GOOD PRACTICE SHEET N° 3
FERTIGATION

What is fertigation?

Fertigation is a combination of fertilization and irrigation. This agricultural technique consists of applying water-soluble fertilizing elements through an irrigation system. It can be applied to almost any irrigated crop, in both open field and greenhouses. On this sheet, fertigation is only detailed when coupled with a drip irrigation system.

Which **impactful changes** can fertigation bring to your business model transformation?

- **Production model** — Requires medium commitment
- **Competitivity** — Not applicable
- **Revenue model** — Not applicable

Why should you implement fertigation?

The fertigation technique allows producers to save time, resources, and effort by completing two operations at the same time time: fertilization and irrigation. Customization of modern fertigation systems enables the pinpointing of variable rate fertilizer applications. The most efficient method is drip fertigation that reduces inputs and delivers nutrients to the root zone. The technology is suitable for farm enterprises of any size since there are large and small-scale fertigation systems, with manual or fully automated control. Fertigation also allows for a more efficient use of both water and fertilizers.

What are the economic needs addressed by fertigation ?

- **Reduce water costs**
- **Facilitate irrigation management with predefined schedule**
- **Reduce fertilization costs**

What are the environmental and agronomic needs addressed by fertigation ?

- **Reduce water consumption**
- **Reduce water and environmental pollution**
- **Enhance crop production with less water**

What are the key figures for fertigation?

AGRO-ENVIRONMENTAL IMPACTS

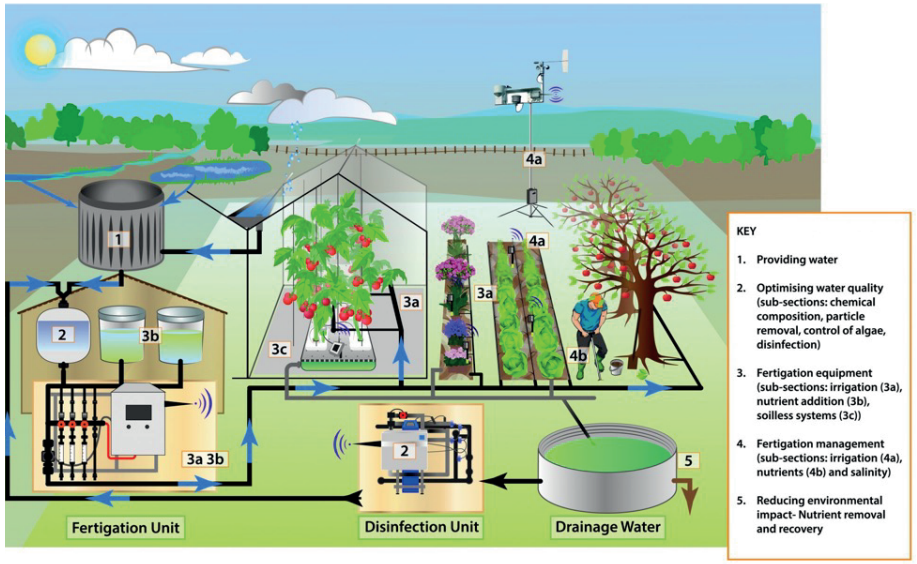
A micro-irrigation installation can save up to 50% of water compared to a traditional or gravity irrigation system. Fertigation technology allows a significant reduction in the application of water to the crop e.g., **more than 40% in a tomato crop without affecting commercial production.**

For citrus orchards, a new method based on soil sensors to manage irrigation, reduces total water applied by 30% compared to conventional management.

Significant reductions of more than 50% in nitrogen application were achieved by using fertigation and a prescriptive-corrective management strategy.
(Source : Fertinnowa)

SOCIAL IMPACTS

When faced with insufficient rainfall, many farmers water each crop by hand. **Drip irrigation and fertigation allow crops to be simultaneously watered across a large area simply.** Drip irrigation ensures that water and fertilizer are **evenly** delivered to every plant and **gives the farmer time to focus on other activities while the crops are watered.**



Source: FERTINNOWA, 2018

ECONOMIC IMPACTS

Installation cost: 2,520 to €3,400/ha of material (filtration station, combs, fittings, dripper bars, tank, dosing pump...) plus 420 to €560/ha/yr of labor.

