

## **Water Management: Towards Sustainable Agriculture**

Sustainable water management in agriculture aims to match water availability and water needs in quantity and quality, in space and time, at reasonable cost and with acceptable environmental impact.

### **Need for Sustainable Water Management**

- Irrigated areas will increase in the forthcoming years
- Increasing demand of domestic use and industry
- The efficiency of irrigation is very low
- Changing climate scenario
- Feeding 17.5% of the world's human population from a meagre 2.3% of land area and with only 4% of the global water resources at its disposal
- the country also has to provide fodder to 11% of the world's livestock population.

India has set a target of 355 MT for foodgrains, 180 MT for vegetables, 182 MT for milk, 15 MT for meat, and 16 MT for fish by 2030. This can only be achieved through a development strategy centred on regional water availability, water budgeting and its efficient use.

### **Sustainable Agriculture:**

- Sustainable Agriculture is a form of agriculture aimed at meeting the needs of the present generation without endangering the resource base of the future generations.
- Sustainable agriculture focuses on:
  - **Soil management** through conservation agriculture, organic farming, integrated nutrient management system and on-farm residue management;
  - **Efficient water resource management** techniques like right method of irrigation, micro-irrigation, life-saving irrigation, use of mulches etc.;
  - **Crop management** includes right time of sowing, cultivation of suitable crops and varieties in rotation, inter cropping, mixed-cropping, integrated pests management, etc.

### **Water Resources of India**

- India annually **receives a rainfall of 1,085 mm**. Nearly three-fourths of the total rainfall received in India is through south-western monsoon activity.
- **Total utilisable water resource** in the country has been estimated to be about 1,123 billion cubic metres (BCM) (690 BCM from surface and 433 BCM from ground water).
- On the basis of the available water resources, the total irrigation potential from surface and ground water resources is estimated to be 139.9 MH. The major source for irrigation is groundwater.
- At 68.1 MH (2013–14), **India has one of the largest net irrigated areas** in the world. However, the **productivity of irrigated areas** at the national level is only around 3 tonnes per hectare.
- The **efficiency of surface irrigation systems** is around 30–40 percent which implies that at least 60 percent of the water being supplied is being lost at various stages in the system.

### **Efficient Water Management Practices**

Under water demand management most attention is given to both **irrigation scheduling and the irrigation method**. Various technologies and practices focusing on enhancing water use efficiency are:

1. **Laser Land Levelling** - It increases the water application efficiency which leads to higher yields as well as rise in water use efficiency. It also has a direct impact on the nutrient use efficiency.

2. **Irrigation Scheduling** - Irrigation scheduling is the decision-making process for determining when to irrigate the crops and how much water to apply so as to supply the plants with sufficient water while minimising loss to deep percolation or runoff.

### Methods of Irrigation

The selection of the right method of irrigation is influenced by soil type, land topography, crops to be grown, quality and quantity of water available for irrigation and other site-specific variations. Various methods of irrigation are:

#### A. Check Basin and Border Strip Irrigation

- This type of **surface irrigation** (surface irrigation involves the application of water by gravity flow to the surface of the field) is the easiest and least costly method.
- It is highly inefficient as only less than 20 percent of the water is taken up by the plant.

#### B. Furrow Irrigation

- It is generally used to irrigate row crops and vegetables, and is suited to soils in which the infiltration rates are between 0.5 and 2.5 cm/hr.
- It is ideal for slopes varying from 0.2 to 0.5% and a stream size of 1–2 litre/ second.
- 20–30 percent savings in irrigation water can be achieved by switching over to raised bed furrow irrigation systems.

#### C. Surge Flow Irrigation

- Excessive water intake and deep percolation losses are major limitations for irrigation through furrows and border strips.
- Surge flow irrigation, the intermittent application of water in a series of on and off modes of constant or variable time spans has the potential of reducing intake and percolation losses, increasing the irrigation efficiencies and conserving irrigation water.

#### D. Micro-irrigation

- It is **most efficient methods** of irrigation and also **leads to increased crop productivity**.
- As on 2017, the area covered under micro-irrigation is about 8.7 MH, accounting for only about **13 percent of the potential area**.
- Micro-irrigation mainly includes drip irrigation and sprinkler system water application.

