



Agronomía aumentada

Gemelos Digitales para aprender y decidir
mejor la nutrición en sistemas complejos

 **Esteban Tronfi**

RAVIT AGRO

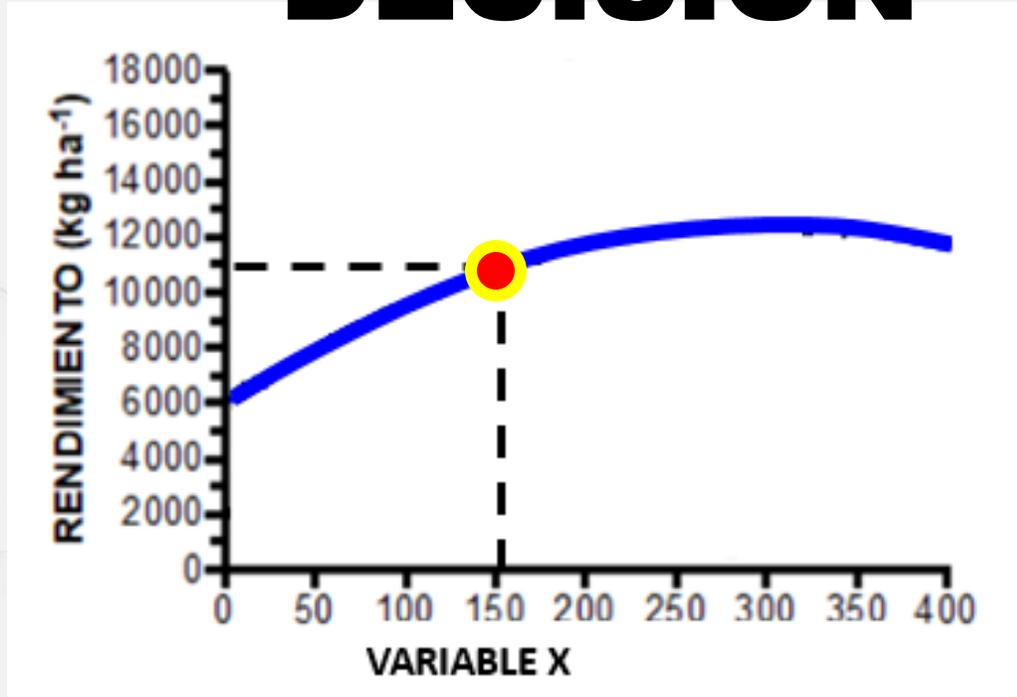
7 y 8 de mayo

Metropolitano, Rosario



Introducción. Dos mundos..

