Synchronising Irrigation and Cropping

For Prelims: Millets, Digital Agriculture Mission,Pradhan Mantri Krishi Sinchayee Yojana, Jal Shakti Abhiyan, Krishi Vigyan Kendras

For Mains: Irrigation infrastructure and cropping patterns, Water-use efficiency and sustainable agriculture, Role of subsidies and MSP in shaping cropping patterns

Source:FE

Why in News?

India's **agriculture** has long assumed that expanding irrigation automatically changes cropping patterns toward water-intensive crops, but 2011-12 to 2022-23 data shows **irrigation and cropping decisions are made together,** driven by immediate factors like rainfall and market conditions.

- Understanding this dynamic is critical to **making irrigation investments more effective and sustainable.**

What is the Relationship Between Irrigation and Cropping?

- **Irrigation and Cropping Patterns:** Reliable irrigation enables farmers to shift from traditional subsistence crops (like **millets**) to high-value crops (like fruits, vegetables, and cash crops such as **sugarcane and cotton**).
  - Irrigation facilitates multiple cropping (double or triple cropping) by reducing **dependence on monsoons,** thereby increasing land use efficiency.
  - Areas with **better irrigation infrastructure (e.g., Punjab, Haryana)** , supported by **Green Revolution investments** in canals and tube wells, benefit from **flat terrain and fertile soil.**
    - These regions exhibit more intensive and commercialized cropping patterns compared to largely rain-fed areas in Central and Eastern India.
  - **High-Yielding Varieties (HYVs)** require assured water supply. Irrigation supports the adoption of such varieties, especially in the Green Revolution regions (Punjab, Haryana, and western Uttar Pradesh).
- **Timing of Irrigation:** Irrigation is most effective when it **aligns with the sowing season.** When infrastructure becomes available with a delay of one or two years, its **impact weakens or turns negative.**
  - Farmers consider **present-day rainfall, prices, seed and fertiliser availability, and policy signals** when deciding what and when to plant. Delayed irrigation doesn't help them in such scenarios.
- **Crop Choices Beyond Irrigation Infrastructure:** Though irrigation is vital, farmers' crop choices often depend on real-time factors like **water availability, weather, input accessibility, and market prices,** not solely just irrigation infrastructure.

What are the Trends in Irrigation and Cropping in India?

- **Gross Irrigated Area (GIA):** It was increased from 91.8 million hectares in 2011-12 to **122.3 million hectares in 2022-23.**
    - GIA is the **sum total of the areas irrigated under all crops over the various seasons** in the agricultural year, under GIA, area irrigated twice/thrice in the same year is counted as two/three times.
- **Gross Sown Area (GSA):** It rose from 195.8 million hectares to 219.4 million hectares during the same period.
    - The share of sown area under irrigation grew from 46.9% to 55.8%.
    - GSA is the **sum total of the areas under all crops over the various seasons in an agriculture year**, under GSA, area sown twice/thrice in the same year is counted as two/three times.
- **Crop Yields:** Improved from 841 kg/acre to 1,009 kg/acre, with an average annual growth rate of 1.67%.

What are the Different Irrigation Systems?

Click here to Read: Different Irrigation Systems

What is the Need for Synchronising Irrigation and Cropping?

- **Efficient Water Use**: Aligning irrigation with **actual crop cycles** helps reduce water **losses and prevents over-irrigation**.
    - In Punjab, farmers use **drip irrigation** with **soil moisture sensors** for cotton and maize, reducing water use by up to 30% and increasing yields by targeting key crop stages
- **Higher Productivity**: Timely irrigation supports optimal crop growth, especially for high-yielding and water-sensitive varieties.
- **Adaptation to Climate Risks**: With erratic monsoons and rising extreme weather events, synchronised planning ensures that **irrigation buffers crop failure** during dry spells.
- **Cost-Effective Infrastructure**: Investments in canals, micro-irrigation, or groundwater systems yield better returns when they meet farmers' real-time cropping needs.
- **Environmental Sustainability**: Reduces risks of waterlogging, salinization, and groundwater depletion caused by poorly timed irrigation.

What are the Flaws in Traditional Irrigation Planning?

- **Mismatch with Sowing Cycles:** Long gestation infrastructure projects (like Maharashtra's long-delayed Gosikhurd irrigation project) often miss peak sowing windows, leading to **underutilised systems.**
    - Canal repair or desilting works under **centrally managed schemes** are often completed post-monsoon, making them redundant for the kharif season.
- **Top-Down Approach Ignores Local Context:** Centralised irrigation planning does not reflect **local agro-climatic conditions or cropping preferences.**
    - In **Punjab and Haryana**, continued government support for water-intensive paddy, combined with canal irrigation, has led to alarming **groundwater depletion** (the total estimated groundwater depletion in India is in the range of **122–199-billion-meter cubes**), showing the ecological cost of rigid planning.
        - Excessive borewells use, due to free electricity has led to **critical aquifer depletion,** especially in Punjab, Haryana, and western UP.
    - Additionally, poor maintenance, seepage, and theft cause up to 40% water loss in canal-fed areas. There is very little integration of traditional water harvesting structures in formal irrigation planning.
- **Lack of Input Convergence:** Irrigation alone doesn't raise productivity unless combined with **quality seeds, fertilisers, credit, and extension services.**
    - In Uttar Pradesh, irrigation expansion did not boost yields significantly due to poor access to certified seeds and soil health inputs.

