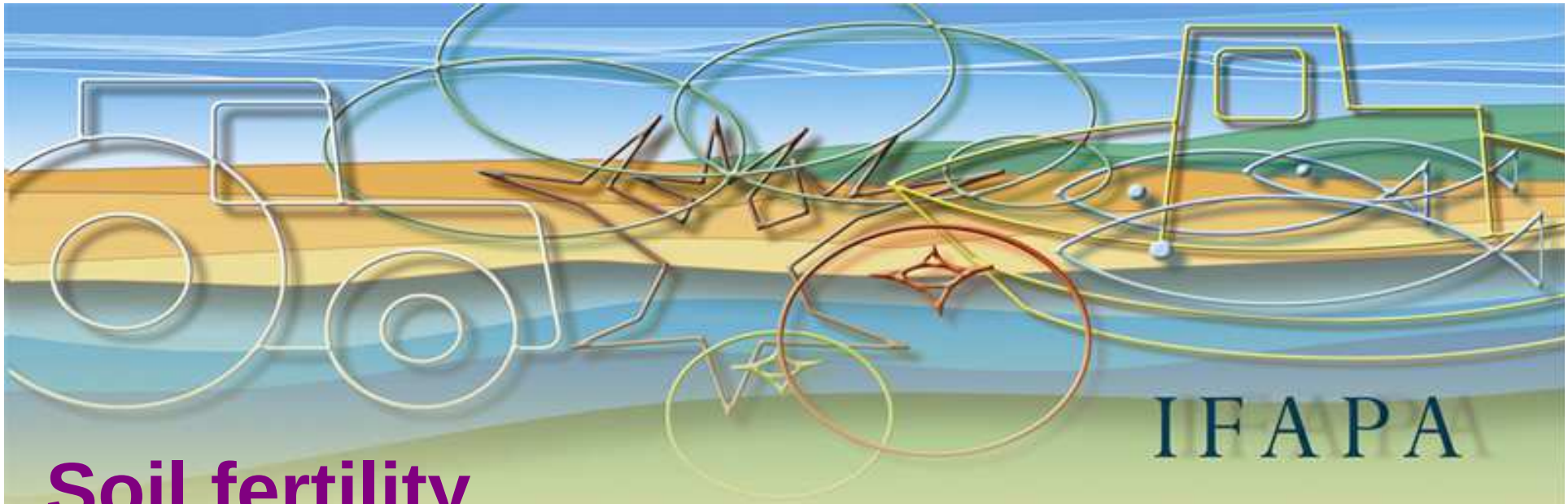

Soil fertility management in intensive Organic GreenHouse systems in Spain

Izmir, April 2016

Carmen García

IFAPA Almería, SPAIN

BioGreenhouse

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cost
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

COST is supported by
the EU Framework Programme
Horizon 2020

Spain:

- Surrounded by Mediterranean Sea and Atlantic Ocean (diferent climates)

- Mediterranean coast, mild climate

- Almería, a province of Andalusia (region of Spain), has a calid climate

- Average annual data:
  . 20ºC Temperature
  . 200 mm rainfall
  . 65% RH
  . 3000 h. sunshine

Similar latitudes :
Almería 36.8340 ºN
Catania 37.5079 ºN
Izmir 38,4237 ºN

Regional governments are responsible for organic farming in Spain. In Andalusia, the organism in charge is the office of Organic farming, included in the Andalusian Ministry of Agriculture, Fisheries and Environment.

In Andalusia there are 11 authorized certifying agents nowadays, for organic farming.