DECISIÓN

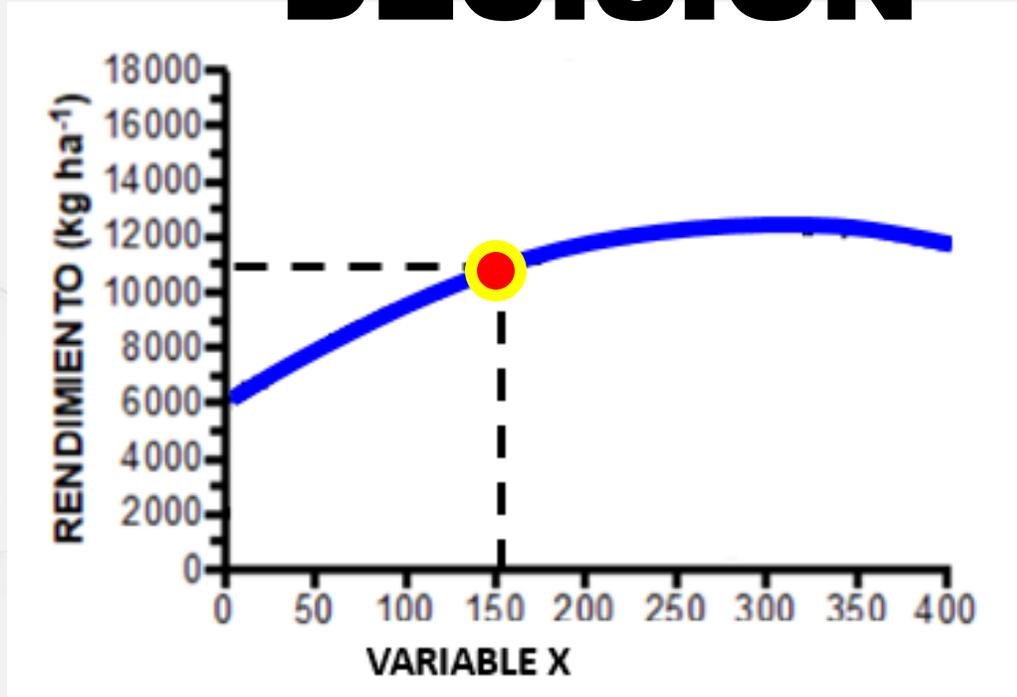


REALIDAD

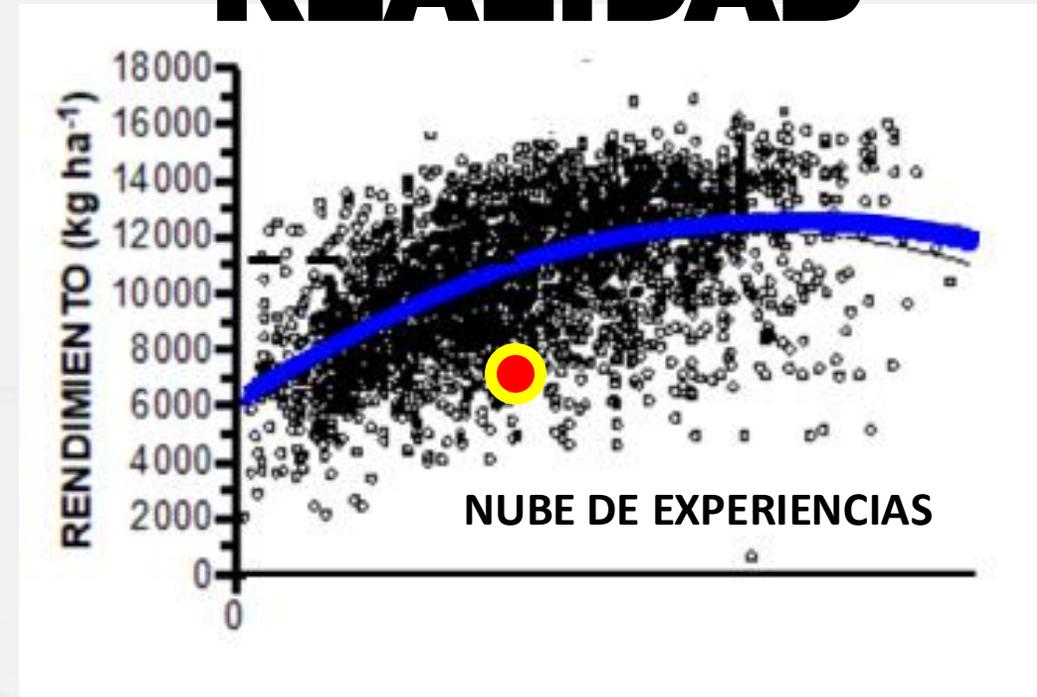


Introducción. Realidad = Fundamento + Contexto

DECISIÓN

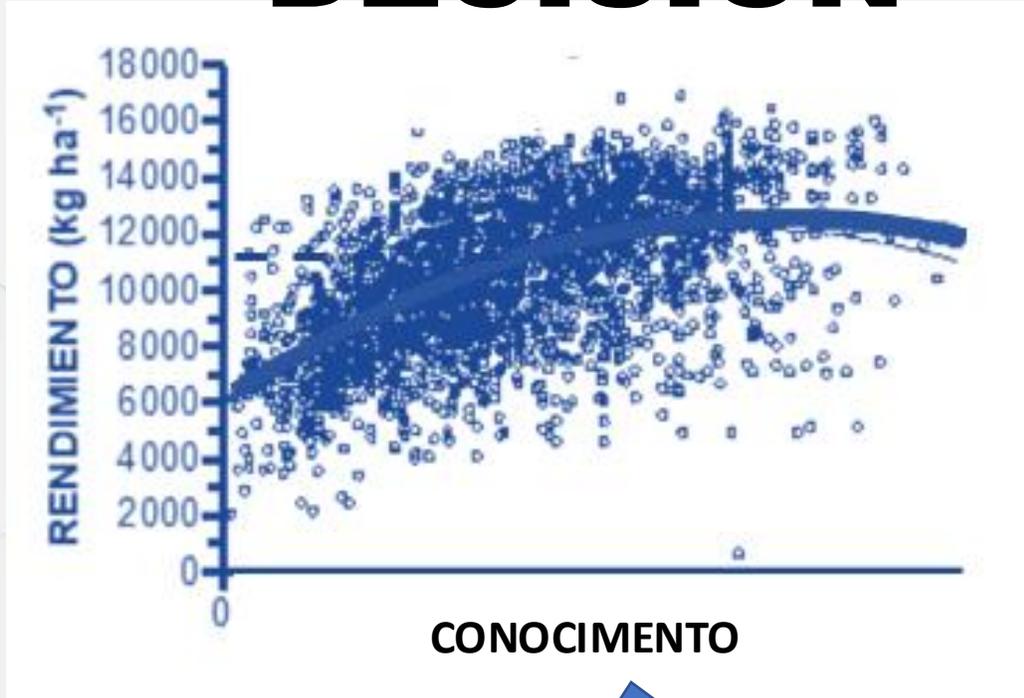


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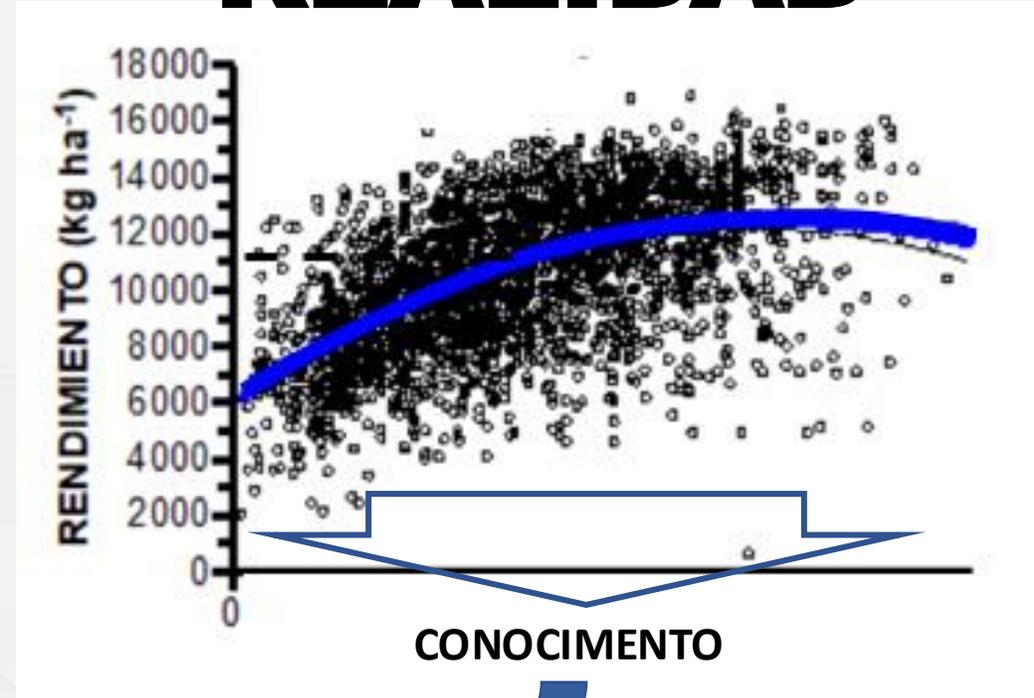


Introducción. Aprender de la realidad y mejorar las decisiones

DECISIÓN

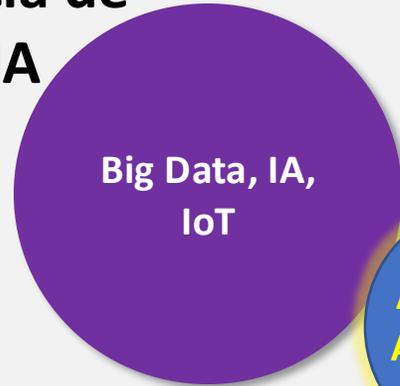


REALIDAD



Traer la nube al plan.. Qué es “agronomía aumentada”

**Convergencia de
TECNOLOGIA**



**Convergencia de
INTELIGENCIA
COLECTIVA**



**Agronomía
Aumentada**



**Convergencia de
EXPERIENCIA**

Construcción de convergencias

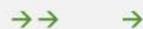
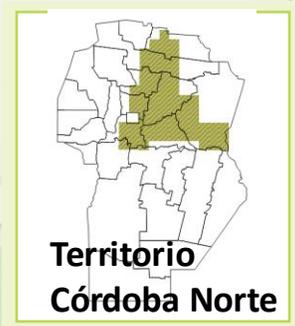
Valor experiencia (On farm experimentation)



