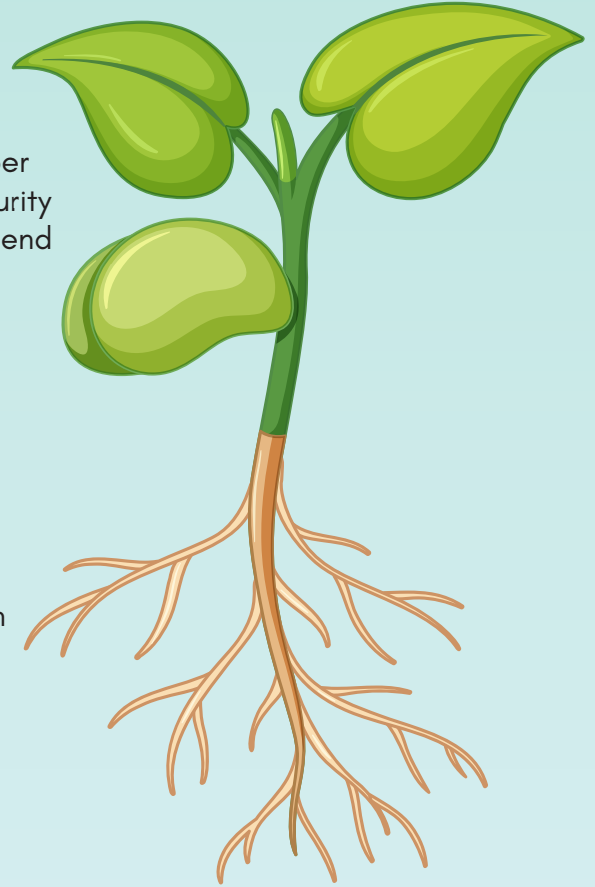
**Overview:** Seed is a critical input for enhancing productivity of all agricultural and horticultural crops and plays a vital role in improving the income status of farmers. While Indian seed sector has been well supported by a legal framework and seed production has evolved robustly, there is an urgent need to take note of various challenges associated with the sector.

## Significance

Use of quality seeds alone can increase productivity by 15- 20 per cent and can help in meeting country's food and nutritional security need. Any attempt to enhance crop productivity will largely depend on higher replacement rate of quality seeds of high yielding varieties/hybrids of agricultural and horticultural crops. The response of all other inputs is contingent upon quality of seeds to a large extent.

## Challenges/Issues

- **Seed production:** Major issues are **quality, price, and availability of seeds** on time. Poor farmers mainly depend on traditional/ conventional seeds (stored by farmers) that are less productive. **Hybrid seeds are more productive and faster growing as compared to conventional seeds but they are not regenerative** and the farmers are bound to purchase them every crop season which increases their dependency on big companies.
- **Seed Delivery System:** In spite of huge investments in infrastructure by both public and private seed sectors and supportive seed development policies of the Government, even today, around 60-65 percent of the seed in use is either farm saved or un-labelled. Certified/labelled seed availability is only around 35-40 percent, which depicts the tardiness of progress.
  - Since 86 per cent of the farmers in India are small and marginal, providing quality seeds at affordable price is also a challenge, as seeds produced by using varieties/hybrids with bio-tech traits are costly.
- **Poor Assessment of Seed Requirement:** Situations of over- production or under-production, both can have serious implications. For example, huge demand-supply gap exists in case of forage seed. This is also a major cause of concern for development of dairy sector in the country.



## Measures Taken so far

### National Seeds Corporation (NSC)

- Established in 1963 to increase in production of quality seeds.



### High Yielding Variety programme

- Launched in 1966-67 to increase production of food grain in India using improved seeds.



## National Seeds Policy 2002

- Envisaged increase in production of quality seeds, genetic engineering/modification technique to develop improved crop varieties, protection of new & improved varieties of plants etc.
- In 2002, it also led to the **establishment of Indian Council of Agriculture Research** (premier organization for seeds R&D).



## Various legislative frameworks

- Seed Act (1966), Seed Rules (1968), Seed (Control) Order (1983), Plants, Fruits & Seeds (Regulation of Import into India) Order (1989), **Protection of Plant Varieties and Farmers' Right Act (2001)**, and the **Essential Commodities Act, 1955** to take care of **seeds right from the production level to marking, labeling, and marketing levels so as to maintain** the quality standards as prescribed by the Central Seed Committee (formed under the Seed Act, 1966).