Watering cost: 150 to €170/ha/year.

Cost of water: 300 to 1,000m3/ha/year, variable according to the mode of withdrawal (water towers, drillings...).

Cost of fertilizer: between 50 and €200 / 100kg.

Maintenance cost: €78/ha/year including cleaning, repairs on the network and necessary labor.

(Source : Hérault Chamber of Agriculture)

POTENTIAL DEVELOPMENT

The use of tools or devices strongly supports irrigation management to correctly estimate the water needs of crops. However, **the irrigation schedule is adjusted throughout the growing season based on the producer's experience in 57% of systems.** The appearance of crops and soil are still the only way to monitor irrigation management in 20% of the cropping systems in Europe. Regarding nutrient management, **crop observation is always used to monitor crop nutrient status in 37% of cropping systems. Crop water status monitoring is still not an extended practice, as applied to only 16% of cropping systems, and therefore offers significant potential for development to reduce water consumption.** (Source : Fertinnowa)

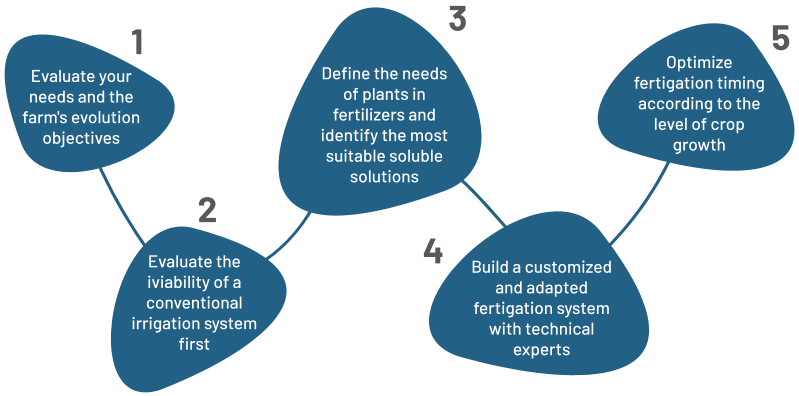
GOOD PRACTICE SHEET N° 3

How to implement fertigation?

ON-FARM ISSUES

1. Decrease in crop yields
2. Important time spent on irrigation and crop fertilization
3. High cost of fertilizers and/or water
4. High water consumption due to irrigation systems
5. Degradation of water quality

KEY STEPS TO A SUCCESSFUL IMPLEMENTATION



IMPACTS AND BENEFITS

1. Promoting rapid root growth and better water and fertilizer use efficiency
2. Saving time and facilitating irrigation management
3. Saving costs on reduced fertilizer and water amounts
4. Optimizing water consumption
5. Decreasing chemical applications and preventing fertilizer leakage

FIELD ADVICE

"I planted asparagus in May with a row spacing of 2.70 m. I positioned one drip line per row, about 5 cm below the level of the claws. On this plot, the soil is rather sandy-silty, light and filtering and yet I only applied a total of 800 m3/ha, in a fractional way, between June and September.
If I had been spraying with the reel, I would have made at least 6 turns of water of 30 mm/ha (that is 1,800 m3/ha), which saved more than 50% of water for this year! The water applications are programmed (periodicity and volume) and at the same time, fertilization can be added when necessary. The water and fertilizing elements are localized at the root level, thus better valorized by the plant. There is no need to move the reel. This is a real time saver. If I hadn't had the tensiometer probes, I would have used the physiognomy of the asparagus to trigger an irrigation, but that wouldn't have been possible. When the shoots start to dry, it's too late!
So, in fact, I think I would have watered much more than I did to be safe".
Joël Pesteil, French multi-crop farmer

KEY CHALLENGES

Limit the risk of clogging

The **soluble fertilizer solution must be chosen and sufficiently diluted** to avoid any risk of clogging of the irrigation systems.

