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# SUBSURFACE IRRIGATION FOR MAIZE



La Mirandette (32) station de tête

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# Presentation outlines

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- 1. Project presentation**
- 2. The experimental system**
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- 4. Lessons learnt**
- 5. Next steps**



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# Project Presentation

- Project **EDEN 2012-2014**, regional operation in the **Midi-Pyrénées Region** :
- **Partnership** CACG-ARVALIS-IRSTEA-CA31&47
  - How to generate water and energy savings on irrigated Maize?
  - Several techniques: **drip / sprinklers**



Solar Pivot



Manifolds & Laterals - SSI





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# The experimental system

## La Mirandette (32) – Experimental Farm of CACG



| Traitement                | Superficie (m <sup>2</sup> ) |
|---------------------------|------------------------------|
| 1- GGE100-GR (85%ETM)     | 4 400                        |
| 2- GGE150-GR (85%ETM)     | 4 500                        |
| 3- GGE100-GS (85%ETM)     | 1 800                        |
| 4- ASP-CI (85%ETM)        | 1 730                        |
| 5a- ASP-CI (100%ETM + ON) | 450                          |
| 5b- ASP-CI (100%ETM)      | 1 280                        |
| 6- PLUVIAL                | 870                          |
| 7- GGS150 (85%ETM)        | 1 460                        |
| 8- Rampe canon (100%ETM)  | 18 000                       |
| 9- Pivot (100%ETM)        | 72 610                       |

- Innovative Irrigation techniques

- Real testing conditions

- CACG collective network

- Connected to the Neste System



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# The experimental system

## Focus on the Sub-Surface Irrigation system (SSI):

- Depth :0,40 m – Width : 1 m vs 1,5 m
- Thick line16 mm self regulated 1,6 l/h - 0,5m spacing vs Soft lines
- Sub-surface vs Surface (1,5m)
- Irrigation 100% ETM / 85% ETM
- Fertigation



Mise en place des gaines



Station de filtration avec 2 départs





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# The experimental system

## Field Measurements / Analysis Criteria:

- Water Balance – Comparative methods
- Soil sensors and Neutrons probes
- Energy consumption
- Nitrogen balance and leaf development
- Yields



Soil sensors



Field Visits



Moisture metering with neutron



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# Résultats

## Energy Consumption

- Benefits are measurable...
- ... compared to other irrigation techniques

| Dispositif 2014           | m Colonne Eau | kWh / m3    | kWh / ha  |
|---------------------------|---------------|-------------|-----------|
| SSI 100-TL 85% ETM        | 30            | 0,09        | 75        |
| SSI 150-TL 85% ETM        | 30            | 0,09        | 75        |
| <b>SSI 100-GS 85% ETM</b> | <b>20</b>     | <b>0,06</b> | <b>45</b> |
| SPR-FC 85% ETM            | 40            | 0,11        | 88        |
| SPR-FC 100% ETM           | 40            | 0,11        | 122       |
| ASP-GS 100% ETM           | 40            | 0,11        | 116       |
| ASP-PI 100% ETM           | 40            | 0,11        | 124       |

SSI : Sub Surface Irrigation  
SPR : Sprinkler

TL : Thick Line  
FC : Full Coverage

SL : Soft Line    PI : pivot  
GS : Gun Sprinkler



## Yields

- 2012-2013 Average year, water savings of 10 et 15%...
- 2014 Wet year, variable results...

|      | Dispositif         | Irrigation mm/ha | Rdt grain q / ha | PEI kg / m3 |
|------|--------------------|------------------|------------------|-------------|
| 2012 | SSI100-GR 90% ETM  | 248              | 145              | 2,9         |
|      | GGE150-GR 90% ETM  | 244              | 137              | 2,7         |
|      | ASP-CI 100% ETM    | 275              | 143              | 2,6         |
| 2013 | SSI100-GR 85% ETM  | 191              | 147              | 4,0         |
|      | GGE150-GR 85% ETM  | 192              | 134              | 3,3         |
|      | ASP-CI 100% ETM    | 220              | 151              | 3,6         |
| 2014 | GGE100-GR 85% ETM  | 88               | 129              | 2,3         |
|      | GGE150-GR 85% ETM  | 88               | 119              | 1,1         |
|      | SSI 100-GS 85% ETM | 85               | 160              | 4,4         |
|      | ASP-CI 85% ETM     | 81               | 145              | 4,4         |
|      | ASP-CI 100% ETM    | 113              | 144              | 3,1         |





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# Lessons learnt

- **Yield potential of SSI is competitive** compared to traditional techniques
- **Larger widths affects the yields**,  
7% difference for 1,5m/1m
- **Energy savings are confirmed**
- **Fertigation** : It is a source of energy consumption.  
To be adapted to soil and climate
- **Experimental protocols to be confirmed**



Fertigation par venturi

# Next steps

- **Document the water savings**
- **Refine ETP** : compare with Irstea Penmann/centrale Campbell/FAO
- **Define energy savings respect to kg of grain, and m<sup>3</sup>**
- **Work on fertigation**, energy needs, late nitrogen applications are preferred compared to full fertigation
- **Prepare an irrigation scheduling method based on soil sensors**



La station de filtration

# Next steps

- **Test the installations life cycle**, Thick and soft lines
- **Compare surface and sub surface drip irrigation** (started in 2014)
- **Confront our conclusions with others :**

ARVALIS (site du Magneraud – 17)

IRSTEA (site de La Valette – 34)



Les 3 départs de parcelles GGE





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**THANKS**