## Sub-mission on seed & planting material under National Mission on Agriculture Extension & technology (NMAET)

- It includes interventions that will cover the entire concept of seed chain from nucleus seed to supply to farmers for sowing to infrastructural support.



## Seed Village Programme (SVP), 2005

- To upgrade the quality of farm saved seeds. Under this programme, foundation/certified seed is provided at 50 per cent subsidy on cereals and 60 per cent subsidy on pulses, oilseeds, green manure seeds and fodder crops limiting to 1 acre/farmer.



## Other initiatives

- **Establishment of seed banks** to preserve seed biodiversity.
- **Establishment of national seed grid** as a district-wise data-base for information on requirement of seed, its production, distribution and preference of farmer.



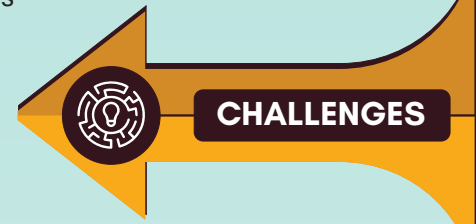
## Protection of Plant Varieties and Farmer's Rights Act, 2001:

### Performance and Achievements

- **More than 200 programs related to awareness and capacity building** for different stakeholders have been organised / supported by the authority under the act.
- **95 distinctiveness, uniformity and stability (DUS) test centres have been established** in State Agriculture Universities, ICAR, CSIR & other reputed research institutes.
- **Registration certificate of more than 300 of new plant varieties** have been issued.
- **National Gene Bank** for conserving seeds of registered varieties has been established in Delhi and Four regional gene banks have also been established at Dapoli, Ranchi, Solan and Jodhpur for maintaining referral samples of perennial asexually / vegetatively propagated crops.

PERFORMANCE

- **Enforcement** issues as agriculture is a state subject, and there exists large variance in laws across states.
- **Lack of IPR protection** may hinder innovation:
  - **Complicated and slow process** for registration of new varieties.
  - **Procedural gaps** exist in the process of registration.



## Possibilities going forward

- **Assessing Seed Requirement:** A robust seed rolling plan for successive five years based on adaptability and performance of the variety to be made at district and block levels by district level and block level committees.
- **Seed Production and Supply Chain:** A robust seed reserve scheme is needed to compensate for quantity of seeds converted into non-seed use, and to account for cost variations in procurement etc. Use of ICT-Real Time Data in seed production across nucleus seed, breeder seed, foundation seed, certified seed, labelled seed can help to trace real time data on the whole seed chain, and also to trace the quality of seed that is made available to the farmer.
- **Integrating Forage crops** into effective seed chain to support dairy and livestock sector has huge growth potential.
- **Enhance seed replacement rate** of all self-pollinated crops like paddy, wheat, ragi, barley etc. and all cross pollinated crops like jowar, bajra, etc. to 33% and 50% respectively. (Recommended by Ashok Dalwai report on Doubling Farmer's Income).
  - **Seed Replacement Rate** is the percentage of area sown out of the total area of crop planted in the season by using certified/quality seeds other than the farm saved seed.
- **Establishment and up-gradation of seed processing and storage plants** is required with advanced equipment/tools with scientific support. In addition to static seed processing plants, mobile processing facilities may also be promoted. This will benefit small & marginal farmers.
- **Seed Distribution:** The farmers are to be made aware about latest technologies like new planting equipment and new varieties suitable for their area by the State Extension Machinery.
- **Focus on Nutri-cereals:** Since millets are climate resilient and nutrition rich, it is necessary to promote them by building a strong seed production chain.
- **Scope for Seed Export:** Indian seed industry should explore opportunities for exporting various crop seeds to African countries as both the continents experience similar tropical and sub-tropical climates. Also, the SAARC-region has huge potential market, for example, varieties that are suitable in Punjab, West Bengal southern, northern and eastern India are found well adaptable in Afghanistan/Pakistan, Bangladesh, Sri Lanka and Nepal/Bhutan respectively.
- **Decentralise and broaden the base of the seed production platform** by roping in SHGs, FPOs, VPOs, youth-entrepreneurs, contract-farming etc.