USI

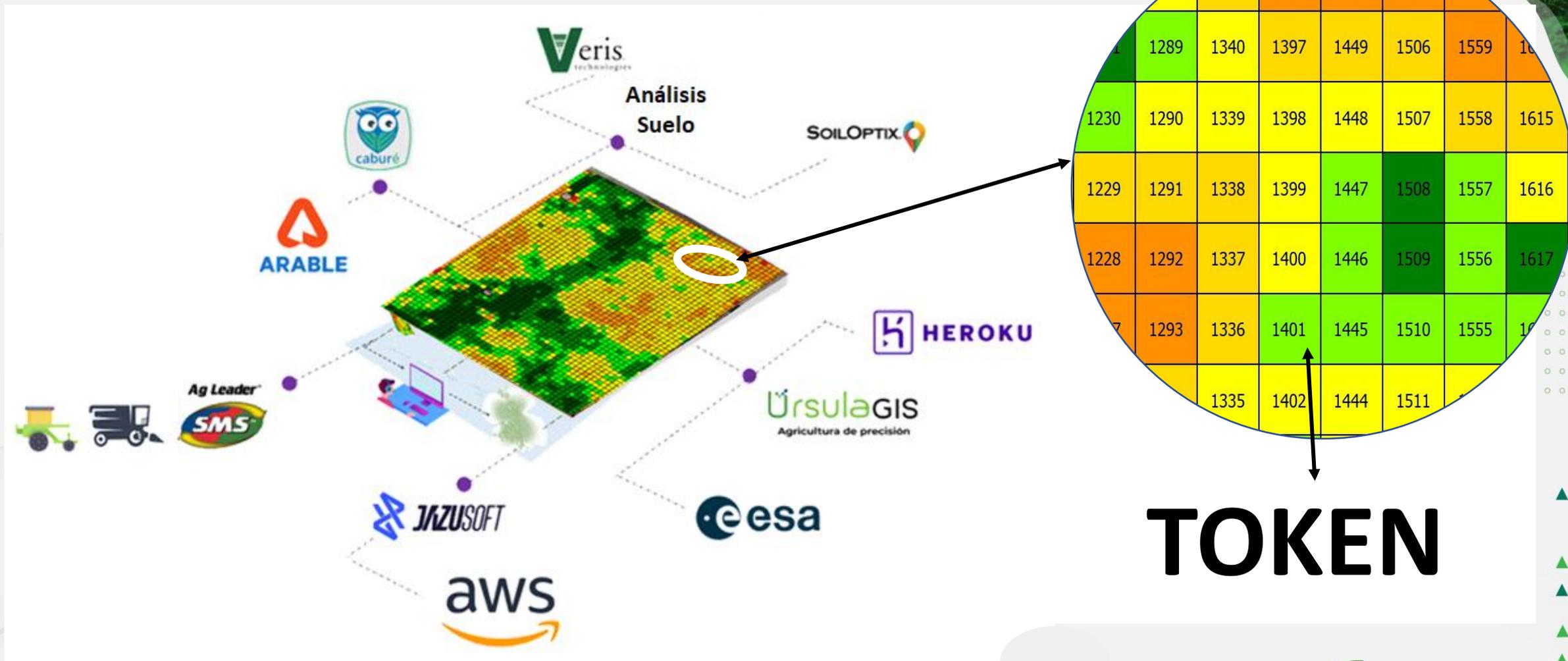
Unidad
Seguimiento
Intensivo

RED



Construcción de convergencias

Valor experiencia (On farm experimentation)



Ambiente de datos ricos..