##### D.1. Sprinkler Irrigation -

- Water is pumped through pipes and then sprayed onto the crops through rotating sprinkler heads.
- It is more efficient than surface irrigation but more costly to install and operate because of the need for pressurised water
- Conventional sprinkler systems spray the water into the air, losing considerable amounts to evaporation.

- **Low Energy Precision Application (LEPA)** offers a more efficient alternative. In this system the water is delivered to the crops from drop tubes that extend from the sprinkler's arm.

#### Promotion of Micro irrigation

- Micro-irrigation in India is popularised with a **subsidy component**, by both the central and state governments.
- In 2006, the GOI started a Centrally Sponsored Scheme (CSS) for micro irrigation.
- In 2010, CSS was enhanced in scope and renamed as National Mission on Micro Irrigation (NMMI), which was subsequently brought under the ambit of the National Mission on Sustainable Agriculture.
- In 2015, NMMI was brought as a scheme under the Prime Minister's Krishi Sinchayee Yojana (PMKSY).

- LEPA can achieve **efficiencies as high as 95 percent**. Since this method operates at low pressure, it also saves as much as 20 to 50 percent in energy costs compared with conventional systems.

#### **D.2. Drip Irrigation**

- Drip and micro-sprinkler irrigation systems apply water slowly on or below the soil surface.
- It is often preferred over other irrigation methods because of its high (90 percent) water application efficiency. The water use efficiency increases up to 100 percent in a properly designed and managed drip irrigation system.
- Water logging and salinity are also completely absent under drip method of irrigation. It also helps in attaining early maturity of crops, increased crop yields and higher fertiliser-use efficiency, reduction in weed growth, less labour requirement and less electric power consumption.

#### **D.3. Fertigation**

- It is the **application of fertilisers through the irrigation system**. The soluble fertilisers at concentrations required by crops are applied through the irrigation system to the wetted volume of the soil.
- Possible disadvantages include the **nonuniform chemical distribution** when irrigation design or operation are inadequate, the **overfertilization** in case that irrigation is not based on actual crop requirements and the **excessive use of soluble fertilisers**.

#### **D.4. Subsurface Drip Irrigation (SDI)**

- SDI is a **low-pressure, low volume irrigation system** that uses buried tubes to apply water. The applied water moves out of the tubes by soil matrix suction. Wetting occurs around the tube and water moves out in the soil all directions.
- The **potential advantages** of SDI are: a) water conservation, b) enhanced fertiliser efficiency, c) uniform and highly efficient water application, d) elimination of surface infiltration problems and evaporation losses, e) flexibility in providing frequent and light irrigations, f) Reduced problems of disease and weeds, g) lower pressure required for operation.
- The main disadvantages are the **high cost of initial installation** and the increased **possibility for clogging**, especially when poor quality water is used.

#### **D.5. Deficit Irrigation Practices**

- In arid and semiarid regions irrigation strategies should not be based on full crop water requirements.
- It should be adopted for more effective and rational use of water based on the critical or sensitive growth stages to water deficit. Thus, **at non-sensitive growth stages irrigation is withheld** which is called as deficit irrigation.

#### **D.6. Regulated Deficit Irrigation (RDI)**

- RDI is an optimising strategy under which crops are allowed to sustain some degree of water deficit and yield reduction.
- The main objective of RDI is to **increase Water Use Efficiency** of the crop by eliminating irrigations that have little impact on yield and to improve control of vegetative growth (improve fruit size and quality).
- The allowed water deficits favour water saving, control of percolation and runoff return flows and the reduction of losses of fertilisers and agrochemicals.
- It provides for leaching requirements to cope with salinity and the optimization approach leads to economic viability.

**D.7. Partial Root Drying (PRD)**

- PRD is a new irrigation technique, first applied to grapevines that subject one half of the root system to dry or drying conditions while the other half is irrigated. Wetted and dried sides of the root system alternate on a 7–14 day cycle.
- PRD uses **biochemical responses of plants to water stress** to achieve balance between vegetative and reproductive growth.

**E. Agronomic Practices**

- Agronomic practices, such as soil management, fertiliser application, and disease and pest control are related to sustainable water management. Some of the agronomic practices use for efficient water management are:

**1) Contour Tillage**

- Soil cultivation is made along the land slope and the soil is left with small furrows and ridges that prevent runoff. This technique is also **effective to control erosion**.
- It may be applied to row crops and small grains provided that field slopes are low. This is one of the techniques to increase better use of the rain water, especially in rainfed areas.