- **Community Seed Banks (CSBs)** for promotion of local varieties and **Community Nursery Banks (CNBs)** for promotion of planting material in case of tree species are the best options to **promote farmers' varieties**.
- **Cost rationalisation of certified seeds:** Draft Seed Bill 2019 aims to regulate the quality of seeds sold and facilitate the production and supply of these seeds to farmers.

## Talking Point

*Crops have failed this year too! I am already under huge debt and now I have to purchase those expensive seeds again. I also had to save money for my son's education and daughter's wedding. What do I do now! This life is becoming hell!*



### How is the seed sovereignty being challenged in the current times in India?

The seed is the first link in the food chain - and seed sovereignty is the foundation of food sovereignty. Seed sovereignty includes the farmer's rights to save, breed and exchange seeds, to have access to diverse open source seeds which can be saved - and which are not patented, genetically modified, owned or controlled by emerging seed giants. It is based on reclaiming seeds and biodiversity as commons and public good.

The past twenty years have seen a very rapid erosion of seed diversity and seed sovereignty due to reasons such as:

- **Development of genetically modified seeds:** Besides displacing and destroying diversity, patented GMO seeds are undermining seed sovereignty apart from causing **genetic contamination**. India has lost its cotton seeds because of contamination from Bt Cotton - a strain engineered to contain the pesticide *Bacillus thuringiensis* bacterium. As a farmer's seed supply is eroded, and farmers become dependent on patented GMO seed, the result is debt.
  - Some **95 per cent of the country's cotton seed is now controlled by Monsanto** - and the debt trap created by being forced to buy seed every year - with royalty payments - has pushed hundreds of thousands of farmers to suicide; of the 250,000 farmer suicides, the majority are in the cotton belt.
- **India's IPR regime and farmers' unawareness regarding the same:** Recently, when PepsiCo Inc. filed a lawsuit against Indian potato farmers in Gujarat for violating patent law, it accused farmers of cultivating a variety of potato called FC5, which is under patent. It eventually dropped the charges against the farmer but the issue raised a broader question of seed sovereignty. According to India's Seeds Act 1968, seeds are outside the ambit of IPR, and is a sui-generis right of the farmer.
  - Also, according section 39 of the Protection of Plant Varieties and Farmers' Rights Act, 2001 (PPVFR Act), farmers are allowed to save, use, sow, re-sow, exchange, share and even sell farm produce including seed of a protected variety. But when it is sold, it cannot be packaged and branded as such. These laws are compliant with WTO's TRIPS (Trade-Related Aspects of Intellectual Property Rights) as well but the major issue is farmer's complete lack of awareness about IPR.

# PESTICIDES

**Overview:** Pest Management is one of the key aspects of the pre-harvest practices. Pest Management (non-chemical and chemical) entails cost, and therefore, it is pertinent to ensure efficacious and sustainable practices to rationalise cost of production, while minimising pesticide residues and thereby increasing farmers' income.

## Significance

Pesticides help farmers grow more food on less land by protecting crops from pests, diseases and weeds as well as raising productivity per hectare. It also allows farmers to maximize the benefits of other valuable agricultural tools, such as high quality seeds, fertilizers and water resources.



## Major Challenges/Issues

- **Poor quality of pesticides:** Sale of spurious and misbranded pesticides which are inefficient in treating the concerned pests, prompts the farmers to apply them in proportions greater than prescribed by the Registration Committee (RC). This not only increases the expenditure but also engenders repercussions detrimental to the crop, human health and environment.
- **Optimum application of pesticide is not practiced** due to lack of trained extension officers (who provide training to farmers on pesticide usage), inadequate sensitization of farmers, sale of pesticide by unqualified local pesticide dealers and delay in dissemination of required information to the farmers.
- **Limited reach of Integrated Pest Management (IPM) techniques** due to poor pest surveillance mechanism, non-availability of quality IPM inputs (bio-control agents, bio-pesticides, light traps, sticky traps etc.) and lack of trust on modern IPM techniques among the farmers.
  - IPM includes cultural, mechanical and biological techniques and practices with emphasis on use of bio-pesticides and pesticides of plant-origin like neem formulations.
- **Price of pesticides:** The price of pesticides (both branded and generic) is uncontrolled and is determined by the market forces i.e. inter-play of demand and supply. However, of late, prices of generic pesticides are seen to be increasing for unknown reason. As a result, the farmers' expenditure on pesticides has increased, thereby affecting their net incomes.