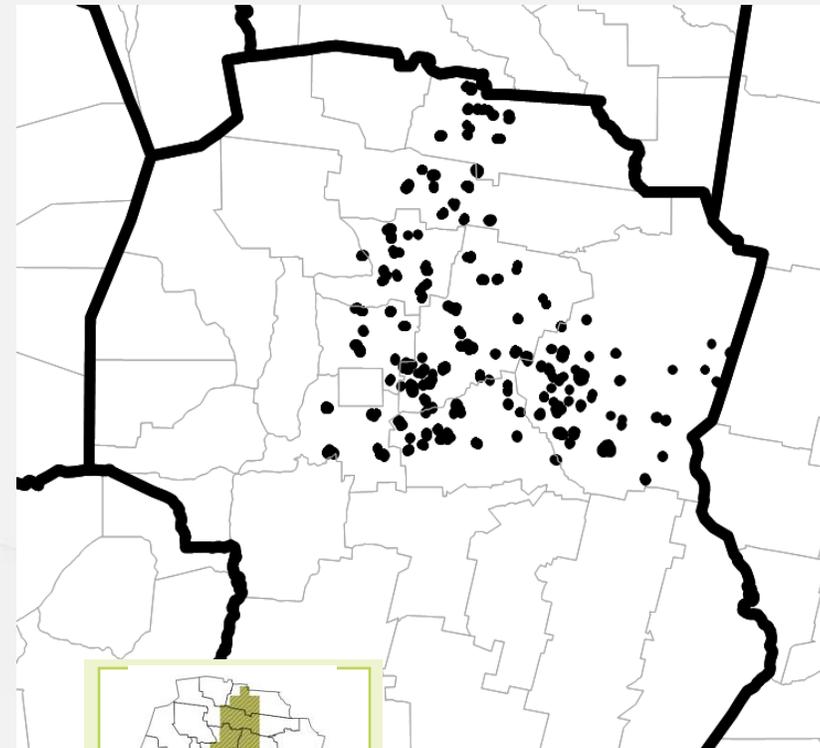
Ambiente

Decisiones
de manejo

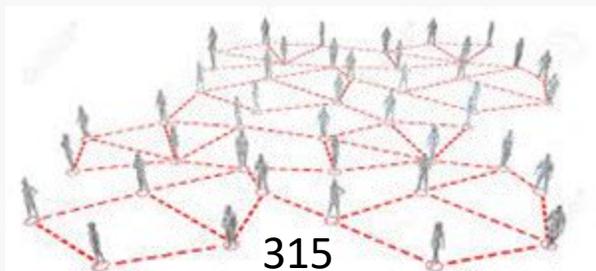
750.000

Tokens

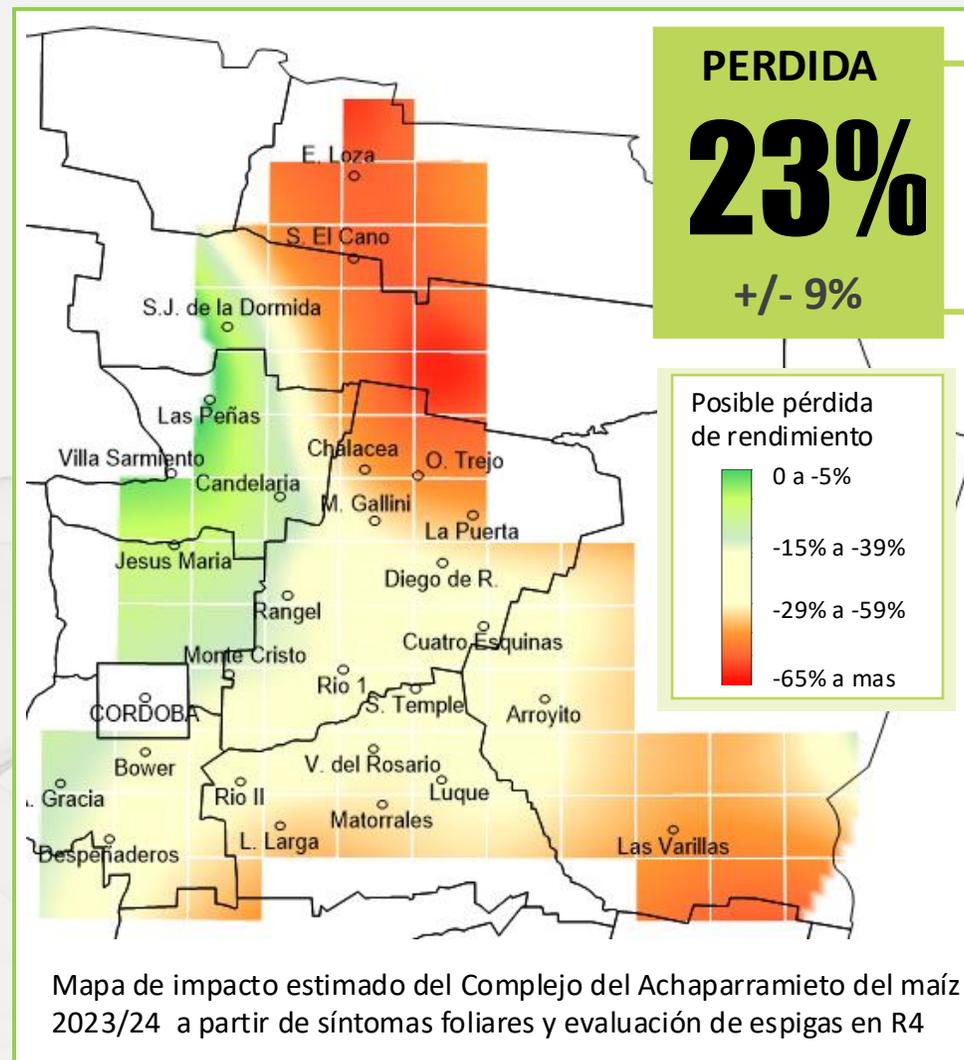
Resultados



CASO: Ambiente de datos ricos..



315
Nodos



Estimada el 30/4/24

90 días

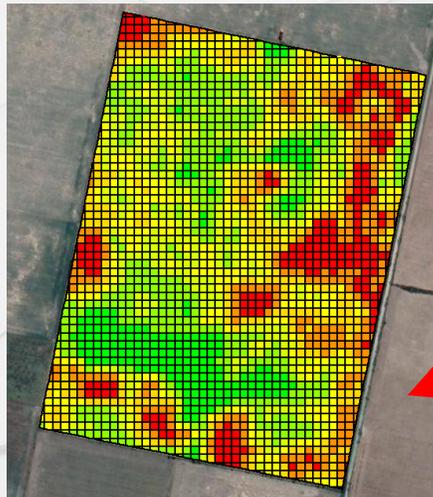
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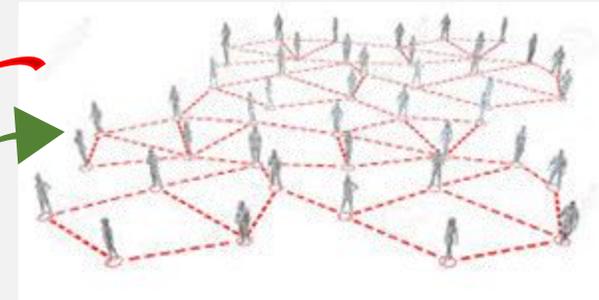
Faltaba una tecnología de información! Qué son los Gemelos Digitales?



