International Commission on Irrigation and Drainage (ICID)

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Smart Agriculture Futures: Leveraging Digital Tools for Water Security

2nd Indo Global Irrigation Summit

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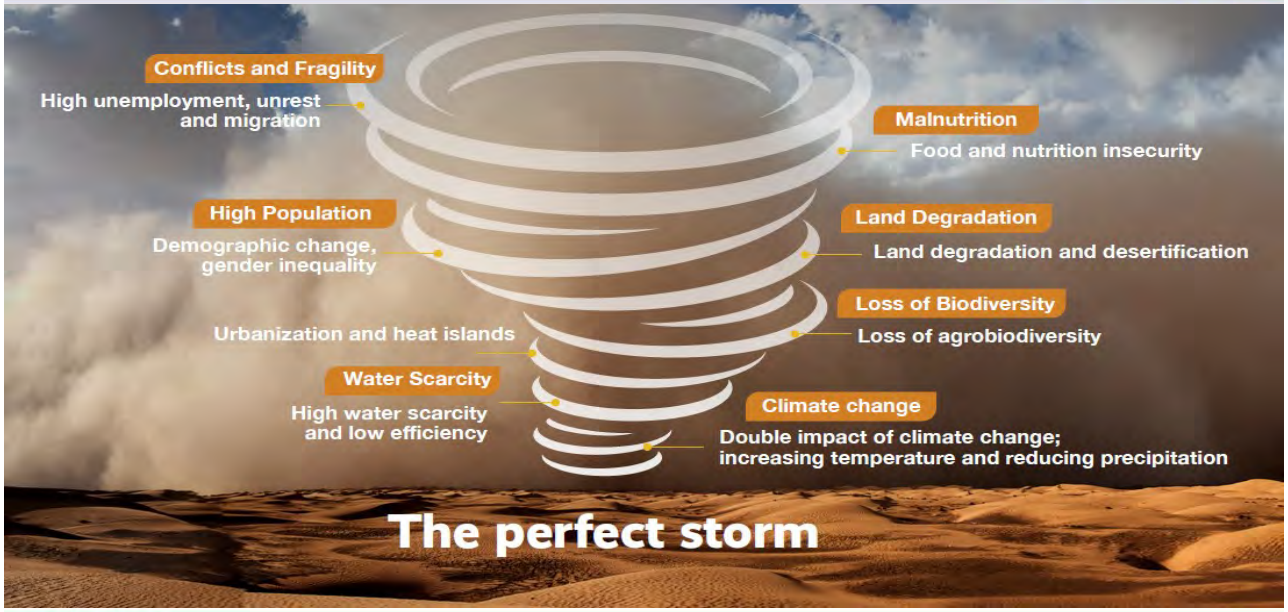
Smart Agriculture Futures: Leveraging Digital Tools for Water Security

Dr. Vinay Nangia
Research Program Director – Soil, Water, and Agronomy

A TRADITION OF EXCELLENCE ACROSS DRY AREAS

ICARDA

Challenges in India



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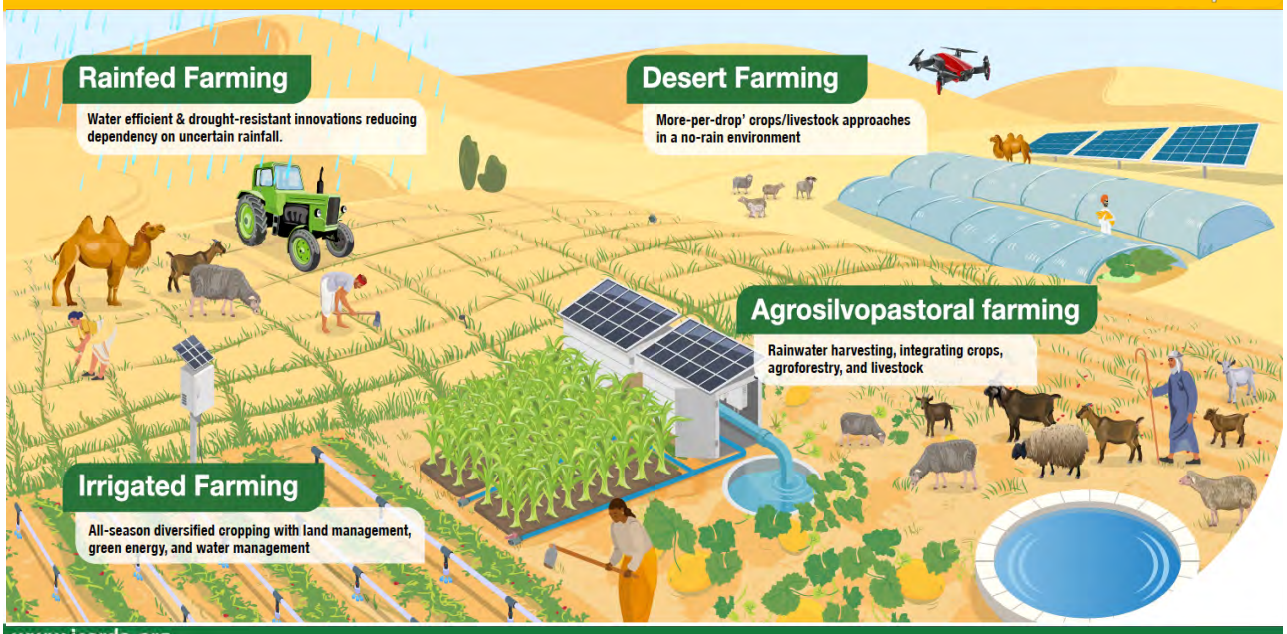
Indian Crop Production Systems