## Measures Taken so far

### Insecticides Act (I.A.), 1968

- Regulates import, manufacture, sale, transport, distribution and use of pesticides so as to prevent risks to human beings, animals and matters connected therewith. The Act is supported by Insecticides Rules, 1971.
  - Recently, **Pesticide Management Bill**, was introduced in 2020 in order to replace the Insecticides Act, 1968. It seeks to regulate the manufacture, import, sale, storage, distribution, use, and disposal of pesticides, in order to ensure the availability of safe pesticides and minimise the risk to humans, animals, and environment.



### Scheme on Monitoring of Pesticide Residues at National Level (MPRNL)

- To sensitize the stakeholders on pesticide use / safe use, pesticide residue and food safety, and regulatory issues related to pesticide residues.



### Other initiatives

- **Electronic platform for pest surveillance, Portal providing information** on various aspects of pesticide, **Setting up Regional Pesticide Testing Laboratories, Sensitisation of farmers** through Media, T.V, etc , **Regular training** of enforcement officials and laboratory analyst.



**Promotion of organic fertilizers** by providing financial assistance under the following schemes:

- Paramparagat Krishi Vikas Yojana (PKVY)
- Mission Organic Value Chain Development for North Eastern Region (MOVCDNER)
- Mission for Integrated Development of Horticulture
- National Mission on Oilseeds and Oil Palm (NMOOP)
- National Food Security Mission (NFSM)
- National Project on Management of Soil Health and Fertility (NPMSHF)
- Rashtriya Krishi Vikas Yojana (RKVY)



**Research Organizations (ICAR/SAU) Interventions** including:

- Recording of region wise and crop wise usage of plant protection molecules
- Research to develop pest resistant varieties
- Creation of a Centralised Prescription Repository (CPR)
- Big data analyses of pest situations
- Timely Dissemination of IPM recommendations



## Insecticides Act : Performance and achievements

- **Simplified guidelines for registration** of bio pesticides as compared to chemical pesticides to promote the use of bio pesticides.
- **35 Central Integrated Pest Management Centres (CIPMCs)** have been established across the country to propagate the use of Integrated Pest Management and recommend judicious use of chemical pesticide.
- **14 crop specific and pest specific Package of Practices** have been issued to the States during the lockdown period to promote Integrated Pest Management and judicious use of Pesticides.
- To promote Make in India, **6788 Certificates of Registration (CR)** have been issued to indigenous manufacturers of pesticides and 1011 CRs issued for export of pesticides.
- During 2020-21, India became the first country in the world to control locusts by using drones.

PERFORMANCE

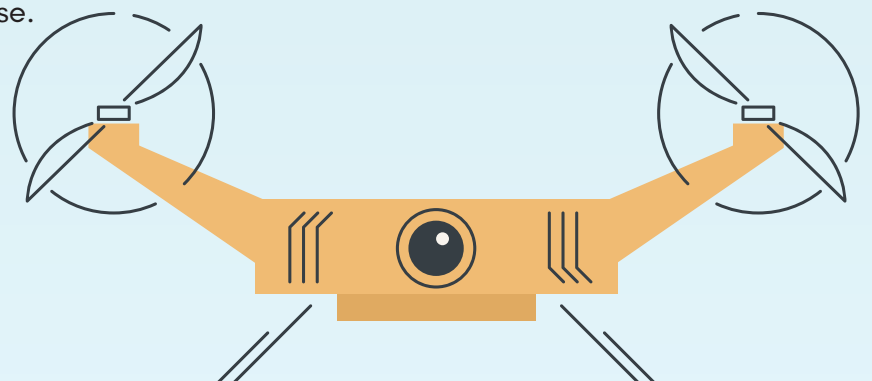


- **The vague definition of pesticides** under the Insecticide Act. The loophole is exploited by manufacturers of products like herbicides and plant growth stimulators to inundate the markets with unregistered products.
- The process used under the Act has **encouraged the manufacturing of multiple variants of the same pesticide molecule**.
- **Long registration process** that may stretch up to 8 years (instead of the 1 year prescribed by the Act).
- **Lack of provisions for periodic review** of the impact of registered pesticides.
- **No regulation of the pesticides' advertising** and promotion via dealers.