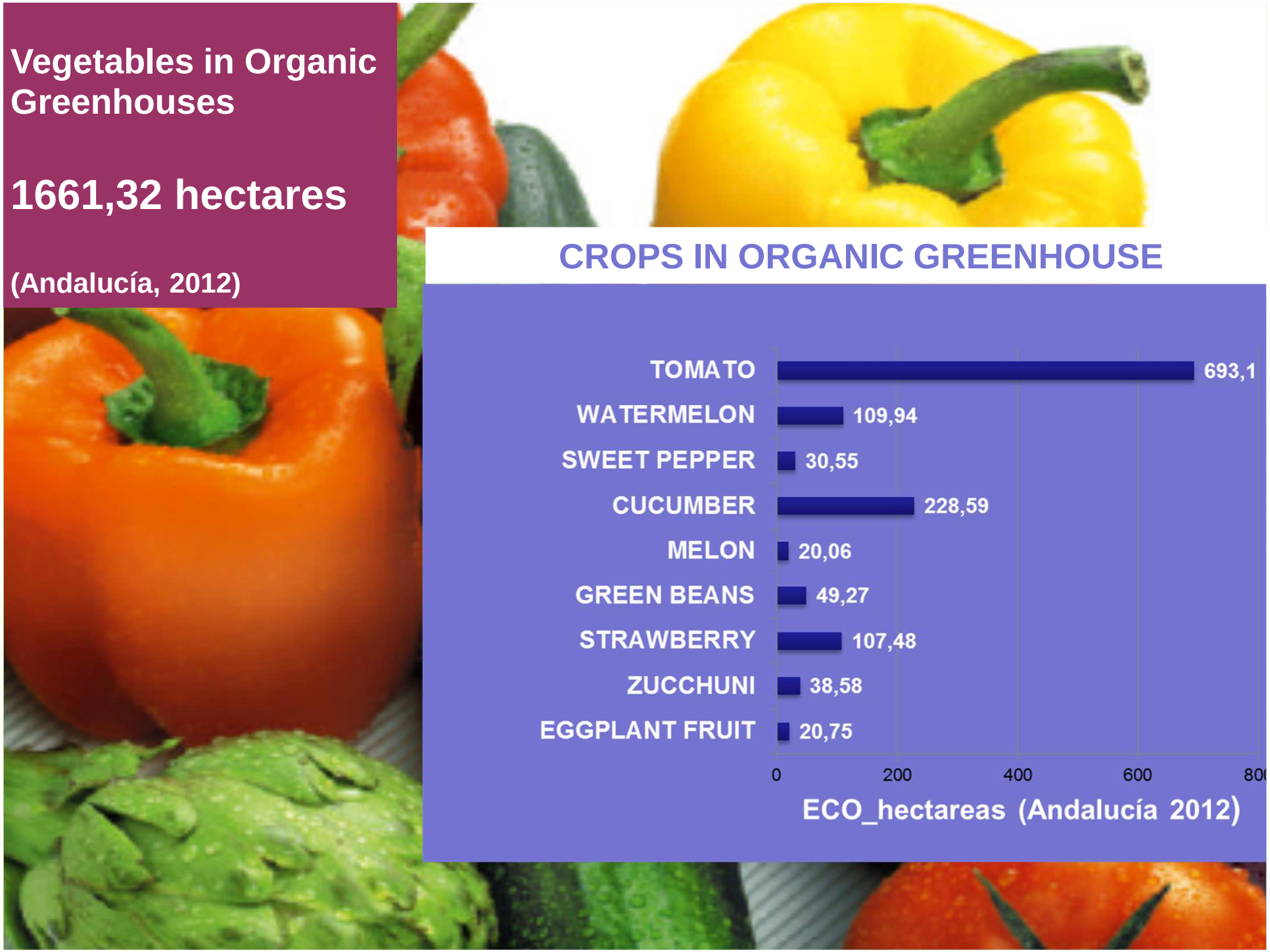
Farms are certified according to European regulations compliance.

There are already some farms applying Biosuisse and Demeter standards.

Vegetables in Organic Greenhouses

1661,32 hectares

(Andalucía, 2012)