Verify the compatibility of fertilizers

Some fertilizers are not compatible or have a limited compatibility and, therefore, must be dissolved in separate tanks, as reactions between different fertilizers might occur and result in a precipitation of minerals in the tank.

Manage the pressure of the irrigation system

The irrigation system should be used **at sufficient pressure to ensure even distribution of fertilizer.**

How to go further?

MORE INFORMATION DOCUMENTS AND DATA

Asadi, M.E., 2004. "Optimum utilization of water and nitrogen fertilizers in sustainable agriculture". Programme and Abstracts N2004. The Third International Nitrogen Conference. October 12–16, Nanjing, China. p. 68.

Asadi, M.E., 2005. "Fertigation as an engineering system to enhance nitrogen fertilizer efficiency". Proceedings of the Second International Congress: Information Technology in Agriculture, Food and Environment, (ITAFE), October 12–14, Adana, Turkey, pp. 525–532.

Azad, N., Behmanesh, J., Rezaverdinejad, V. et al, 2020. An analysis of optimal fertigation implications in different soils on reducing environmental impacts of agricultural nitrate leaching. Sci Rep 10, 7797.

Department of Natural Resources, Environment, 2009. "Fertigation systems."

Goyal M. R., 2015. Water and Fertigation Management in Micro Irrigation, Apple Academic Press, 356p.

Hanson, Blaine R., Hopmans, Jan, Simunek, Jirka. "Effect of Fertigation Strategy on Nitrogen Availability and Nitrate Leaching using Microirrigation". HortScience 2005 40: 1096

Soman P., 2021. Fertigation: A Novel Method of Applying Crop Nutrients, NIPA, 98p.

DISCUSS AND TEST PROJECTS, TOOLS AND NETWORKS

ENSIAP project "Improving of Environmental Sustainability of Irrigated Agricultural Production in Lebanon and Jordan". The system proposed by ENSIAP allows for water savings thanks to the introduction of drip irrigation as well as agricultural efficiency/soil conservation based on fertigation. A simple photovoltaic solution completes the system deployed by ENSIAP by providing the required energy for irrigation water pumping purposes. Field trials on selected crops are underway in order to assess the benefits of the innovative mechanism compared to traditional irrigation. ENSIAP is paying close attention to institutional capacity-building and the training of farmers.

FERTINNOWA "Transfer of INNOvative techniques for sustainable WAter use in FERtigated crops". FERTINNOWA is a thematic network funded under Horizon 2020 dealing with innovative water management in fertigated crops. The project aims to improve water quality, water use efficiency and reduce environmental impact. FERTINNOWA will collect and exchange information on best practice, methods and technologies for the sustainable production of fertigated crops. The network will set up a knowledge exchange platform to evaluate existing and novel technologies (innovation potential, synergies, gaps, barriers) for fertigated crops. This platform will also enable a wide number of researchers, producers, policy-makers, industry, environmental groups and more to provide and learn about these innovative practices.

TAKE ACTION FUNDING SOURCES

Horizon Europe. The biggest EU Research and Innovation program with nearly €95 billion of funding available over 7 years (2021 to 2027). The program includes a specific section on climate action, environment, resource efficiency and raw material which can be relevant for research in the fertigation field.

Water Europe is the European Technology Platform for Water, initiated by the European Commission in 2004 as an industry-led stakeholder forum. Water Europe has developed different Programs which are key to the objectives and implementation of the Water Europe strategy: "Collaboration and Working Groups Program" to foster collaborative initiatives between members and "The Investor Program" to facilitate the growth of investment in the sector.

The Partnership on Research and Innovation in the Mediterranean Area (PRIMA) offers various grants for consortia consisting of public and private actors in the Euro-Mediterranean region who are dealing with farming, agro-food systems and value chains, as well as water resources. It is a ten-year initiative (2018-2028), partly funded by EU's research and innovation program Horizon 2020. Its main objective is to devise new research and innovation approaches to improve water availability and sustainable agriculture production in a region heavily distressed by climate change, urbanization and population growth. It supports sustainable farming systems under Mediterranean environmental constraints.