## Possibilities going forward

- **Reducing Pesticide Consumption in Indian Agriculture requires:**
  - **Multi-stakeholder participation** in diagnosis of the problems and designing of approaches.
  - **Use of injection syringes**, agro-chemical application for orchards without spraying, and GPS and computer assisted tools for **targeted pesticide spraying** need to be promoted.
  - **Application of pesticide as per 3 R's (i.e. right manner, right dosage and at right time)** will help in reducing the consumption of pesticide to an optimum level, and result in reduced pesticide expenditure and higher net income to farmers.
- **Awareness & education for effective and safe use:** Basic harmonized training modules be formulated, and translated into all regional languages so that the issues related to safe & effective use of pesticides are addressed holistically.
- **Decentralisation:** The states should encourage on-farm production and mass multiplication of bio-agents through SHGs, FPOs, Cooperatives, Mahila Sanghs etc. and the inputs should be made available at village level either at the office of Panchayats / Kisan Bhawans, etc.
- **Registration of pesticides:** Time bound registration, particularly of pesticides that are needed on priority is essential. Alternatives should be promoted, so that there is no monopoly.
- **Monitoring and surveillance** to detect manufacturing, storage and appearance of fake and banned pesticides in the market, for which it is important to have specialists with multidisciplinary knowledge.
  - The use of digital tools like **securing hologram seals and labels, light-sensitive ink designs, low-cost transport tags integrated with track-and-trace technologies like individualised bar and QR codes** etc. can help in the identification of genuine or fake pesticides at the time of purchase.
- **Promoting organic and environment friendly pesticides:** For example, Silver Hydrogen Peroxide is a potential eco-friendly disinfectant that can be used universally. It is both safe and non-toxic for people and surroundings.





## Talking Point



*I hope this pesticide would be more effective than the previous three as this is the branded and the costlier one. I should use more quantity this time to get rid of the pests quickly.*

### What is the story behind mismanagement of pesticides in India?

Pesticide poisoning is a big problem in India. Every year, there are about 10,000 reported cases of pesticide poisoning leading to large number of deaths in India. Various reasons account for this such as:

- **Fake pesticides:** The fake pesticide industry is growing at 20 per cent per year (FICCI report). Fake pesticides prove ineffective in controlling the pests being targeted, forcing anxious farmers to use indiscriminate spraying with enhanced dosage at decreased time intervals. It adds to the cost of cultivation without reducing the yield loss and the use of wrong pesticides also adds to the miseries of poor farmers who suffer from low returns from their produce.
  - There are numerous cases of repeated occurrence like the failure of apple, cotton and rice crops in the recent past. This includes a series of farmers' suicide in Odisha over crop failure due to a pest attack and the death of about 30 farmers due to inhalation of spurious pesticides in Yavatmal district of Maharashtra while spraying on cotton.
  - The **sale of chemically adulterated bio-pesticides** and chemical pesticides in the name of bio-pesticides, too, is also a common malpractice by unscrupulous traders.
- **Unregulated sale:** Monopoly of the private sector which manages around 90 per cent of the retail trade across the country, leads to unregulated sale guided by the profit motive alone.
- **Wrong advise:** At least 47 per cent of the farmers get guidance from pesticide sellers. Most farmers, being illiterate and ignorant, do not enquire about the quality, correctness, specific chemical brands and other minute details while buying a pesticide. Normally, there is neither any prescription nor receipt, which disqualifies the farmers from filing a claim for any loss due to the use of substandard pesticides.
- **Use of hazardous pesticides:** Two of the pesticides blamed for the deaths—monocrotophos and oxydemetonmethyl—are classified as Class I pesticides by the World Health Organization (WHO) because of their acute toxicity. Class I pesticides contain ingredients that are extremely hazardous (Class Ia) or highly hazardous (Class Ib). They are banned in several countries, including the EU. However, they are widely used in India.

➤ The **Anupam Verma Committee, in 2016**, recommended a ban on 13 'extremely hazardous' and phasing out of six 'moderately hazardous' pesticides by 2020. However, total compliance of the recommendations is yet to be seen.

