

Role of Precision Agriculture in Soil Water Conservation & Management

Kaushal Jaiswal

Managing Director- Rivulis Irrigation India

Over the last decade, “Precision Agriculture” has become a major talking point, often surrounded by ambiguity. The more one discusses Precision Agriculture, the more elusive its definition seems to become, as everyone has their own valid interpretation.

But what exactly is Precision Agriculture? As a general understanding, it refers to the application of science and technology in farm management to achieve precision in all farming practices. This includes seed selection, disease and pest management, fertilizer application, irrigation, and other aspects of farm production, with the goal of maximizing output while making optimal use of resources.

Population growth and changing food preferences are two major drivers of growth in agriculture. According to a United Nations report, the global population is expected to approach 10 billion by 2050. With limited land resources, the only viable solution is to grow more food without further disrupting the ecosystem. This is where the Ag-Tech sector plays a pivotal role by transforming farming practices with



innovative technologies to ensure food and nutritional security. For a clearer understanding, it is crucial to grasp the fundamental principles of agriculture, the emerging innovative technologies, and how these technologies can be applied in evolving agricultural practices to produce more food with fewer inputs, minimize waste, and optimize economic efficiency.

The concept of Precision Farming originated in the 1980s in the United States. Over the years, numerous new technologies have been developed and incorporated into this practice. However, the core concept remains unchanged: to enhance and optimize farming methods through technology.

Some of the technologies currently in use include the following.

- Remote Sensing
- IOT (Internet of Things)
- Soil Sensors
- Robotics
- Artificial Intelligence.
- Drones
- Weather Modelling Software

HOW PRECISION AGRICULTURE CAN HELP IN SOIL WATER CONSERVATION & MANAGEMENT

The demand for increased food production to feed the anticipated population by 2050, against the backdrop of shrinking aquifers and an unpredictable climate, calls for massive implementation of demonstrated technologies.

The World Bank has stated that the Climate Crisis is, in fact, a Water Crisis. Climate change is exacerbating the situation by causing longer dry spells and more intense rainfall in India. According to the World Resources Institute, the number of heavy rainfall events in India has increased by 6% per decade. Half of India's annual precipitation occurs in just 15 days. With such high-intensity rains, water fails to percolate into the ground to



recharge aquifers and quickly runs off. Water and agriculture are inextricably linked, and the impact of the water crisis significantly affects the agriculture sector.

The challenge, therefore, is not the quantum of water available but its management. This demands a remarkable transformation and a tectonic shift in our approach—from focusing on productivity in terms of yield per unit of area (kg/ha) to “Per Drop More Crop,” which emphasizes water productivity defined as yield per unit of water utilized (kg/m³). Hence, the emphasis must shift towards resource-use efficiency and prioritizing irrigation of crops rather than the land.

Globally, the agriculture sector accounts for 70% of freshwater withdrawals, according to the World Resources Institute (WRI). In India, as per the Central Water Commission (CWC), the figure is a staggering 80% for the agriculture sector, leaving only 7% for industries and power generation, 6% for domestic use, and 7% for other purposes.

Precision agriculture can significantly reduce the use of irrigation water, chemical fertilizers, and other inputs, thereby preventing groundwater pollution caused by the leaching of these

chemicals. It also helps in improving soil health. Simultaneously, it contributes to decarbonization in two ways:

- a) Less use of fossil fuel and less energy consumption in farm operations.
- b) Lower usage of chemical fertilizers and crop protection chemicals.

At the same time, it supports climate-resilient agriculture because of its ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate. This gives farmers an opportunity to mitigate risks caused by unfavourable climatic conditions, such as drought or excessive rainfall.

MAKING FARMING MORE RESPONSIVE AND CLIMATE-RESILIENT

In precision agriculture, it is crucial to collect and analyse data from various sources, such as remote sensing, on-site soil samples, weather modelling, and soil sensors, to make informed decisions for managing groundwater effectively.

Many metrics are available that can be reviewed to provide detailed insights into soil health, crop nutrition, water usage inefficiencies, and measures to maintain good soil health and achieve better yields.

Data-based decision-making, supported by user-friendly software packages, removes the guesswork from the decision-making process. IoT-enabled smart devices with API integration can work collaboratively to make farming more responsive and climate-resilient.

Nowadays, many effective technologies are available to provide accurate inputs about soil water content and overall soil health, which are helpful in managing soil water efficiently. However, the biggest challenge remains the cost and affordability of these tools.

Nonetheless, as these technological advancements contribute to long-term sustainability, protect the environment, and improve agricultural productivity through better soil water management, I am confident that governments and financial institutions will step forward to fund and support their adoption.