**2) Broad Bed Planting:** Cultivation of crop on broad beds and irrigation is applied in furrows. This method helps to save 30–40 percent water and typically suitable for close planted field crops and horticultural row crops.

**3) Conservation Tillage (CT):** CT includes zero tillage and retention of crop residuals on the soil surface at planting. Crop residues acts as mulches and reduce evaporation losses and protect the soil from direct impact of raindrops, thus controlling crusting and sealing processes. CT helps to maintain high levels of organic matter in the soil thus it is highly effective in improving soil infiltration and controlling erosion which results in increase of WUE.

**4) Mulch:** Mulching with crop residues on soil surface shades the soil, slows water overland flow, improves infiltration conditions, reduces evaporation losses and also contributes to control of weeds and therefore of non-beneficial water use.

**5) Addition of Organic Manures** - It provides for better soil aggregation, reduced crusting or sealing on soil surface and increased water retention capacity of the soil.

**6) Addition of Clay or Hydrophilic Compound** - increases the water retention capacity of the soil and controls deep percolation

**7) Control of Acidity:** Lime application to soils with high pH favours more intensive and deep rooting, better crop development and contributes to improved soil aggregation, thus producing some increase in soil water availability.

**8) Weed Control Measure:** Adoption of appropriate weed control techniques to alleviate competition for water and transpiration losses by weeds is very important.

**9) Integrated Pests Management (IPM):** IPM techniques aim to increase crop productivity with the same amount of other inputs like water, fertilisers etc.

**Conclusion:**

Water is a critical input for agriculture, therefore, adoption and upscaling of new technologies of efficient water management especially micro-irrigation as quickly as possible is the only viable solution to sustain agricultural productivity.

**Smart Agriculture**

- India has demonstrated a big transformation in agriculture sector in the second half of the 20th century with the advent of 'Green Revolution' but now we need to go for a 'technology revolution' to accelerate the growth in the agriculture sector. Technology innovation in agriculture has always paid dividends.
- The Economic Survey 2018–19 suggests that “**focus should shift from 'land productivity' to 'irrigation water productivity'**”. The document emphasizes that thrust should be on micro-irrigation that can improve water use efficiency.
- **Benefit of Micro-irrigation** – Reduced electricity consumption, decreased irrigation cost, reduction in total fertiliser consumption, enhanced productivity, increase in farmers' income

The Food and Agriculture Organization (FAO) estimates that over the last century the **global water withdrawal grew 1.7 times faster than the population**, which aggravates the concern over the sustainability of water use.

**Smart Agriculture:**

It is the all-new agricultural production mode and ecosystem which is based on digital agriculture and precision agriculture.

**Transformative Discoveries for Smart Agriculture**

- **Internet of Things (IoT) & Artificial Intelligence (AI)** - Integration of AI and IoT devices further improves the growing and selling processes via predictive analytics.
- These programmes will help farmers determine which crops to grow and anticipate potential threats by combining historical information about weather patterns and crop performance with real-time data.
- **Blockchain** – It has the potential of creating a more transparent, authentic, and trustworthy digital record of the journey that food and other physical products take across the supply chain.
- When blockchain is integrated with IoT, it creates an immutable supply chain, ensuring that buyers are getting an authentic product that has not been damaged along the way.
- **Robotics** - Drones with AI-enabled vision processing capabilities are being used to assess the real situation on the condition of crops on ground.
- **Autonomous Swarms** - Swarm robotics involves multiple copies of the same robot, working independently in parallel to achieve a goal too large for any one robot to accomplish.
- Using this, pesticide and fertilizer can be applied more sparingly and planting and harvesting can be done with individual attention to each plant.
- **Big Data** – It has potential to add value across each step and can streamline food processing value chains such as selection of right agri-inputs, monitoring soil moisture, tracking prices of market, controlling irrigations, finding the right selling point and getting the right price.