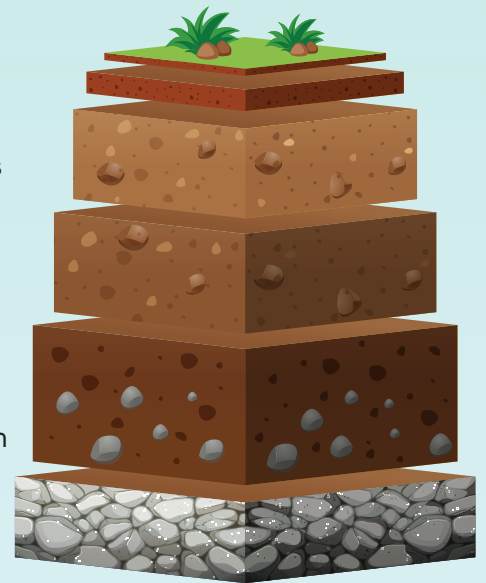
- **Violation of international codes:** As per the International Code of Conduct on Pesticide Management, jointly released by the Food and Agriculture Organization and WHO, in 2014, "pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available should be avoided, especially in the case of small-scale users and farm workers in hot climates." Maharashtra's case highlights violation of this code.

## *What is the impact of climate change on the effectivity of natural agriculture inputs?*

Indian agriculture is highly prone to the risks due to climate change either directly or indirectly. Following are the major impacts of changing climate on the various agriculture inputs and ultimately on the agriculture productivity.

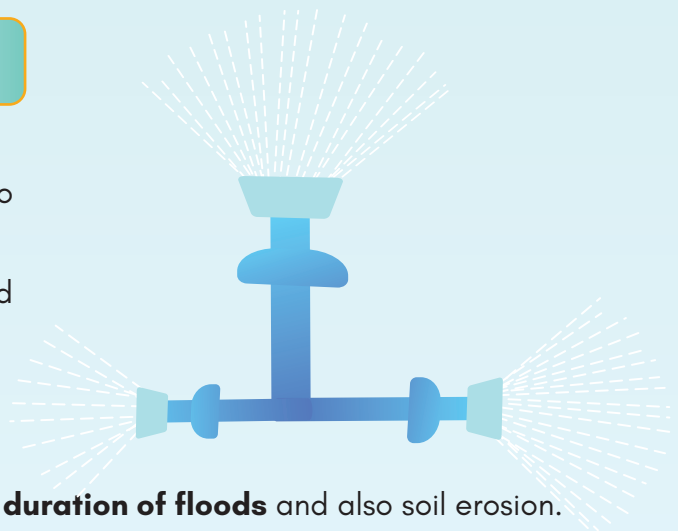
### Soil

- **Reduced quantity and quality of organic matter content**, which is already quite low in Indian soil.
- Under elevated CO<sub>2</sub> concentration, crop residues have **higher C:N ratio**, which may reduce their rate of decomposition and nutrient supply.
- Increase of soil temperature will increase N mineralization but its availability may decrease due to **increased gaseous losses** through processes such as volatilization and denitrification.
- Change in rainfall volume and frequency and wind intensity may alter the **severity, frequency and extent of soil erosion**.
- Rise in sea level may lead to **salt-water ingress in the coastal lands** turning them less suitable for conventional agriculture.



### Water

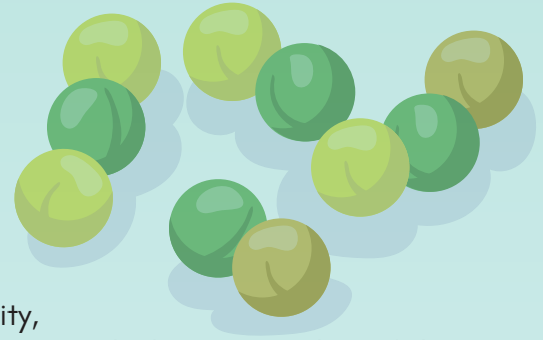
- **Increased irrigation demands** with increased temperature and higher evapo-transpiration. This may also result in **lowering groundwater table** at some places.
- Melting of glaciers in the Himalayas may lead to increased water availability in the Ganges, Bhramaputra and their tributaries in the short run but **in the long run the availability of water would decrease considerably**.
- A significant increase in runoff is projected in the wet season that may lead to **increase in frequency and duration of floods** and also soil erosion.



- The water balance in different parts of India is predicted to be disturbed and the quality of groundwater along the coastal track will be more affected due to intrusion of sea water.