CROPS IN ORGANIC GREENHOUSE

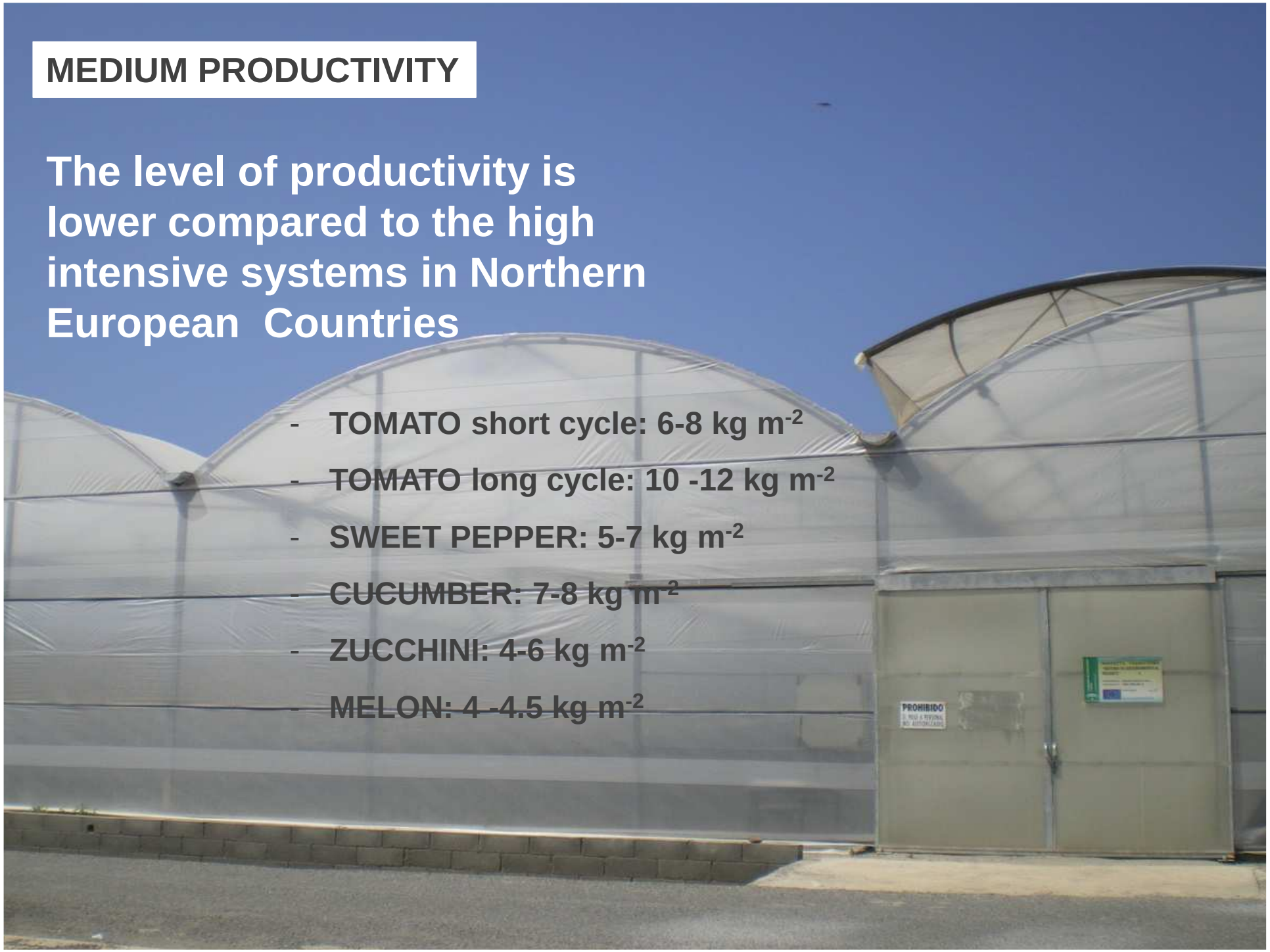
SIPEA-web is our Register of Organic Operators: trader, processor, packer, exporter, importer, producer