- **Absence of Real-Time Data Use:** Irrigation planning rarely incorporates timely weather forecasts, soil moisture maps, or cropping patterns to guide water allocation.
    - States like **Andhra Pradesh and Karnataka** have begun integrating **remote sensing and crop water requirement data** to make irrigation more adaptive, but such models are still not widespread.
- **Technological and Financial Barriers:** Traditional planning does not integrate modern **micro-irrigation or renewable-powered systems.** Poor farmers are often excluded from drip irrigation due to high costs.
- **Soil Salinization:** Lack of efficient drainage planning causes **waterlogging and soil salinization** in irrigated areas.
    - By 2025, around **13 million hectares of irrigated land in India may be affected by waterlogging and soil salinity**, worsened by saline groundwater use and climate change.
    - These conditions can reduce crop yields by up to **80%** and lead to land abandonment.
    - In Haryana alone, waterlogged saline soils cause annual losses of over 2 million tons of crops.

Note: Irrigation is a **State subject** and planning, execution, funding as well as priority of execution and completion of irrigation projects is within the purview of respective State Governments.

- However, the Central Government provides financial assistance to State Governments under **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** for expeditious completion of selected projects as per guidelines of the Programme.
- PMKSY is amalgamation of various schemes viz. **Accelerated Irrigation Benefits Programme (AIBP)**, **PMKSY –Har Khet Ko Pani (HKKP)** , **PMKSY - Per Drop More Crop (PDMC)** (Implemented by Ministry of Agriculture & Farmers Welfare) and **PMKSY - Watershed Development (WD)** (Implemented by Department of Land Resources).

What Reforms are Needed in Irrigation Planning to Ensure Sustainable Cropping?

- **Adopt an Agro-Ecological, Region-Specific Irrigation Strategy:** Shift focus from blanket irrigation expansion to region-specific planning based on soil types, rainfall patterns, and water availability.
    - Promote millet, pulses, and oilseeds in arid zones under schemes like the **Millet Mission**, reducing pressure on water resources.
- **Integrate Irrigation with Input Services:** Link irrigation investment with timely access to seeds, credit, fertilisers, and weather-based advisories through the **Digital Agriculture Mission** and **electronic National Agriculture Market (e-NAM).**
    - Encourage models like **Andhra Pradesh's Real-Time Governance Society (RTGS),** using satellite data, soil moisture sensors, and cropping maps for precise irrigation scheduling.
- **Expand Micro-Irrigation and Small-Scale Innovations:** Scale up the **Per Drop More Crop (PDMC)** component of **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** by offering **cluster-based, demand-driven subsidies** and **custom hiring centers** for micro-irrigation tools.
    - Encourage low-cost, farmer-friendly innovations like **solar-powered pumps**, **smart drip kits**, and **mobile-based irrigation alerts**.
- **Rationalise Input Subsidies**: Replace **free or flat-rate electricity and water subsidies with targeted direct benefit transfers (DBTs)** to discourage over-extraction and incentivize efficient water use.
    - Expand **Punjab's "Paani Bachao, Paise Kamao"** scheme to other groundwater-stressed states, offering financial rewards for using less water.
    - Link **Minimum Support Prices (MSP)** with sustainable cropping patterns, rewarding cultivation of less water-intensive crops.

- **Restore Traditional Water Harvesting:** Integrate **traditional systems** (like tanks in Tamil Nadu, johads in Rajasthan) with modern irrigation grids under **MGNREGA** and **Jal Shakti Abhiyan**.
- **Address Drainage, Salinity, and Waterlogging Proactively:** Launch a **National Drainage Mission** under the Ministry of Jal Shakti to tackle waterlogging and soil salinity, especially in Indo-Gangetic plains.
    - Promote **salt-tolerant crop varieties** (sorghum, oats and barley) and conjunctive use of surface and groundwater to control salinity.
- **Capacity Building and Awareness:** Educate farmers through **Krishi Vigyan Kendras (KVKs)** and NGOs on water-saving practices, climate risks, and efficient irrigation methods.

Conclusion

India's irrigation planning needs to evolve from infrastructure-centric to **climate-smart, farmer-responsive, and ecologically sustainable systems**. This shift demands **policy convergence**, **behavioural change**, and **technology integration**, supported by strong community participation and institutional reforms. Only then can irrigation truly enable sustainable cropping and secure water, food, and livelihoods for the future.

Drishti Mains Question:

Reforming Irrigation, Reshaping India's Future: The Path to Sustainable Agriculture" – Discuss.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q.1. Which one of the following ancient towns is well known for its elaborate system of water harvesting and management by building a series of dams and channelizing water into connected reservoirs? (2021)

(a) Dholavira

(b) Kalibangan

(c) Rakhigarhi

(d) Ropar

Ans: A

Q.2. With reference to 'Water Credit', consider the following statements: (2021)

1. It puts microfinance tools to work in the water and sanitation sector.
2. It is a global initiative launched under the aegis of the World Health Organization and the World Bank.
3. It aims to enable the poor people to meet their water needs without depending on subsidies.

Which of the statements given above are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: C

Mains:

Q.1 What are the salient features of the Jal Shakti Abhiyan launched by the Government of India for water conservation and water security? **(2020)**

Q.2 Suggest measures to improve water storage and irrigation system to make its judicious use under the depleting scenario. (2020)