## Seeds

- Farmers and growers expect uniform seed quality, but variable quality due to environmental factors like high temperature cause **poor plant population establishment** and farmers will experience big economic losses
- Change in temperature and rainfall distribution can result in **poor performance of existing seed varieties.**
- Seed quality such as physical and genetic purity germination, viability, vigour etc. depends on climatic variables prevailing during the entire period of crop growth, and the subsequent seed processing environment. If **climatic factors are adverse during crop growth period, seed production is affected.** For example, water stress during grain filling stage will result in poor quality of seed, as also the yield level.
- Climatic vagaries such as cyclones, untimely rains, hailstorms severely affect quality of seed produced.



## Pest Management

- **Extension of geographical range** of insect-pests and pathogens.
- **Changes in population growth rates** of pathogens and insect-pests.
- **Changes in relative abundance and effectiveness of biocontrol agents.**
- **Changes in pathogen/insect-pest × host × environment interactions, and loss of resistance in cultivars** containing temperature-sensitive genes.
- **Emergence of new diseases/pest problems** and increased risk of invasion by migrant diseases and pests.
- **Reduced efficacy of** different components of **disease and insect-pest management.**



## Conclusion

Use of appropriate and quality seeds along with correct application of pesticides ensures longevity and sustainability of the agricultural system and contributes to efficient economic conversion by way of higher productivity. These material inputs therefore must be managed for better use efficiency and productivity, as well to mitigate possible shortfalls in other inputs such as labour and water.



**TOPIC AT A GLANCE****AGRICULTURAL INPUTS-PART II**  
**Seeds and Pesticides: Essential Consumable Inputs****Significance**

Use of quality seeds can increase productivity, can help in meeting country's food and nutritional security need and improves the response of all other inputs.

**Challenges**

- **Seed production:** Major issues are quality, price, and availability of seeds.
- Tardy progress of **seed delivery system** Poor soil fertility: Certified/labelled seed availability is only around 35-40 percent.
- **Poor Assessment of Seed Requirement.**

**SEEDS****Measures taken**

- National Seeds Corporation (NSC) 1963.
- High Yielding Variety programme(1966-67).
- National Seeds Policy 2002.
- Various legislative frameworks such as Seed Act (1966), Protection of Plant Varieties and Farmers' Right Act (2001),the Essential Commodities Act, 1955 etc.
- Sub-mission on seed & planting material under National Mission on Agriculture Extension & technology (NMAET).
- Seed Village Programme (SVP), 2005.
- Other initiatives such as Establishment of seed banks and seed grid.

**Possibilities going forward**

- **Assessing Seed Requirement.**
- **Strengthening Seed Production and Supply Chain.**
- **Integrating Forage crops** into effective seed chain to support dairy and livestock sector.
- **Enhance seed replacement rate** of all self-pollinated crops like paddy.
- **Establishment and up-gradation of seed processing and storage plants.**
- **Developing strong seed production chain** for climate resistant Nutri-cereals.
- **Explore opportunities for seed export**
- **Decentralise and broaden the base of the seed production platform.**
- **Community Seed Banks (CSBs)** for promotion of local varieties.
- **Cost rationalisation of certified seeds.**

**Significance**

Pesticides help farmers grow more food on less land by protecting crops from pests, diseases and weeds as well as raising productivity per hectare, and to maximize the benefits of other inputs such as seeds and water.

**Challenges**

- Poor quality of pesticides.
- Optimum application of pesticide is not practiced.
- Limited reach of Integrated Pest Management (IPM) techniques which emphasises on use of bio-pesticides.
- Unregulated price of pesticides.

**PESTICIDES****Measures taken**

- Insecticides Act (I.A.), 1968.
- Scheme on Monitoring of Pesticide Residues at National Level (MPRNL).
- Other initiatives such as Electronic platform for pest surveillance,Regional Pesticide Testing Laboratories, Sensitisation of farmers through media etc.
- Promotion of organic fertilizers through schemes like Paramparagat Krishi Vikas Yojana .
- Research Organizations (ICAR/SAU) Interventions including developing pest resistant varieties,timely dissemination of IPM recommendations etc.

**Possibilities going forward**

- Reducing Pesticide Consumption through proper diagnosis, use of injection syringes and proper application.
- Awareness & education for effective and safe use.
- Decentralised production and mass multiplication of bio-agents through SHGs, FPOs etc.
- Registration of pesticides.
- Monitoring and surveillance to detect fake pesticides.
- Promoting organic and environment friendly pesticides.