Agricultural

Installation of soil moisture monitoring system to improve productivity

Lodi, Italy

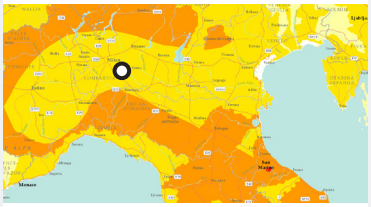
water scarcity impact	
Reduced withdrawal	●
Reduced consumption	
Improved water quality	
Increased productivity	●
Net basin benefit	

volumetric impact
3 800 m^3/yr

capital cost
$ 15 000

estimated unit cost of water
155 ¢/m^3

Water Stress
Lodi, Italy



Arid & low water use
Low (<10%)
Low to med (10-20%)
Med to high (20-40%)
High (40-80%)
Extremely high (>80%)
No data available

Water Stress Map:
F. Gassert, P. Reig, T. Shiao, M. Luck and M. Landis, 2015. "Aqueduct Global Maps 2.1."

Confidence level
Low Medium High

Water Scarcity Impact Key
Main Minor

Credits
We would like to acknowledge Monsanto for its input in the preparation of this case study.

Project Overview

Corn production in Italy is constrained by unreliable and expensive water supply. The annual precipitation is a moderate 920mm/yr (heavy rain in the winter and dry and hot summers), but farms face variable weather patterns during the corn growing season and increasing costs of water. 75% of corn farms in Italy rely on water from municipalities which amounts to 30% of their annual costs.

In a search for improved irrigation practices, three farms near Milan, installed a drip irrigation system coupled with soil moisture monitoring as part of the AquaTEK™ programme. This system allows farmers to irrigate only when needed, without stressing the plants by supplying too much or too little water. The system also allows for more precise application of fertilisers (fertigation), and thus minimises the leaching of excess nutrients into the ground.

The intervention was developed and implemented through a public private partnership between Monsanto, NETAFIM™ Italia, HydroBio Inc and the University of Milan.

Key Elements

- Installation of drip irrigation with soil moisture sensors.
- Automatic analysis of soil moisture content and adjustment of irrigation by specialist software.
- Application of fertiliser through drip irrigation.

Key Outcomes

- Water withdrawals of the farms decreased by approximately 22% from the original 16 900m^3/yr to 13 100 m^3/yr .
- Crop yield increased by 124% from the original 19.31 kg of dried matter per m^3 of water with drum irrigation to 43.18kg/m^3 with AquaTEK™.
- Reduced evaporation losses, reduced return flows and increased evapotranspiration.

Lodi, Italy

Intervention Features

- Drip irrigation systems
- Soil moisture content monitoring
- Fertigation systems
- Remote monitoring and sensing

Project Levers

(1) Drip irrigation system with soil moisture monitoring

The key component of the irrigation system is the soil moisture content monitoring system and the irrigation management software.

Soil moisture monitoring probes (appoximately 9 per 10ha) transmit data every 10 minutes on the volumetric water content of soil (mm of water per 100 mm of soil measured). This data is automatically analysed and guides the irrigation regime.

Data is provided at a scale of 400m^2 rather than at a wider farm level thus further improving the impact of the system.

As a result, there is a reduction in the stress the plants are under from over- or under-watering and so produces a higher yield crop and withdraws less water.

(2) Fertilisation through drip irrigation system

Crop yield is further improved through a fertigation system that more precisely delivers fertilisers through the drip irrigation system to the plant root system. This offers both cost savings for farmers and reduced leaching of nutrients into the ground.

(3) Partnership Delivery

The system has been developed through a partnership between Monsanto, NETAFIM™ who specialise in drip irrigation products, HydroBio specialists in crop monitoring and the University of Milan who have provided independent evaluation. Extension services have been provided to farmers to demonstrate the benefits of the system.

The initial cost to install the system is around $1200 per hectare. Annual maintenance is approximately $300 per hectare.

Outcomes and Challenges

Drip irrigation together with the implementation of soil moisture monitoring software showed considerable benefits:

- 22.4% of water withdrawal decrease
- 124% dry matter yield increase

The system was installed on a total of 10ha at three separate farms resulting in a reduction in withdrawal of 3 800 m^3 per year when compared to a conventional irrigation system. The reduction in withdrawals is beneficial with respect to water scarcity although the increase in crop yield indicates an increase in evapotranspiration and reduced return flows. This may be offset by reduced field level evaporation.

There is significant potential for the extensive role out of the system across Mediterranean region (appoximately 2 750 000 ha) that currently grows and irrigates corn. However, whilst maintenance and operational costs tend to be lower than conventional systems, the high upfront installation cost acts as a barrier to uptake.

Following the success of this project, future development of system is planned. This involves improving the accuracy of the decision support tool for irrigation with the usage of satellite images and relevant agronomic data. Further developments include the use of the data to guide the seed selection appropriate for the local growing climate.

Above: Lodi corn farms using a probe for soil moisture monitoring © Monsanto