Realidad Física



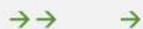
Transformación



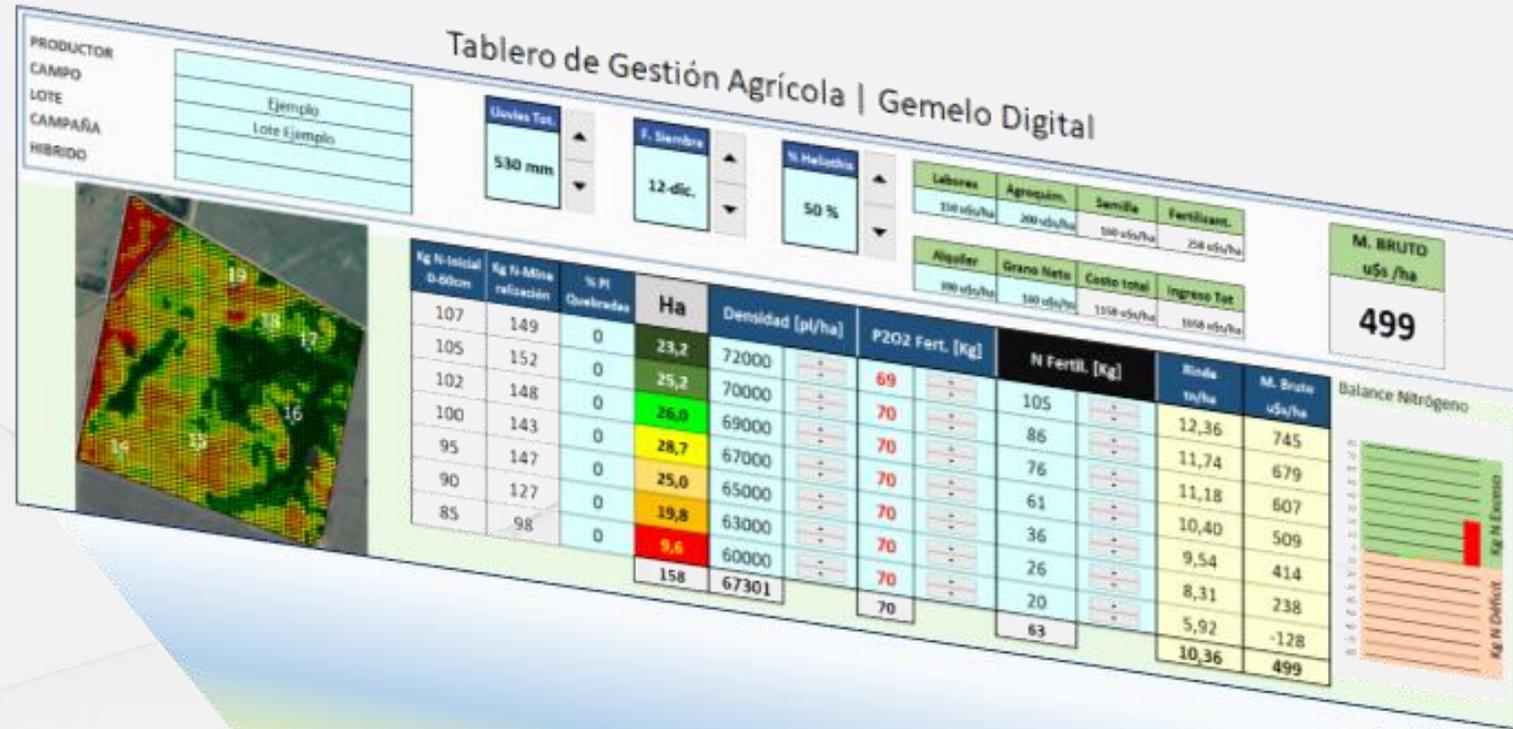
Red

Gemelo Digital

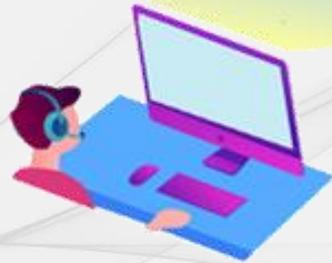
Transformación



Cómo se vé un Gemelo Digital



"Un gemelo digital es un sistema informático programado de tal forma que, al recibir las mismas entradas que experimenta el objeto o proceso físico del que es gemelo, proporciona las mismas salidas."