**Smart Agriculture in India**

- In India, Microsoft collaborated with ICRISAT to develop a **predictive analytics app** that calculated the best crop sowing date for maximising the yield. As a test case, farmers that used the app boosted their yields by 30 percent.
- **In Andhra Pradesh, Vijay Bhaskar Reddy**, a software engineer, has developed an IoT based autonomous irrigation solution, **Mobile Motor Controller Device- Kisan Raja** which helps farmers monitor, control and utilise water judiciously.

**Smart Irrigation Systems**

- Smart irrigation systems are more inclusive and are equipped with self-governing capabilities that result in **more precise watering schedules** that reflect the actual conditions of the grow site.

- It can drastically increase the water efficiency which currently hovers around 38%.

### Need for Water Accounting

- Water accounting **includes approaches to demand forecasting** on the basis of demographic change, urbanisation, industrialisation and energy production. Such systems have been developed in some countries (e.g. Australia, China, Iran, US etc.)
- In China, water is allocated to different sectors within a limit on total water use at the national level and in each major river basin. Water accounts are created to assess the volume of water resources available at basin and subsidiary levels, to incorporate long-term inter annual variability in rainfall and weather, and **to estimate water availability**.
- The accounts are updated through the year and reassessed at the beginning of each “**water year**”.
- Water accounting alone is not sufficient to drive the required shifts in water use as scarcity worsens. Accounting must be accompanied by regular assessments of governance, institutions, legislation and the wider political economy of water.
- **Malaysia is a good example** of a country in the region which has invested in improving national water accounting and auditing processes.

### Initiatives of Smart Agriculture

- NITI Aayog came up with a **National Strategy for Artificial Intelligence in India**, which is aimed at focusing on economic growth and social inclusion. The Government **signed an MOU with IBM to use AI to secure the farming capabilities** of Indian farmers.
- In a bid to push innovative technologies in agriculture sector, the govt has also launched **AGRI-UDAAN to mentor 40 agricultural start-ups** and enable them to connect with potential investors.
- **Maha Agri Tech Project** in Maharashtra is another such project which seeks to use innovative technologies to address various risks related to cultivation such as poor rains, pest attacks, etc., and to accurately predict crop yielding.

### Conclusion:

- It is estimated that the **IoT has the potential to increase agricultural productivity by 70 percent by 2050**.
- There is a need to develop an infrastructure in our agricultural institutions to have scientific understanding for such technologies so that the farmers can be trained to use of such technologies in the field. There is a need for convergence of available institutional resources in the country.

***It is not the quantity of water applied to a crop; it is the quantity of intelligence applied which determines the result - there is more due to intelligence than water in every case. (second Prime Minister of Australia, Alfred Deaki, 1890)***

#### **Agribot: Saving Water and Spraying Pesticides**

- Agribot drones are being utilised in the country for agricultural land spraying pesticides.
- Using this drone, around 3920 litres of water is saved per acre in a year. Agribot drones are also being used to **control grasshoppers**.
- Amidst the terror of the locust attack, in January 2020, the drone sprayed over 500 hectares of land in 16 days and freed the area from locusts.
- Along with saving water, the use of pesticides is 15 to 35 percent higher with drones than the conventional methods.

### Water Conservation: Minimizing Wastage

- Water, the elixir of life, is becoming increasingly scarce due to challenges of rising population, rapid urbanisation, industrial growth and increasing water pollution.
- According to the Population Division of the **UN Department of Economic and Social Affairs**, urban population of the world has grown rapidly to 4.2 billion in 2018. By 2050, it is projected that India will have added 416 million urban dwellers.

#### **Water Availability in India**

- In India, **per capita availability of water** has decreased to 1545 m<sup>3</sup>/year in 2011 and it is estimated to decline further up to 1140m<sup>3</sup>/ year in the year 2050.
- According to a 2018 NITI Aayog report, currently **600 million Indians face high to extreme water stress** and about two lakh people die every year due to inadequate access to safe water.
- By 2030, the country's water demand is projected to be twice the available supply.

#### **Ground Water Exploitation in India**

- India is the **biggest user of groundwater**. According to a report, **India extracts more groundwater than China and the US** the next two biggest pullers of groundwater combined.
- The 2014 report of the parliamentary standing committee on water resources highlighted that **about 89 percent of groundwater extracted in India is used for irrigation** making it the highest category user in the country.
- **Household use comes second** with 9% share of the extracted groundwater followed by **industry that uses only 2% of it**.
- The unmindful extraction of groundwater has caused a **reduction in groundwater levels in India by 61 percent between 2007 and 2017**.

