Q6

How is science interwoven deeply with our lives? What are the striking changes in agriculture triggered off by the science-based technologies?

UPSC Civil Services Mains 2020 · GS III · 10 marks · Crops, Irrigation and Marketing

Major crops - cropping patterns in various parts of the country; different types of irrigation and irrigation systems; storage, transport and marketing of agricultural produce and issues and related constraints; e-technology in the aid of farmers.

Core demand of the question

- How is science interwoven deeply with our lives? What are the striking changes in agriculture triggered off by the science-based technologies?
- Keep the explanation within a 10-mark length

Revision summary

Everyday life runs on applied science in energy, health, and digital public goods.

Agriculture's striking shift was HYV seed, fertiliser, and irrigation - the Green Revolution.

Pumps, Bt cotton, drip, Soil Health Cards, and satellite advisories are later layers.

The same technologies created groundwater and chemical stress in some belts.

The next task is science for climate-smart, less wasteful farming, not a rejection of labs.

Introduction

Science is no longer a lab visit. It sits in the grid, the phone, the vaccine, the weather warning, and the seed. Agriculture is the oldest Indian livelihood that those science-based technologies have most visibly rewritten - yield, water, chemicals, and now data.

Body

Science interwoven with lives

- **Energy and materials:** electricity, steel, cement, and fertiliser are applied thermodynamics and chemistry in daily shelter and food.
- **Health:** germ theory, antibiotics, vaccines, imaging, and now molecular diagnostics decide whether a fever is a death sentence.
- **Information:** satellites, fibre, and semiconductors run UPI, Aadhaar rails, and cyclone alerts that ordinary households use without naming Maxwell.
- **Risk:** IMD forecasts, seismic codes, and food standards are science as a public good, not a hobby.
- **The COVID year made the weave obvious:** sequencing, oxygen plants, and digital epidemiology were civic infrastructure.

Striking changes in agriculture

• **Green Revolution biology: HYV** wheat and rice, fertiliser-responsive plant architecture, and irrigation turned north-western plains into a grain bowl (**Swaminathan**, **Borlaug**, ICAR system).

• **Mechanisation and energy:** tractors, pumpsets, and later solar pumps changed labour and groundwater at once.

• **Plant protection and nutrition:** synthetic pesticides, herbicides, and soil-test based fertiliser; **Soil Health Card** tries to make the chemistry site-specific.

• **Biotechnology: Bt cotton** is the large Indian GM field crop; tissue culture and marker-assisted breeding spread in horticulture and rice.

• **Water technologies:** drip and sprinkler (**PMKSY-PDMC**), laser levelling, and canal lining are engineering answers to flood irrigation.

• **Information agriculture: INSAT/IRS** for crop and drought watch, **mKisan**, agro-met advisories, and the beginnings of precision and drone spraying.

• **Post-harvest science:** storage chemistry, food irradiation in niches, and cold-chain physics that decide whether horticulture pays.

The other side of the weave

• The same science locked some regions into **water-guzzling rice-wheat**, pesticide treadmills, and nutrient imbalance. Technology is not automatically wisdom.

• Climate-smart varieties, biologicals, and better extension are the next science layer, not a return to a pre-scientific farm.

Flow diagram

Science in daily life -> Health energy data

Science in daily life -> Agriculture

Agriculture -> HYV irrigation chemicals irrigation chemicals

Agriculture -> Bt cotton biotech

Agriculture -> Drip satellites advisories

Conclusion

Science is woven through power, medicine, data, and risk management in ordinary Indian life. In agriculture it delivered HYV seed, pumps, biotech cotton, micro-irrigation, and satellite advice - a yield revolution that now needs a sustainability revolution from the same scientific method.

Facts & figures

HYV wheat and rice

Semi-dwarf, fertiliser-responsive varieties that underwrote India's grain self-sufficiency from the late 1960s.

Bt cotton

India's principal commercial GM crop, aimed at bollworm, with continuing debates on pink bollworm and seed systems.

Soil Health Card

Scheme to issue plot-wise nutrient advice so fertiliser use is not a blunt N-heavy dose.

PMKSY-PDMC

Per Drop More Crop: micro-irrigation support as a science-and-engineering water save.

Agro-met advisories

IMD-ICAR district weather-based farm advice delivered by SMS and extension.