Cómo se construye un Gemelo Digital

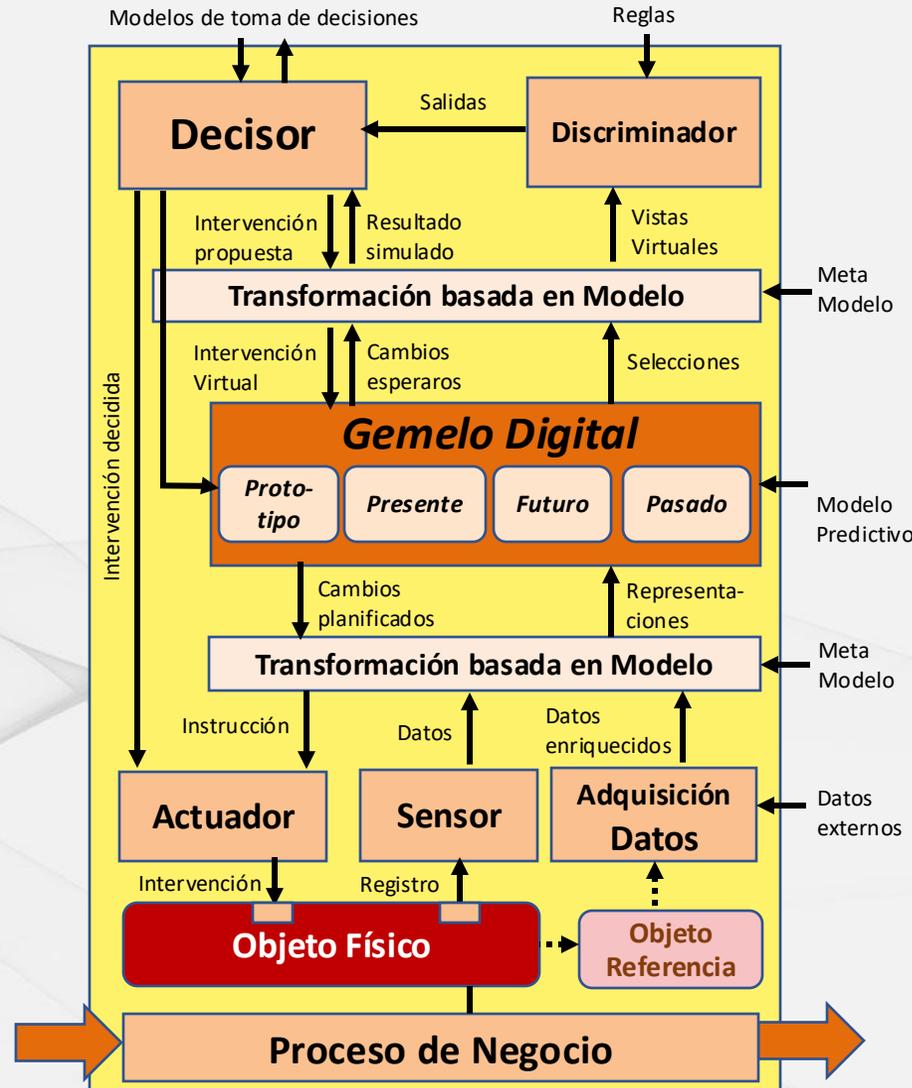
Digital twins in smart farming



Bedir Tekinerdogan

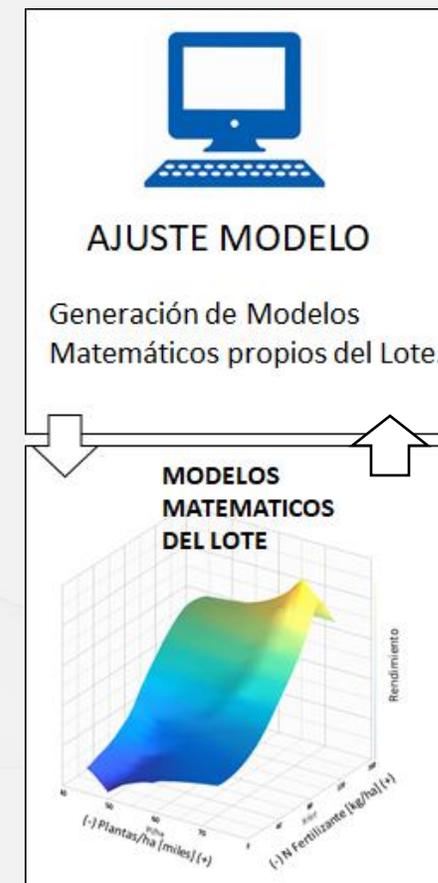
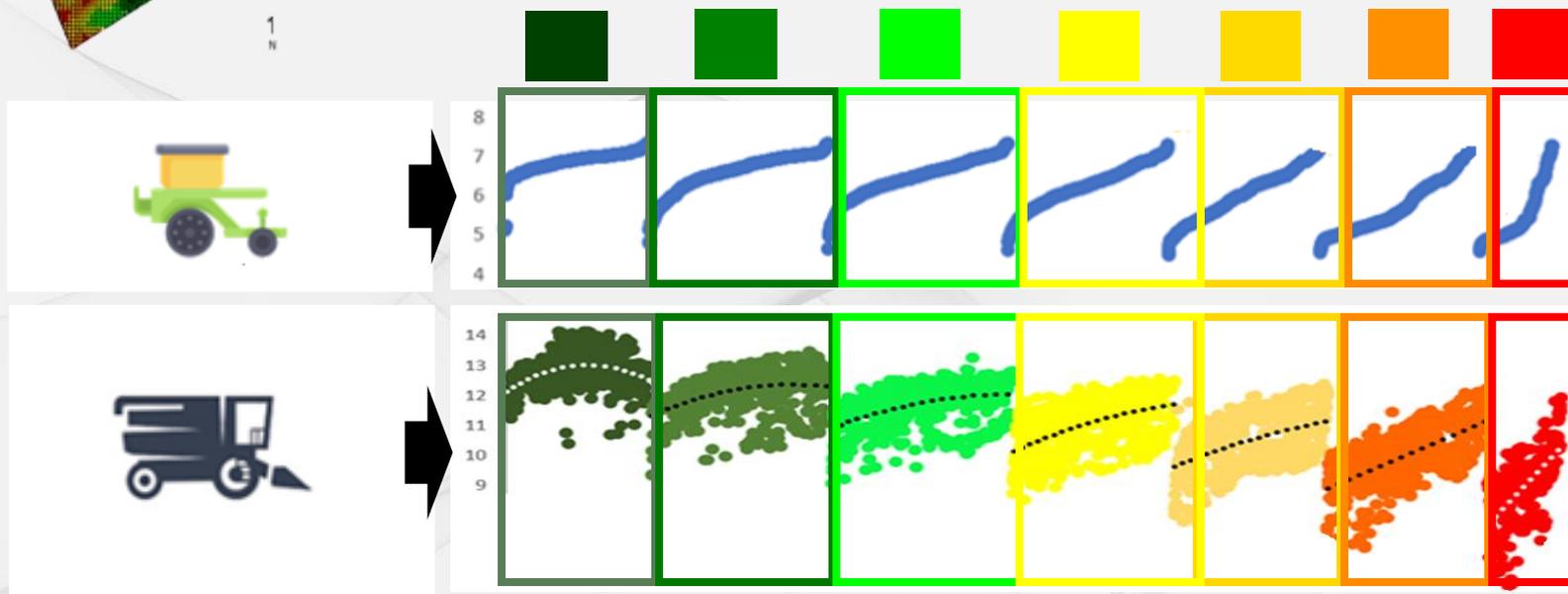
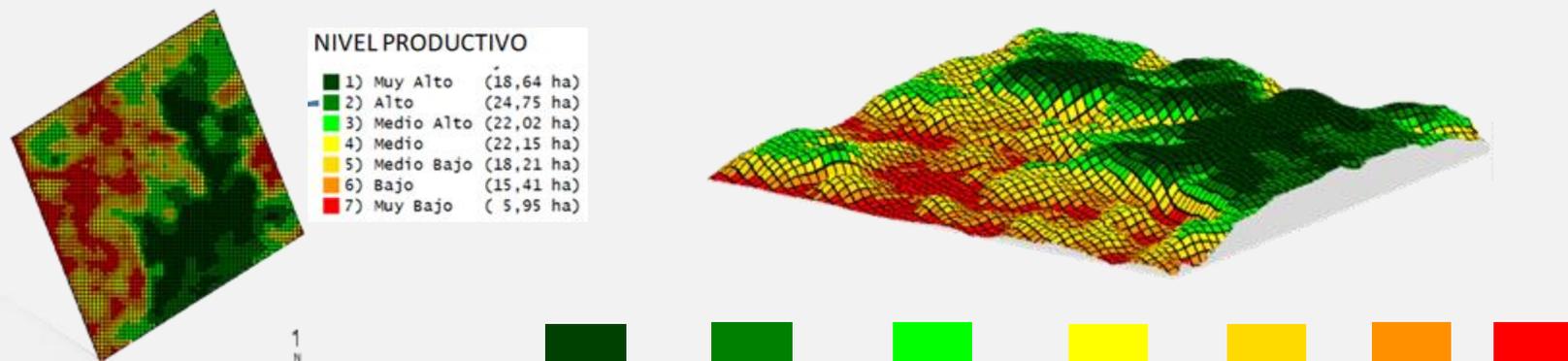


Cor Verdouw



Marco conceptual de Modelo de Control

Cómo se construye un Gemelo Digital | Crafting.. “la última milla”.



CASO: Gemelo Digital

10,4 tn/ha

10 tn/ha

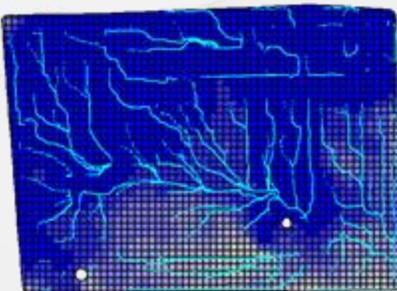
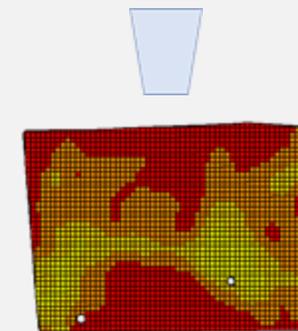
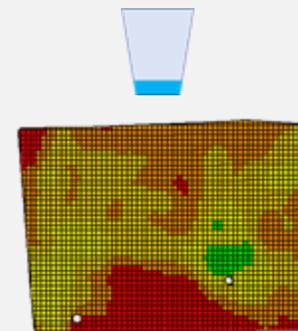
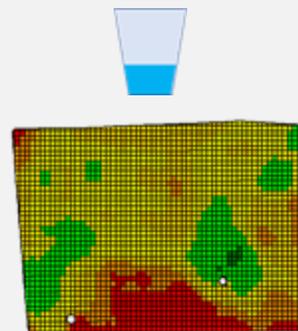
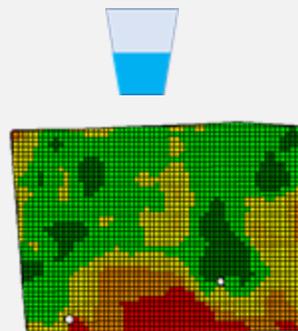
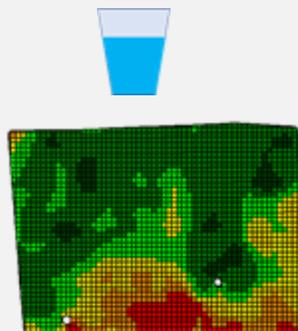
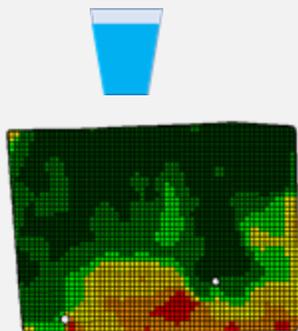
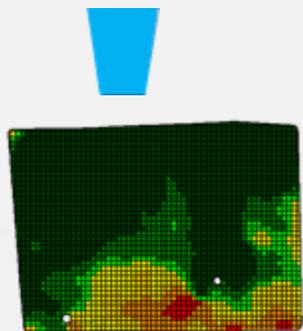
9,6 tn/ha