#### **Schemes for Water Conservation**

##### **A. New Ministry**

- The creation of **Jal Shakti Ministry** by merging Ministry of Water Resources, River Development and Ganga Rejuvenation and Ministry of Drinking Water and Sanitation.

##### **B. Jal Shakti Abhiyaan (JSA)**

- It aims to focus on integrated demand and supply management of water at the local level.
- **Five important water conservation interventions** envisaged: water conservation and rainwater harvesting; renovation of traditional and other water bodies/tanks; reuse borewell recharge structures; watershed development and intensive afforestation.
- The JSA is a time-bound, mission-mode water conservation campaign. It aims at making water conservation a **jan andolan** through asset creation and extensive communication.

##### **C. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)**

- In 2015, the union govt. launched the scheme with the dual aim of '**Har Khet Ko Pani**' and improving water use efficiency '**More crop per drop**' in a focused manner.
- PMKSY was formulated by amalgamating the then-running schemes like Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development and Ganga Rejuvenation, Integrated Watershed Management Programme (IWMP) of Department of Land Resources (DoLR) and the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC).

- The scheme has been **divided into 99 prioritized projects** with different timelines. **Total irrigation potential utilisation** after completion of the entire project is expected to be **76.03 lakh hectares**.
- The major objective of the PMKSY has been to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision-irrigation and other water saving technologies, enhance recharge of aquifers and introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal-based water for peri-urban agriculture and attract greater private investment in precision irrigation system.
- **Monitoring Mechanism under PMKSY**
  - At the national level, by an Inter-Ministerial National Steering Committee (NSC) under the Chairmanship of the Prime Minister
  - a National Executive Committee (NEC) under the Chairmanship of the Vice Chairman of NITI Aayog to oversee programme implementation, allocation of resources etc.
  - At State level, by a State Level Sanctioning Committee (SLSC) chaired by the Chief Secretary of the respective states.

### **Solution to Groundwater Crisis**

- During the General Budget for 2020–21, Finance Minister announced that the government will **identify 100 most ‘water stressed’ districts** and comprehensive measures on addressing this shortage will be chalked out.
- It will be **a part of the Jal Jivan mission**, for which Rs 3.06 lakh crore has been earmarked. This highlights the water crisis India is about to face.

### **Ground Water Crisis in India: How severe is it?**

- In 2018 NITI Aayog, came up with its **maiden Composite Water Management Index (CWMI)**. This was the first ever effort to fathom the water crisis scientifically in India.
- According to the report, **21 major cities are racing to reach zero groundwater** levels by 2020, affecting access for 100 million people.
- Nearly **40 percent of the population will have absolutely no access** to drinking water by 2030, and 6 percent of India’s GDP would be lost by 2050 due to water crisis.
- The report also highlighted that by 2030, the country’s water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people.
- As per the international norms, a country is **classified as water stressed and water scarce** if per capita water availability goes below 1700 cubic meter and 1000 cubic meter, respectively.
- In India, the per capita annual water availability has declined to 1508 cubic meter in 2014. It is estimated to decline further to 1465 cubic meter by 2025 and 1235 cubic meter by 2050.

### **Anatomy of the Problem**

- If we look at the water crisis, **potability is only a small part of the problem** which can be solved by **turning sea water into drinkable water on mass scale**.
- The real catastrophe waiting to happen, is in agriculture. As per a World Bank report, India withdrew a total of 761 billion cubic meter ground water in 2018 out of which 688 billion cubic metre (around 90%) was used for agriculture.
- We **do not rely on rationalising crop selection** on the basis of availability of water. For example, it is estimated that a kg of rice needs 2500–4000 L of water for production. Similarly, according to



CACP, it takes 2515 L of water to produce a kilogram of sugar in Maharashtra. Despite this fact, our focus is more towards production of rice and sugar.

### **Impact to the farmers**

- Sinking water level increases their cost of cultivation and decreases the production level at one hand, and increases their cost of living on the other hand. It farmers' profit negatively.
- There are strong links between cash cropping, the failure of borewells, overwhelming debts and farmer suicides in the semi-arid regions of northern and western Andhra Pradesh and other parts of the Deccan plateau.

