Extended Practice Abstract Nº 9

GO CITRICS – Citrus Irrigation and Fertilisation Precision Farming

Short description of the OG

The OG aimed to carry out a pilot test in an irrigation community using thermographic cameras, drones, satellites and capacitance sensors to determine the areas with excesses or defects in irrigation to balance this aspect.

The water reality of the irrigation system is determined using the data obtained and, by applying the appropriate corrections, the knowledge acquired can be transferred to growers to be applied on their farms.

Benefits

More efficient irrigation is achieved, both at the water level, in a context of limited water resources, and at the energy level, reducing associated costs.

Stage of implementation

Finished in September 2021.

Key Data Box

Theme
Citrus; adaptive management; digital technologies; energy efficiency; water-use efficiency

Context
Citrus production area, especially with a risk of water availability in the future

Duration
2019-2021

Partners
ASAJA Málaga, IVIA, Centro de Edafologia y Biologia Aplicada del Segura, Ignacio Puech Suanzes, Distribución de Maquinaria Agricola y Agroquímicos, Hemav Technology S.L., Hemav Technology S.L.

Budget
€ 123,762.57

Particularity
The OG studied the effectiveness in the application of new agricultural precision technics.

Main achieved or expected results

- The installation of capacitance probes in the plot (see Picture 1) makes it possible to monitor soil humidity; thus, it is possible to know the optimal time of irrigation and the amount of water to provide, programming the irrigation based on this information.

- The data obtained from drone flights (prepared with a hyperspectral camera; see Picture 3) and satellite images makes it possible to detect failures in the irrigation systems, highlighting areas with both over- and under-irrigation. Detecting this problem, individualized in the area of the field, enables this aspect to be corrected, possible failures to be repaired and irrigation to be adapted to the needs of the crop and, consequently, production to be increased; see the information obtained displayed on a digital platform in Picture 2.

- Installing a mulching layer of rice straw in this case, because it is difficult to manage and because it is a crop present in the area generates benefits in terms of reducing irrigation needs.

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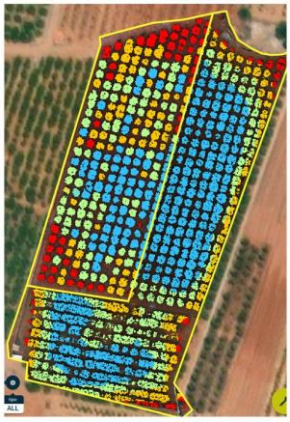
Picture 1. Capacitance sensor



Picture 2. Digital platform with the hydrological results

Picture 3. Drone equipped with thermographic cameras

Existing materials

Web links

Project website:

https://gocitrus.eu/

Further reading

Manual on maintenance of irrigation communities and installations on plots

https://www.avaasaja.org/index.php/de-interes/proyectos/gos-citricos/item/download/2129_74252b506edaaeff5c9eee0f1819e62a

Manual on precision agriculture in irrigation and fertilization

https://www.avaasaja.org/index.php/de-interes/proyectos/gos-citricos/item/download/2128_13cea774bafebde26b06084f6f03e6a3

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Rice straw mulching to increase water efficiency in citrus production

Challenge

Citrus cultivation takes place in areas where water can be a scarce resource, especially given the current climate change situation. Therefore, good management of this resource is essential.

Solution

One practice that allows water saving is the use of mulching, in this case, rice straw from the Albufera Natural Park in Valencia (Spain). However, it is possible to use straw from any crop, prioritising those that do not have a circular use in the area of application.

Benefits

- We avoid the evaporation of water.
- With the decomposition of the straw, we provide organic matter to the soil.
- We control the appearance of weeds, avoiding the use of herbicides.
- As regards rice straw, it is not the best for animal feed due to its characteristics and is traditionally burnt. Thanks to using it for mulching, we can avoid burning it.

Applicability box

Theme
Citrus; adaptive management; water-use efficiency

Context
Citrus production area, especially with the risk of water availability in the future

Application time
September/October

Required implementation time
1 month

Period of impact
Immediately after applying the mulching

Equipment
No specific equipment is required.

Practical recommendation

- It is necessary to wait for the rice to be harvested, and then acquire it from companies that manage it.
- Beforehand, the field must be prepared, eliminating weeds and levelling the ground if necessary.
- Distribute the rice straw uniformly over the surface of the soil around the trees.
- Avoid placing the straw directly in contact with the tree trunks to prevent humidity and disease problems.
- Regularly monitor and recalibrate the irrigation, as it will almost certainly be necessary to reduce the previous water allocation.

Furthermore, capacitance probes, satellite information and/or drone flights with thermographic cameras can be used to monitor water needs and achieve more efficient irrigation.
With the data obtained through one or more of these systems, together with a platform to display the data, it is possible to determine the optimal time for irrigation, as well as the amount of water to provide.