9.2 tn/ha

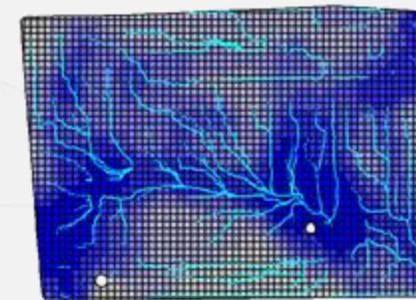
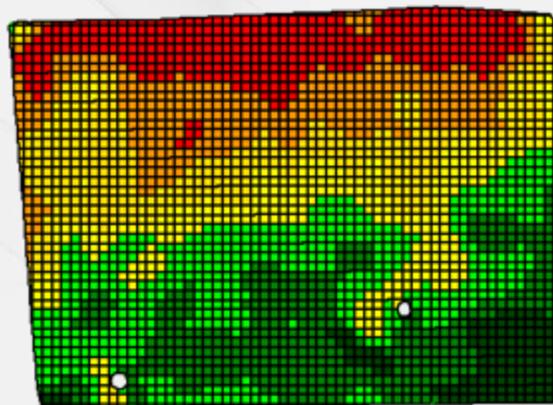
8,8 tn/ha

8,4 tn/ha

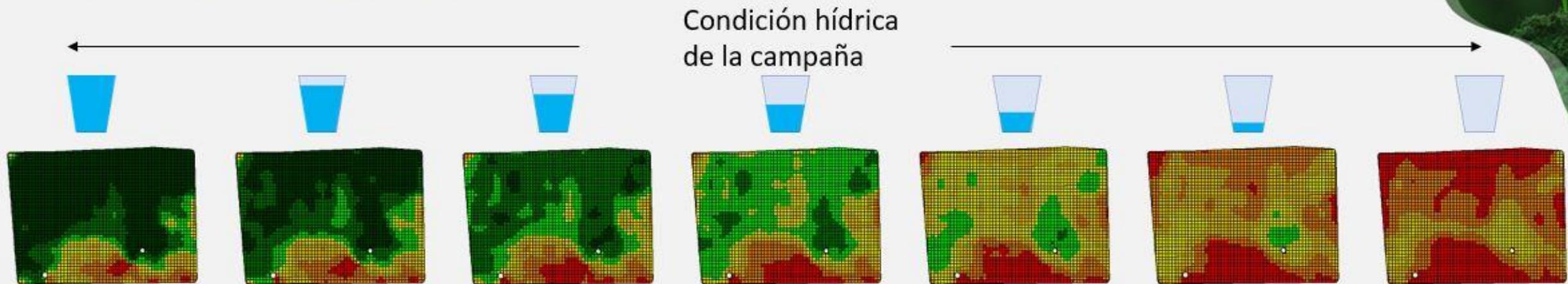
8 tn/ha



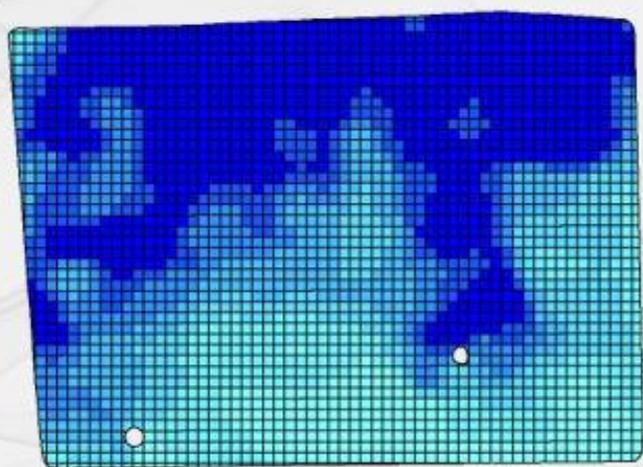
ESTABILIDAD



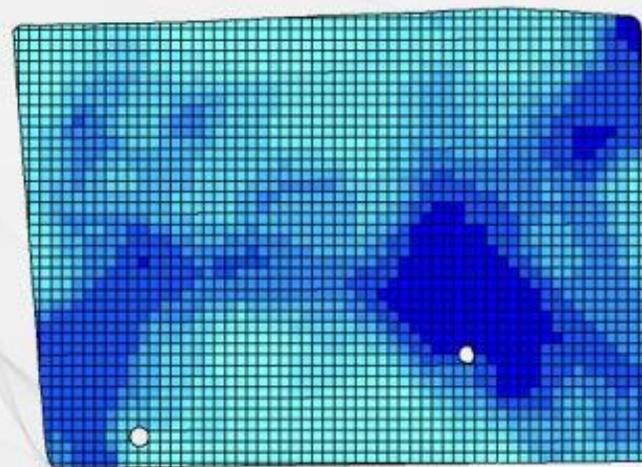
CASO: Gemelo Digital



Manejo de Fertilización Nitrogenada



72 Kg N Fert/ha



68 Kg N Fert/ha

Análisis: Manejo de Nitrógeno en diferentes escenarios



Escenario

1

2

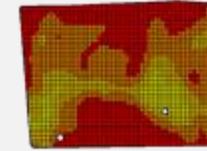
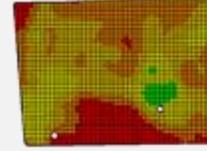
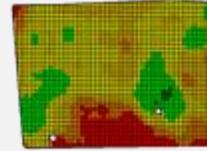
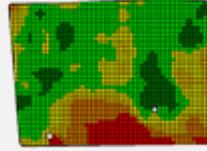
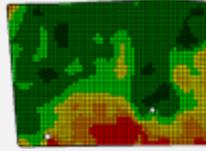
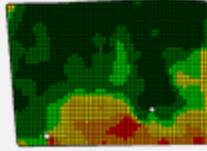
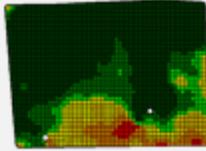
3

4

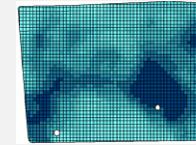
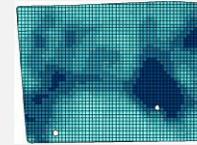
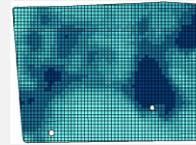
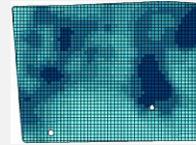
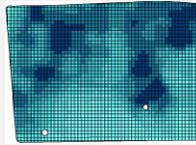
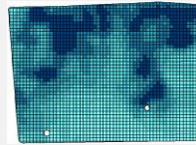
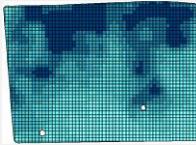
5