### **What is the solution?**

- While at just over 260 cubic km per year, **India uses 25 percent of all groundwater extracted globally**. It receives only four percent of the global precipitation and ranks 133 in the world in terms of water availability per person per annum.
- The key to the solution is **producing more with less water**. There is need to shift the focus from more water guzzling crops to lesser ones.
- Steps should be taken towards **creating awareness among farmers** to use micro-irrigation tools.
- The farmers also need to be made aware and trained about **conservation of water**. One such model is to **preserve each drop of rain water falling within their farm land**. For example, Subhash Sharma, a farmer from Vidarbha, has developed a 5-point technology to preserve the rain water pouring in his farmland.
- **Farm ponds** are basically an idea to collect rain water in a small part of one's farmland by digging a pond so that he/she could get water for captive usage. **So, micro-irrigation, farm pond and natural farming could be the way to move on.**

### **Conclusion:**

The challenge before us is formidable. Nevertheless, the silver lining is that there are easy remedies available. Only thing we need is a perfect combination of government's and people's efforts.

### **Participatory Irrigation Management**

- There has been a remarkable increase in irrigation potential from 22.6 million hectares in 1950–1951 to about 123 million hectares by 2007.
- Irrigated agriculture is about 48 per cent of net sown area (net irrigated area 68 million hectares) and contributes to 60 per cent of India's food grain production.

### **Problem in Irrigation Sector**

- low irrigation efficiency (30–35 percent), deteriorating physical structures, inadequate maintenance, low cost recovery, under-utilisation (74 percent) of created potential
- Uncontrolled water delivery, tail-end water deprivation, seepage loss, siltation, waterlogging, and soil salinity.
- Inequitable and unpredictable water supply among the farmers over space and time lead to the injudicious use of water in the irrigation commands and increase in inequity within the same unit of command area.

### **Towards Finding a Solution**

- In search of the solutions, **farmers' participation in irrigation management has taken the center stage**. The irrigators who were considered as beneficiaries are now considered partners in planning, development, operation and maintenance of irrigation systems.
- Most of the states in India have been implementing the **Participatory Irrigation Management (PIM)** reform and transferring the irrigation management to **Water User Associations (WAUs)** with a view to provide equitable, timely and assured irrigation.

### **What is PIM?**

- PIM refers to the participation of water users, the farmers, in the management of the irrigation systems.
- Participation of beneficiaries **facilitates the optimal upkeep of irrigation system** and effective utilisation of irrigation water with greater participation of the farmers, more investments in the irrigation infrastructure and other irrigated agriculture related services will be need based and hence more effective.
- In many places, **PIM reforms lead to Irrigation Management Transfer (IMT)**. IMT is the full or partial transfer of responsibility and authority for the governance, management and financing of irrigation systems from the government to WUAs.

### **Rationale of PIM**

- **Performance of government** - managed irrigation systems **has been sub-optimal** because of deterioration of physical infrastructure due to deferred maintenance, poor water service delivery, lack of accountability, poor incentives (financial) and weak institutional arrangements for infrastructure management.
- Against this backdrop, PIM has emerged as an important approach.
- Other reasons for promoting PIM include reduction of the burden of costs, staff requirements and technical or management problems faced by governments, farmers' access and control on operation, maintenance, water delivery and fixation of water rate, improvements in the agricultural productivity and economic profitability of irrigation systems.

### **Legal Framework of PIM**

- Union Government plays the role of a facilitator but the actual implementation of PIM is done by the states **as water is a State subject**.
- In India, 16 states have either enacted exclusive legislation or amended their Irrigation Acts for involvement of farmers in irrigation management.
- These enabling laws and/or bylaws ensure formation of WUAs for undertaking management of irrigation, participation of farmers in irrigation management within the operational area of WUA, entrusting legal rights to WUA to receive irrigation water and distribute the same among the members in the operational area, empowering WUA in developing a suitable crop pattern, fixation of water rates for different crops on season-wise area basis, collection of water charges from the farmers for utilisation of irrigation water etc.

### **Progress of PIM**

- Command Area Development and Water Management (CADWM) work is being implemented in 99 prioritised Accelerated Irrigation Benefit Projects (AIBP) under Pradhan Mantri Krishi Sinchai Yojana (PMKSY)/Har Khet Ko Pani (HKKP).