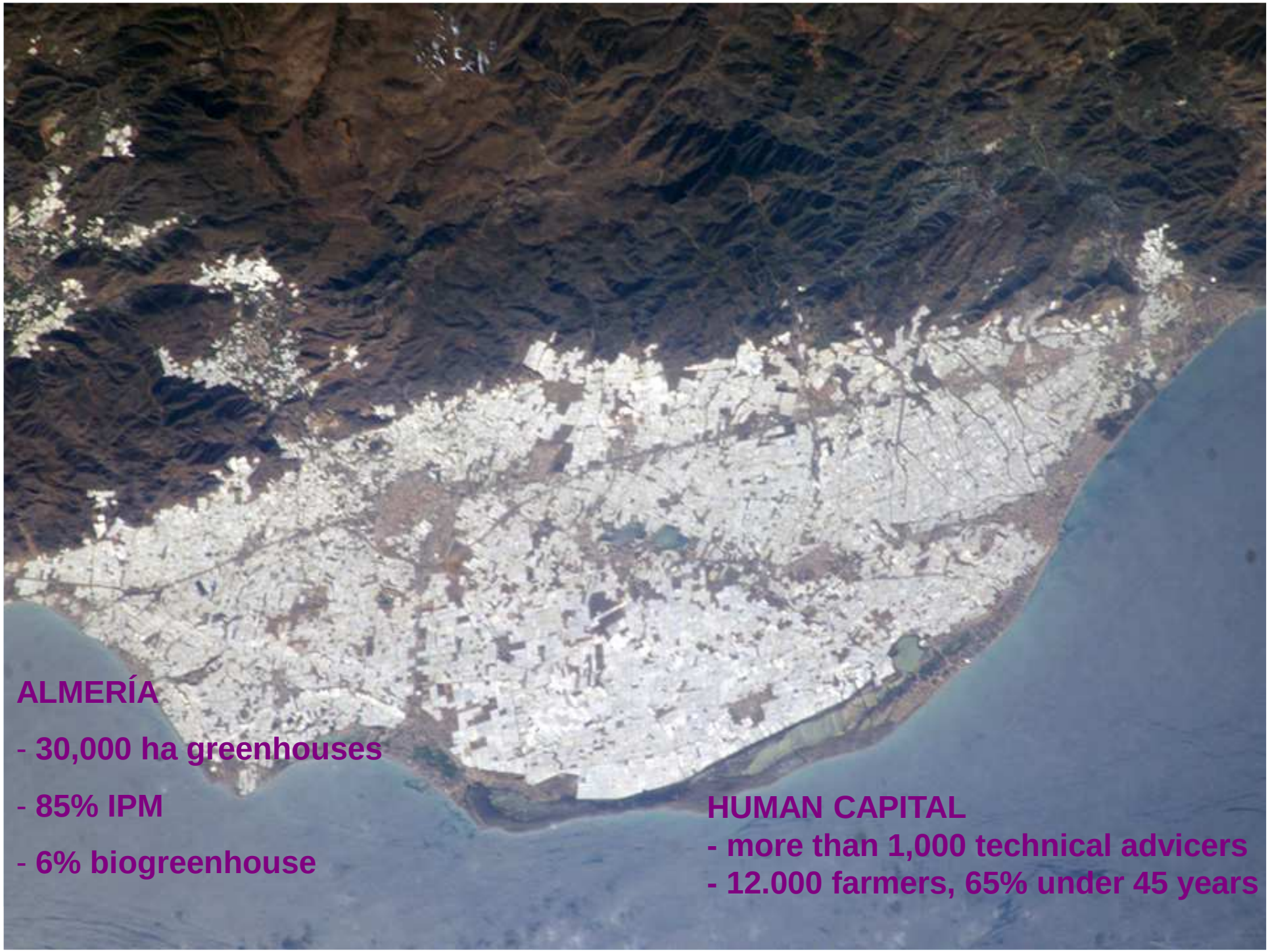
The register contains data on producers, area, crop and location

MEDIUM PRODUCTIVITY

The level of productivity is lower compared to the high intensive systems in Northern European Countries

- TOMATO short cycle: 6-8 kg m^{-2}
- TOMATO long cycle: 10 -12 kg m^{-2}
- SWEET PEPPER: 5-7 kg m^{-2}
- CUCUMBER: 7-8 kg m^{-2}
- ZUCCHINI: 4-6 kg m^{-2}
- MELON: 4 -4.5 kg m^{-2}




ALMERÍA
- 30,000 ha greenhouses
- 85% IPM
- 6% biogreenhouse
HUMAN CAPITAL
- more than 1,000 technical advicers
- 12.000 farmers, 65% under 45 years

A wide variety of horticultural cultivars is used.

Our producers try to buy organic seeds but not always exist in the market.

Sometimes non-organic but not chemically treated seeds are used, with previous authorization to of the certifying entity.

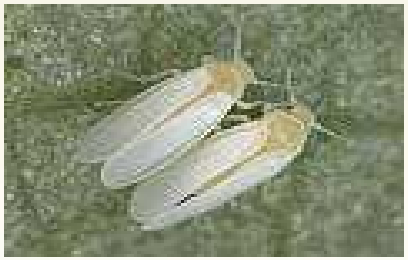
The market apreciatted very much traditional cultivars.

Andalucía has 25 organic nurseries.