6

7



Manejo
Optimo
Fertilizante
Nitrogenado



1

2

3

4

5

6

7

Simulación
de todos los
manejos en
todos los
escenarios

2

3

4

5

6

7

1

3

4

5

6

7

1

2

4

5

6

7

1

2

3

5

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1

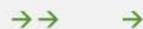
2

3

5

5

6



Análisis: Manejo de Nitrógeno en diferentes escenarios



Ingreso Marginal u\$s/ha

Escenario

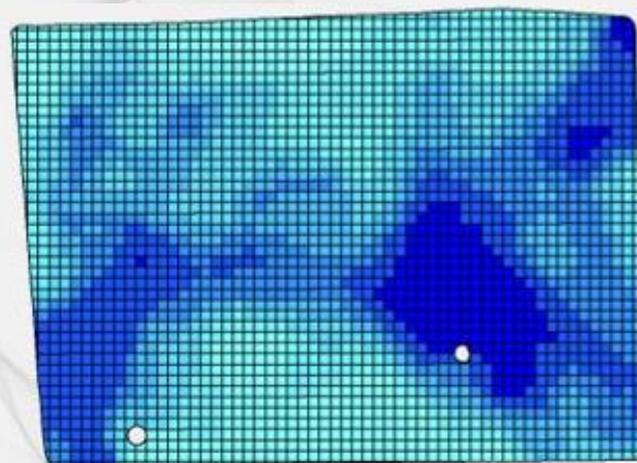
	1	2	3	4	5	6	7
1	67	63	60	56	52	48	44
2	68	64	61	57	53	49	45
3	69	65	62	58	54	50	46
4	70	66	62	59	55	51	47
5	71	67	63	60	56	52	48
6	72	68	64	61	57	53	49
7	73	69	65	62	58	54	50

50%

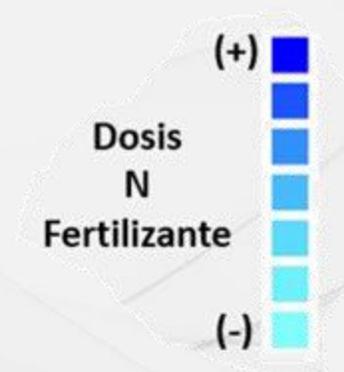
Manejo Fertilizante Nitrogenado



10%



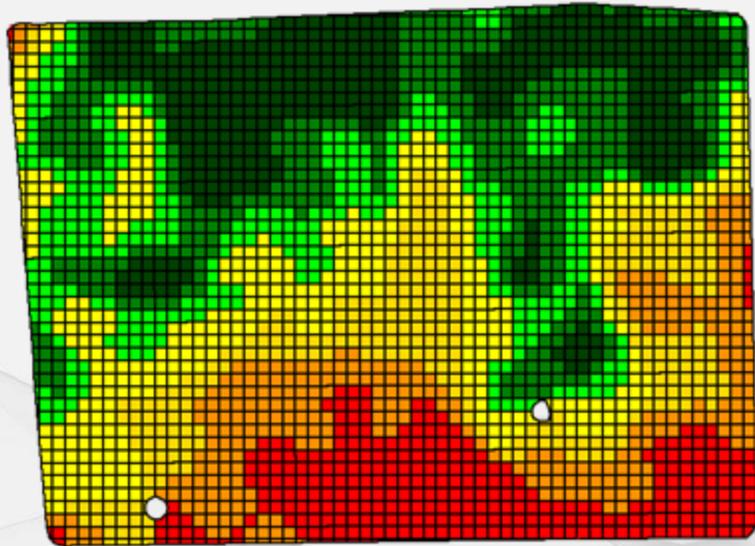
Manejo 7 Promedio 68 Kg N fert/ha



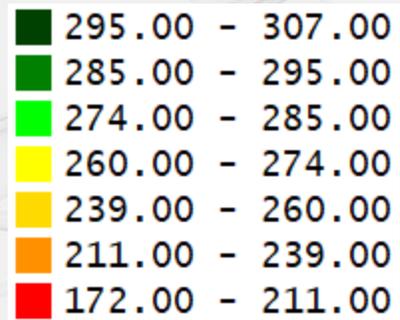
Análisis: Manejo de Nitrógeno en diferentes escenarios

Capacidad compensatoria | Nitrógeno efectivo

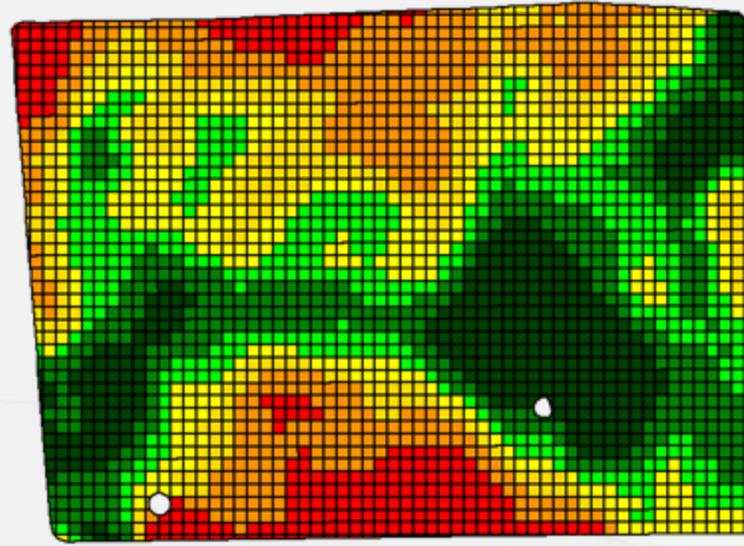
Escenario 1



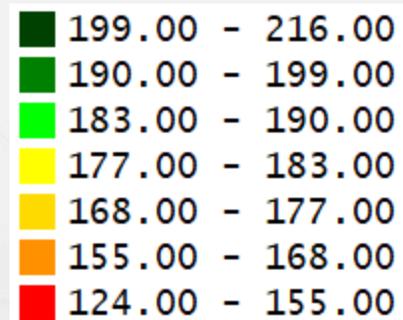
260 Kg N efectivo/ha



Escenario 7



179 Kg N efectivo/ha



Para cerrar, tres ideas clave como resumen:

1. La complejidad de la realidad no es una amenaza, es el punto de partida.

Con las herramientas adecuadas podemos aprender de ella y transformarla en mejores decisiones.

1. La Agronomía Aumentada no es solo tecnología, es una nueva forma de pensar. Integra experiencias, ciencia y tecnología.

2. Los Gemelos Digitales nos permiten simular, explorar y decidir mejor. Pero por sobre todo son la tecnología de información que hace fluir el conocimiento en la Red.

Y una cita...

El conocimiento ya no es lo que sabe un individuo, sino lo que fluye en la red a la que pertenece.

Yuval Noah Harari, Nexus