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Climate-smart Precision Farming

Precision agriculture is a key component of the **third wave of modern agricultural revolutions**

The first agricultural revolution was the increase of mechanized agriculture, from 1900 to 1930 - each farmer produced enough food to **feed about 26 people** during this time

The 1960s prompted the Green Revolution with new methods of genetic modification, which led to **each farmer feeding about 156 people**

With new technological advancements through the agricultural revolution of precision farming, **each farmer will be able to feed 265 people on the same acreage**

Popular definitions of precision farming describe the concept as '**a technology-enabled approach to farming management that observes, measures, and analyses the needs of individual fields and crops'**

NEXT GENERATION FARMING SYSTEMS

- Transform desert agriculture in the global drylands into highly productive food systems
- Accelerate agricultural innovations along field-to-fork value chains
- Handheld devices for on-the-spot diagnostics of agriculture heath
- Carbon farming
- Plant-based alternative proteins
- Green energy solutions
  - *Agrivoltaics*
  - *Solar desalination technology*
  - *Solar drip irrigation*
  - *Solar hydroponics and root zone cooling*

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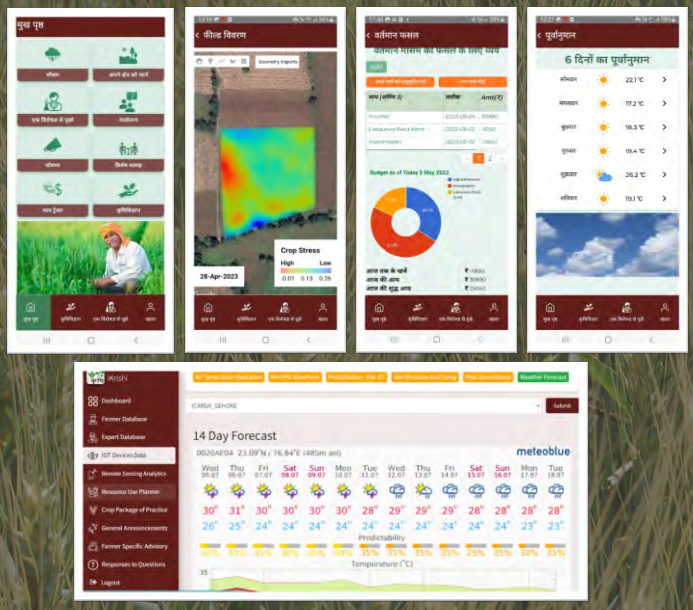
AI PLATFORM FOR DIGITAL EXTENSION SERVICES



ICARDA's flagship GeoAgro Platform can:

- Forecast weather
- Do yield gap analysis
- Forecast probability of disease outbreaks
- Improve modeling and climate change patterns

Precision Farming Solutions for Smallholders

Smart irrigation

Automatically monitor soil conditions, weather changes, evaporative losses, and plant water use to determine and adjust watering schedule

Smart detection

Computer vision-enabled high-resolution cameras recognize insects/pests for detecting and planning for managing pest attacks