Grafting on resistant rootstock is a common practice.

Biological control of pest is completely implemented

The main pests are controlled with *Amblyseius swirskii* and *Orius laevigatus* in pepper plants and with *Nesidiocoris tenuis* in tomato plants



Because *N. Tenuis* is slow to settle in the crop, bioinoculation strategy in nurseries has been adopted.

Aerial fungi and bacteria are treated with authorized plant protection products, mainly copper, sulfur, soaps and vegetal extracts.

Páez, 2014

SOIL DISINFECTION is solarización or biosolarización (+organic matter)

SUN + WATER + ORGANIC MATTER + RECICLABLE PLASTIC

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There are basicly two types of greenhouse structures: “raspa y amagado” and multitunnel greenhouses.

Our greenhouses are of the "raspa y amagado“ type, a simple coat of plastic on top of a structure made of wire and galvanized pipes without active climate control.

There are practically nor heating systems by petrol or gas combustion neither CO_2 fertilitation

Strategies to optimize management of energy consist of the use of thermal plastics, double roofs and cover textiles

Greenhouses are equiped with rain-water collectors

VENTILATION

Our advisors and farmers give much importance to possess a large area of ventilation.

LATERAL and ZENITHAL ventilation

FERTIGATION INSTALATION

Our farms have high fertigation technology and efficient water use.

100% of farms are equipped with drip irrigation.

Around 70% farms with Automata for control:

- **Irrigation times**
- **Fertilizers balance**
- **pH**
- **EC**


Controller
FERTIGATION INSTALATION
Filtration System
Fertilizer tanks
pH and EC control
Fertilizer injection equipment

Frecuently, in organic farms is enough with two tanks because they used more fertilizer basal dressing.

1000 liters/tank is an usual volume

Sometimes there is a tank in the open air because there are organic products that give off bad odors.

Drippers used are interline type
It is important to make:

- **Analysis of soil and irrigation water**
- **Irrigation uniformity coefficients**
- **Cleaning filters**
- **Routine maintance**

The fertilizers used in organic farming are sometimes not very soluble and clog up pipes and drippers
(Baeza y col. 2014)

Our Irrigation department is working also on economic and technical compare with the usual drip irrigation vs. exudative pipe, that is installed annually and is cheap and recyclable (Baeza y col. 2014).

Tests conducted by our Irrigation Dep. confirm good results with the use of citric acid alone or in combination with hydrogen peroxide. Protocolos are being optimized

EFFICIENCY OF FERTIRRIGATION depends on several factors, two of them are NUTRIENT CONCENTRATION and the VOLUME OF WATER USED

NUTRIENT CONCENTRATION

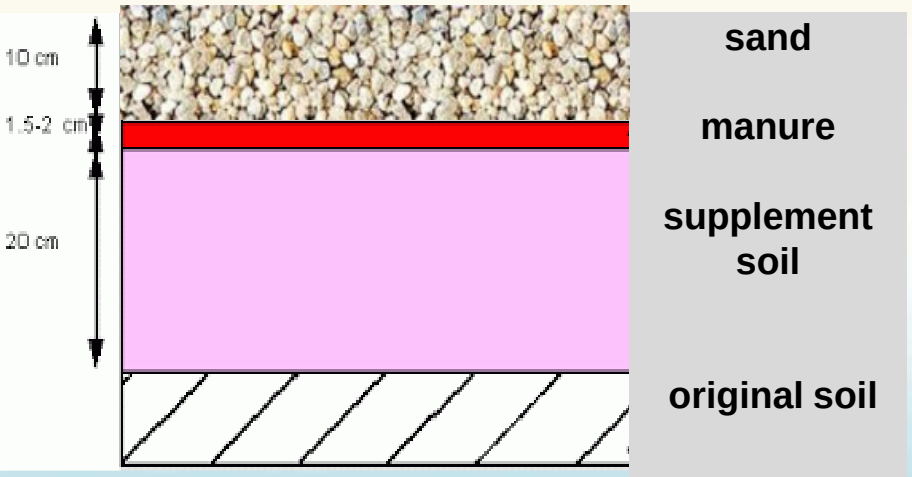
- **Soil fertility**
- **Irrigation water quality**
- **Estimation of the nutritional needs of the crop**

VOLUME OF WATER

- **Estimation of crop water needs**

The soils of southeast Spain are generally poor in organic matter (around 1%). In some areas, there is no arable land

Some soils are sand-mulched and extra soil supplied is sandy-loan (Lao, 2004).



