**Why fertigation?**

- **Grain output VS Fertilizer input in China**

- **Utilized efficiency of Inorganic fertilizer**

**Outline**

- Why fertigation
- Definition
- Developing smart fertigation
- Case study

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**Innovation Technology on Smart Fertigation**

Dr. Wenyong Wu
Department of Irrigation and Drainage, China Institute of Water Resources and Hydropower Research

**Outline**

- Why fertigation
- Definition
- Developing smart fertigation
- Case study

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**Grain output VS Fertilizer input in China**

**Utilized efficiency of Inorganic fertilizer**

*UCIF* - Utilized Coefficient of Inorganic Fertilizers

*UCIF %*

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Why fertigation?

Fertigation development

- USA: 45%
- Israel: 90%
- China: <5%

Environmental pollution problems

Fertigation is regarded as one of the important measures to improve Utilized efficiency of Inorganic fertilizer at China national level

Definition

- **Fertigation**
  - Fertilization + Irrigation = Fertigation
  - Fertigation — Chemigation
- **Fertigation** is the injection of fertilizers, soil amendments, and other water-soluble products into an irrigation system.
- Sprinkler system - reported since 1958
- Drip system – about 20-30 years of history

What fertigation

Passive Injector Equipments

- Pressure differential tank
- Venturi injectors
- Proportional Pump
What fertigation

Initiative Injector Machines

Fertifixm  Fertigal  FERTIMASTER
NutriFlex  Nutrifit  Nutrijet  Smartfertil

Developing smart fertigation

Improvement Potentials

- Fertigation decision
  - How to match water and fertilizer
- Precision Control
  - How to regulate proportion
- Multiple function
  - Irrigation control, Auto-filtration, integrative system

What smart fertigation?

Smart Fertigation

Principal diagram

Fertigation

\[ T_i = \frac{Q_i}{q} \]

\[ T_i = t_{i1} + t_{i2} + t_{i3} \]

When?  How much?

\[ t_i = \frac{F_i}{\mu / J_i} \]

\[ \frac{F_i}{EC_i - EC_d} \]

\[ \frac{ET_i}{S_i} \]
Developing smart fertigation

**INST Injector machine**

Functions:
- Irrigation control
- Precision injection
- Automatic filtration
- Environmental Monitoring & control

Software interface:
- Fertigation control
- Monitoring & control
- System setup
- Fault diagnosis

Developing smart fertigation

**INST Injector machine**

Software interface:
- Microclimate Data
- Soil moisture EC, T
- Fertilizer Solute
Developing smart fertigation

Fertigation module – Irrigation control:

- Time schedule control
- Manual operation
- Flow control
- ET control

Developing smart fertigation

Fertigation module – Injection control:

- Time schedule control
- Quantitative control
- EC/pH control
- Injection time

Case study

Applications:

- Tongzhou project
- Daxin project

Case study

Case 1 Experimental study on injection frequency on vegetables

Radish experiment

Treatments (150 kg/hm²)

<table>
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<tr>
<th>Day</th>
<th>F1</th>
<th>F2</th>
<th>F4</th>
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Fertigation frequency on yield and WUE

Yield: t/hm²

WUE: kg/m³

Table:

- F1: 16.1%
- F2: 11.5%
- F4: 14.1%
- F8: 16.8%
Case study

Case 1: Experimental study on injection frequency on vegetables

Case 2: Experimental study on injection intervals on vegetables

Thank you

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