Smart fertilization

Demand-based application of right inputs at right place at right time for balanced nutrition approach eliminating guess-based fertilizer application by farmers

Smart sensing

Using weather pattern analytics, automatically generate alerts for disease outbreak

Smart advising

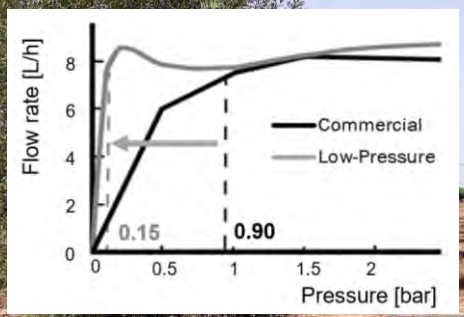
Cloud computing-based analytics to generate vernacular advisory for farmers on precision farm management to optimize inputs and enhancing income

Green Energy Solutions

Agrovoltaics
Photovoltaic Electrodialysis (PV-ED) Desalination of brackish water
Solar-powered Ultra-Low Energy Drip Irrigation
Solar-powered hydroponic systems with Rootzone Cooling




64% GHG emission reduction with our Solar-powered Ultra-low Energy Drip Irrigation

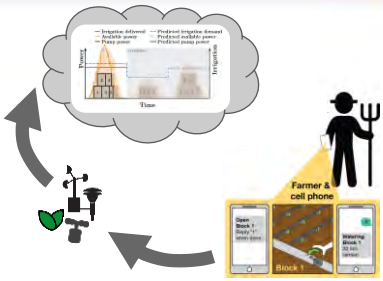


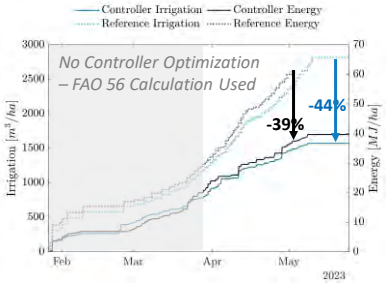
- Ultra-Low Energy drippers have an activation pressure of 0.15 bar, **which require 85% less pressure, 50% less** overall system **pumping power** than existing products and **lowers the GHG emissions by 64% compared to diesel pumps and capital cost** of a solar-powered **drip irrigation system by 42%.**

CONTROLLER SAVES WATER AND ENERGY

Benefits

- System design, optimization, and control that **reduces energy, water, and cost** to make precision agriculture accessible
- **Machine learning algorithm is trained on historical weather** from nearby weather stations and previously recorded weather
- Machine learning & optimization **calculations are done in the cloud** and an app facilitates use of manual labor, reducing hardware costs
- **44% irrigation water saving; 39% energy saving**





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Diversified Cropping Systems to Improve WP

Diversified cropping systems provide nutritious diets through climate-smart and sustainable production systems.
By incorporating legumes, vegetables, fruits, or nut trees into existing cereal systems, DCS have the potential to significantly increase income and improve nutrition for vulnerable dryland farmers under a climate crisis.

In **Morocco**, the return for lentil+onion system was ($ 11,104/ha) followed by lentil+quinoa ($ 10,726/ha), lentil+chickpea ($ 1391/ha), lentil+bean ($ 1219/ha), wheat ($ 809/ha), and lowest was under lentil ($ 633/ha)

In Asia's largest irrigation scheme in **India**, when comparing cropping systems, cluster bean-mustard crop rotation was most **economically water productive** cropping system amongst all.

Cropping system	Yield (kg/ha mm)		Return (rupees/ha mm)	
	Biological Yield	Seed Yield	Gross Return	Net Return
	Water Productivity (in terms of water applied)			
Cotton - Wheat	13.4	4.8	134.4	79.6
Cotton - Mustard	12.3	3.6	137.9	78.3
Clusterbean - Wheat	16.3	5.9	327.1	273.2
Clusterbean - mustard	15.5	4.6	383.6	323.1
Cotton – Barley	15.1	5.3	155.3	91.4
Cotton – Chickpea	12.2	3.7	151.8	91.5

Frequent Collaborators and Donors

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CARITAS

ARAB FUND FOR ECONOMIC & SOCIAL DEVELOPMENT

PRIMA IN THE MEDITERRANEAN AREA

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NARC

USAID UNITED STATES AGENCY INTERNATIONAL DEVELOPMENT

USDA United States Department of Agriculture