It is difficult to till and to incorporate fertilizers.

Some farmers mix sand and soil.

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VOLUME OF WATER

- **Estimation of crop water needs**

The source of irrigation water in Almería in more than 80% is from underground sources.

We also have desalinated water and regenerated urban water

Many farms have a storage pond for irrigation water

Depending on the vegetable crop and the duration of its cycle, a total of 150 to 350 liters/m^2 are used

Practically all Almeria growing areas are designated by the EU as vulnerable zones pollution by nitrates from agricultural sources

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VOLUME OF WATER

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DIFFERENT FORMS of NUTRIENT and WATER MANAGEMENT

- **Prescriptive Management: calculate the contribution as extractions for a crop production estimate**
- **Corrective Management: adjust the supply of nutrients and water by symptoms or measures on soil / plant**

MIX STRATEGY to OPTIMIZE NUTRIENT and WATER MANAGEMENT

- **Prescriptive-Corrective Management:**

calculate the contribution according to crop needs for an estimated production and correct in greenhouse according to plant/soil indicators

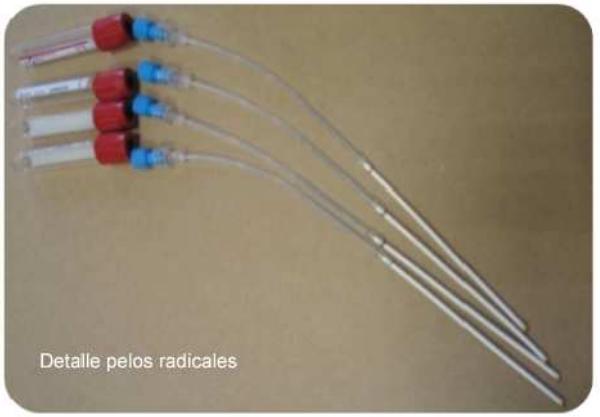
example of MIX STRATEGY to OPTIMIZE WATER MANAGEMENT

- **Prescriptive Management: calculate the extractions with program for dose irrigation or with elaborated recommendations**
- **Corrective Management: adjust the dose of irrigation water with tensiometers**

example of MIX STRATEGY to OPTIMIZE NUTRIENT MANAGEMENT

- **Prescriptive Management: calculate the contribution as extractions of crops and expected production**

- **Corrective Management: extraction of sample without soil disturbance and fast and cheap analysis**



Suction probes are used to adjust the nitrogen fertilization (Fernández y col., 2014)

Andalucía se mueve con Europa

PROTOCOLO DE ACTUACIÓN PARA DISMINUIR LA CONTAMINACIÓN POR NITRATOS EN CULTIVOS DE PIMIENTO Y TOMATE BAJO ABRIGO

SERVIFAPA

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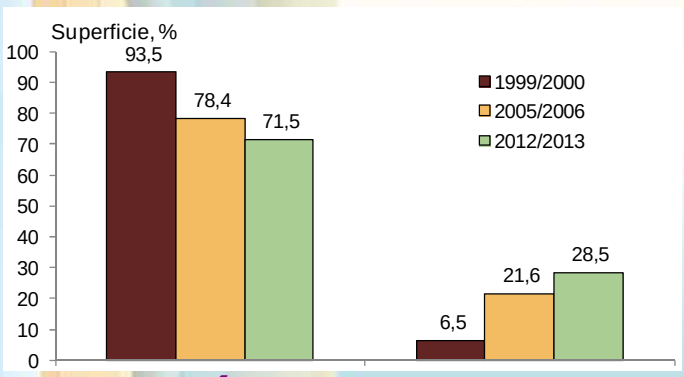
Organic amendments Animal manure

Almost 95% of organic farmers use animal manure, mainly from goat and sheep, some mixed with crop residues. The use of compost is little implanted (4.5% total)

Most farmers provides organic amendments in ditches near the crop line. Others leave it on the surface, especially crop residues, and some wrapped with tractor

The spending on labor force is high



Conventional greenhouse. Addition of organic matter to the soil (García-García et al, 2016)

The decision about when and what basal dressing apply take together between the farmer and advisor, with soil analysis.