- Under the restructured CADWM Programme, more emphasis is being given to participatory approach. PIM has resulted an increase in irrigation intensity, cropping intensity and yield with spatial and temporal variations.

### **Women Participation**

- Representation of women in the WUAs at all levels has been brought in the guidelines issued by the Ministry of Water Resources.
- Participation of women in management of water resources is ensured through their membership in the WUAs.

### **Way Forward:**

- The formation and functioning of WUAs, ageing irrigation and drainage infrastructure and its operation and management remain to be the major institutional and PPP challenges for sustainable agricultural water management in the immediate future.
- The WAUs **must focus on sustainability** by ensuring a proper flow of revenue which is greater than the expenditure, improvement in recovery of water charges from farmers etc.
- The **issues of rights** are beginning to enter the debate on Indian irrigation. Currently, allocation of water rights takes place in proportion to land size. However, the current format **does not consider other uses of water** (domestic, industrial use, etc.) and also the needs of landless people in irrigation command area.
- The water allocation, in current format, hampers the social support and accentuates rural inequity. Hence, equal distribution of water must be ensured.

### **Conclusion:**

- Transfer of irrigation management responsibilities from government agencies to farmers is now an important policy that has resulted variable impact over space and time.
- The most ideal situation may be when the demand of taking over of management of irrigation system comes strongly from the farmers.

## **Irrigation Projects**

The increasing gap between irrigation potential created, through major and minor projects, and the actual usage is affecting the country's crop yields.

### **Statistics:**

- About 80 percent of the current water use is drawn by agriculture. Irrigated area accounts for nearly 49 percent of the 140 million hectares of agricultural land in India.
- The remaining 51.2 percent is rainfed but accounts for nearly 40 percent of the country's total food production.

### **Steps Taken:**

- The government in its 2016 Budget announced that of the roughly 150 then-ongoing irrigation projects under the Accelerated Irrigation Benefits Programme (AIBP) under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), 99 would be expedited and completed by December 2019.
- Together, these projects were to add **about 76.03 lakh hectares of cultivable land under irrigation network**. The 99 projects were to be completed along with their Command Area Development and Water Management (CADWM) works.

- The government put in place a **funding mechanism through NABARD** for providing loans towards central as well as state share for completion of these identified irrigation projects.

#### **Results So Far:**

- The latest figures shared by the Central Water Commission (CWC) show the number of projects to be fast tracked for completion has gone up to 106 now. Out of which, 40 projects have been fully completed till now.
- The delay in completion of identified 99 projects has not been due to the lack of funds but mainly **because of land acquisition.**

#### **Farmers yet to Reap Irrigation Benefit**

- Farmers are yet to get the benefit from the 40 completed projects **as command area development has not started in many projects.**
- The last mile connectivity of irrigation network is done under the Command Area Development and Water Management Programme (CADWM).
- CADWM is a participatory programme under which **farmers are required to contribute some money and form water association**, which is little bit lagging.
- Most of the states are not ready for command area development as **it requires land acquisition and small farmers are reluctant to part with their lands.**
- In the absence of command area development, farmers in the tail end on both the sides of the main canal take water from it by using pump sets, which increases their costs and leads to wastage of water.

#### **Way Forward:**

- Expressing concern over low irrigation coverage, **a task force headed by Economic Affairs Secretary Atanu Chakraborty on National Infrastructure Pipeline (NIP)** for 2020-2025 projected an investment of Rs 8,94,473 crore to ramp up irrigation network in the next five years by both the Centre and states.
- While pitching for **greater participation of private players** to bring in efficiencies in irrigation system, the task force suggested **key regulatory reforms** which include sharper focus on better management of existing irrigation infrastructure than putting more money into building new infrastructure.
- It also emphasised the need to **increase micro-irrigation coverage.** It also called for **according priority status to micro-irrigation projects** to ensure greater flow of bank credit to farmers to buy equipment.
- It recommended **a better method for pricing water for irrigation** which must move from area-based fees to quantity-based fee.
- It also suggested **subsidy on water up to a threshold level** and putting in place a robust IT and automated system to track efficient use of water resources among others.