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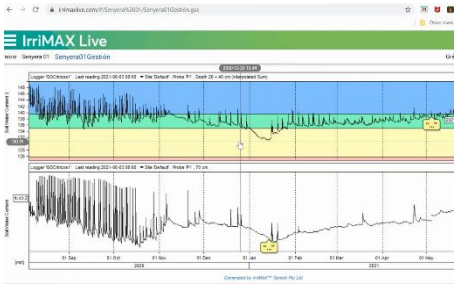
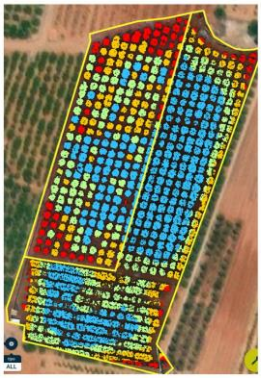
Picture 1. Rice straw applied in field 1

Picture 2. Rice straw applied in field 2

Picture 3. Capacitance probe



Picture 4. Digital platform with results obtained from the capacitance probe



Picture 5. Digital platform with results from satellite/drone

Further information

Web links

Project website:

https://gocitrus.eu/

Further reading

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Extended Practice Abstract Nº 9

Simplified cost/benefit analysis

Rice straw mulching to increase water efficiency in citrus production

Introduction – presentation of ex-ante and ex-post situation

Climate change, through the drastic decrease in precipitation in some regions of the Mediterranean, causes a decrease in water contributions, as well as the availability of water, and an increase in dependence on irrigation systems. This is more evident in the case of irrigated crops such as citrus.

Therefore, it is necessary to continue researching new systems and solutions that allow optimal management of water resources in agriculture, such as mulching, in the case of this practice, with rice straw, a waste that is difficult to manage. that is currently burned in the study area, with the consequent impact on CO2 emissions into the atmosphere.

The ex-ante situation considered for this analysis involves a citrus farm with the usual fertigation system, and without vegetation cover, being the most frequent situation in the study region. The ex-post situation considers the implementation of mulching with rice straw.

The calculations have been made for a typical plot of 1 hectare.

Economical costs and benefits

The data refers to the area of Valencia, a province located in the Mediterranean region of Spain. As for the rice straw implemented as mulching, it comes from the Albufera Natural Park in Valencia. Due to the above characteristics, in the case of Valencia, rice straw is free for interested parties, while this situation may not occur in the case of other European regions or in the case of straw from other crops.

	Ex-ante	Ex-post
Variable costs		
Input		
Fertilizers	828,00 €	745,20 €
Phytosanitary products (mainly herbicides)	1.033,20 €	929,88 €
Water	1.736,40 €	1.389,12 €
Installation (material + labour)	-	850,58 €
Labour (excluding installation)	1.741,20 €	1.392,96 €
Machine costs (fuel + depreciation)	400,80 €	380,76 €
TOTAL	**5.739,60 €**	**5.688,50 €**
COMPARISON	Global reduction of 0,90% of the cost: 	

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Environmental costs and benefits

Energy	Indicator improvement of 20%: 
In order to obtain this indicator, the energy used has been measured both for the extraction of irrigation water and the energy related to the machinery used, with savings recorded in the latter through savings in herbicide treatments. Likewise, the transportation and installation of the mulch on the plot has been considered in the ex-post analysis.	
Water	Indicator improvement of 20%: 
In this case, the amount of water used to irrigate the plot has been measured in the ex-ante and ex-post situation. This data has been obtained through measurements made with the capacitance probes installed in the pilot plots, in parallel with other technologies such as drone flights and the interpretation of satellite information.	
Soil	Indicator improvement of 15%: 
It is widely known that the application of mulching on plots, in addition to water savings that responds to the decrease in evapotranspiration, improves the structure and fertility of the soil thanks to the decomposition of organic matter. To obtain this indicator, the data collected in the referenced bibliography has been taken into account, in addition to consulting the soil department of the Polytechnic University of Valencia, which has previously studied these values. (1), (2), (3)	
Air	No change (but a positive impact can be considered): 
Although this indicator remains neutral at the plot level, by applying rice straw mulching on one hectare of citrus, the burning of between 75,000 and 90,000 tons of rice straw is avoided. Studies carried out to date do not reflect improvements in air quality with the alternative use of rice straw. (4)	
Biodiversity	Indicator improvement of 15%: 
In the same way as the analysis carried out for the parameter related to the soil, it is known that mulching increases biodiversity, fundamentally that related to the soil (microorganisms and worms). The estimate has been obtained based on existing bibliography. (5)	

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