Usual frequency is every two years.

Permaculture is beginning to be implemented

Green manure

The green bean is the most sown crop for green manure, at the end of the crop or once removed

Sometimes, if it have good price, the fruit is collected and the plant is incorporated into the soil.

Some *vicias* and *brassicas* is also used.

Plant remains can be left on the surface and become dehydrated, making mulching or incorporate them into the soil as fertilizer.

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Inorganic amendments

Only if necessary, it is applied gypsum (calcium sulphate), potassium sulfate, natural rock phosphate, calcium carbonate or sulfur

Fertigacion

The most commonly used fertilizers are potassium sulfate , chelated calcium, organic nitrogen fertilizers (like vinasse), blood meal and humic acids

Agroecological services providing crops (ASC)

Plant species introduced in the agro-system in order to provide or enhance its environmental functions; Green manure or cover crops incorporated to soil to maintain soil organic matter and improve nutrients recycling; Different plants in different region and with special aims; Green manure outside the green house on farms own fields or bought from other farms; Silage, biogas digestates	Non-use reasons: uneconomic, vegetation period too short; Partially use reasons: regional vegetation condition, lack of alternatives for organic matter; Nitrogen supply by own system, soil structure; Soil diseases and pests management weed control

(Tittarelli *et al*, 2016)

Crop Rotations

One cycle (long cycle) : _Jul.-Aug. to Feb.-May

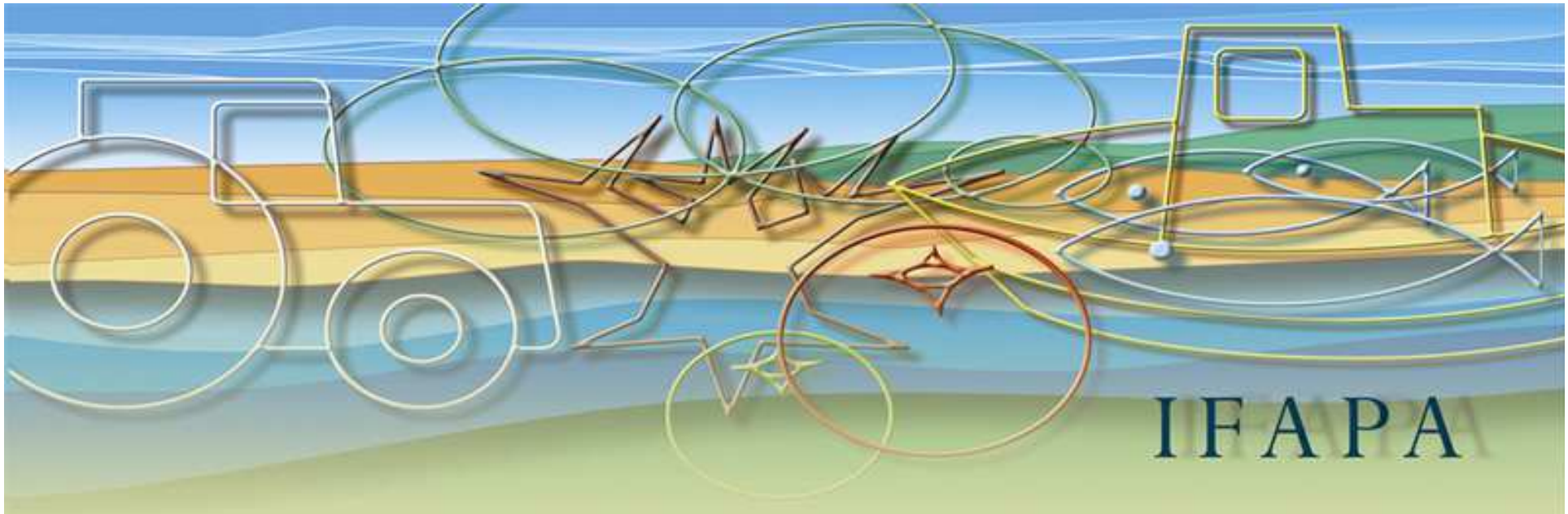



Two cycles:

Autumn campaign (the principal): Jul.-Aug. to Jan.-Feb



Spring campaign: Jan.-Feb to May-Jun

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