

## Manejo del cultivo de maíz

Dr. Gabriel Espósito

29 de Noviembre de 2024



$$R_{to} = R_{inc} \times e_i \times e_c \times e_p$$

Tabla 1. Rendimiento en grano de maíz para una fecha de siembra óptima y una fecha de siembra tardía para la localidad de Río Cuarto, Córdoba (Argentina).

|                    | Fecha de siembra          |                           |
|--------------------|---------------------------|---------------------------|
|                    | 04/10 (167 días)          | 04/12 (136 días)          |
| RFA inc.           | 2.003 MJ m <sup>-2</sup>  | 1.600 MJ m <sup>-2</sup>  |
| Ef. Int. Promedio  | 60 %                      | 65 %                      |
| RFA interceptada   | 1.201 MJ m <sup>-2</sup>  | 1.040 MJ m <sup>-2</sup>  |
| Ef. Conv. Promedio | 3,5 gMS MJ <sup>-1</sup>  | 3,7 gMS MJ <sup>-1</sup>  |
| Materia Seca       | 4.206 gMS m <sup>-2</sup> | 3.848 gMS m <sup>-2</sup> |
| Índice de cosecha  | 54 %                      | 42%                       |
| Rendimiento        | 2.271 g m <sup>-2</sup>   | 1.616 g m <sup>-2</sup>   |

$$R_{to} = N^{\circ} \text{ granos/m}^2 * \text{Peso grano}$$

$$2.275 \text{ g/ m}^2 = 6500 \text{ granos/m}^2 * 0,35 \text{ g/grano}$$

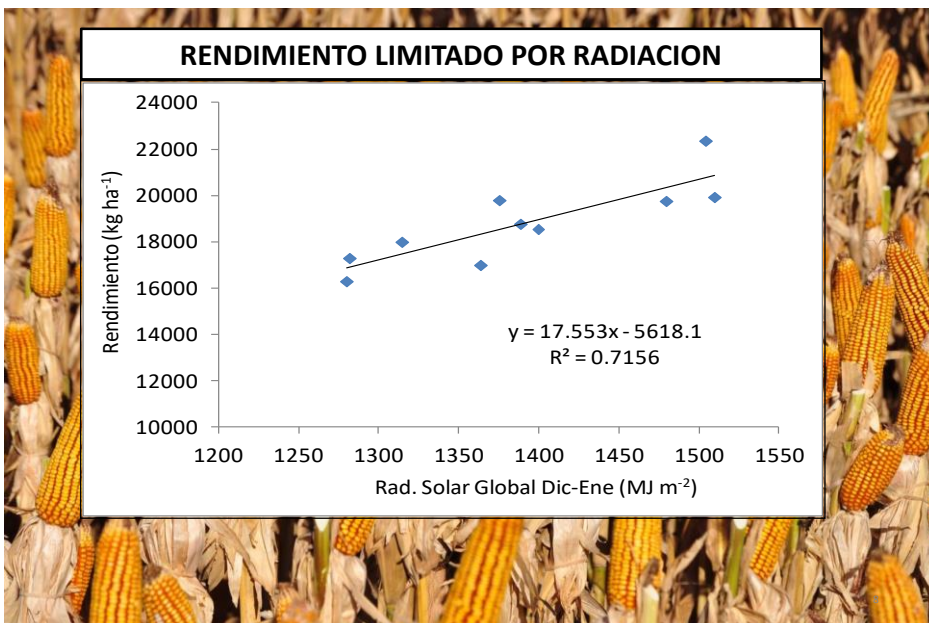
Espósito *et al* (2015)



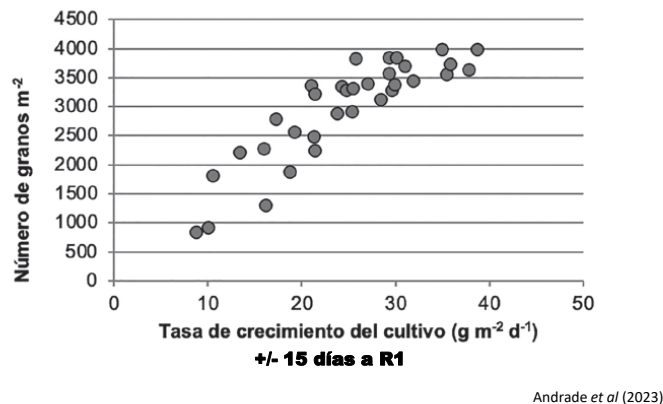
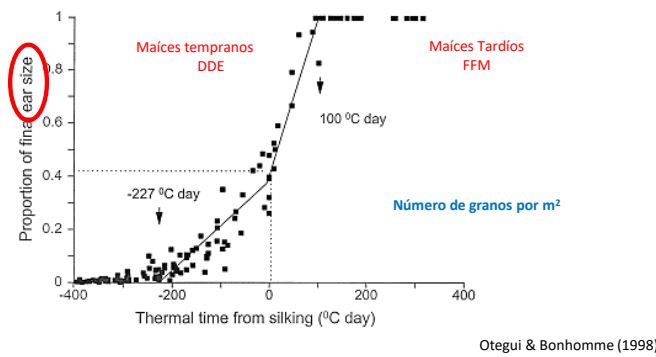
## Ensayos de rendimiento potencial

| Campaña         | Agua total | Riego      | Rto          | EUA          |
|-----------------|------------|------------|--------------|--------------|
| 2005/06         | 831        | 345        | 19800        | 23.83        |
| 2006/07         | 867        | 60         | 18000        | 20.76        |
| 2007/08         | 942        | 200        | 16300        | 17.30        |
| 2008/09         | 760        | 300        | 16500        | 21.71        |
| 2009/10         | 695        | 270        | 17300        | 24.89        |
| 2010/11         | 1009       | 405        | 22365        | 22.17        |
| 2011/12         | 836        | 360        | 19933        | 23.84        |
| 2012/13         | 979        | 300        | 19763        | 20.19        |
| 2014/15         | 886        | 151        | 17837        | 20.13        |
| 2015/16         | 895        | 90         | 18756        | 20.96        |
| 2016/17         | 941        | 427        | 19236        | 20.44        |
| 2019/20         | 758        | 270        | 19500        | 25.73        |
| <b>Promedio</b> | <b>867</b> | <b>265</b> | <b>18774</b> | <b>21.65</b> |





PERIODO CRITICO PARA DETERMINAR  
RTO EN MAIZ



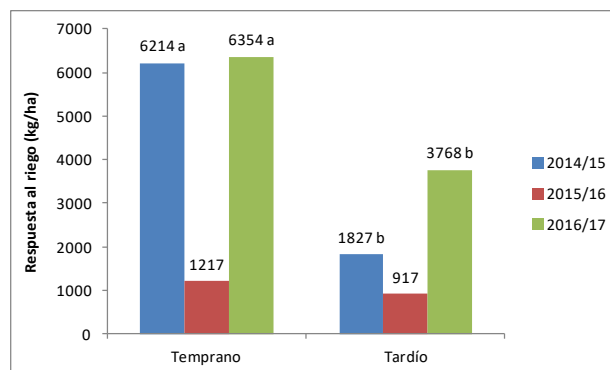


## RESPUESTA AL RIEGO



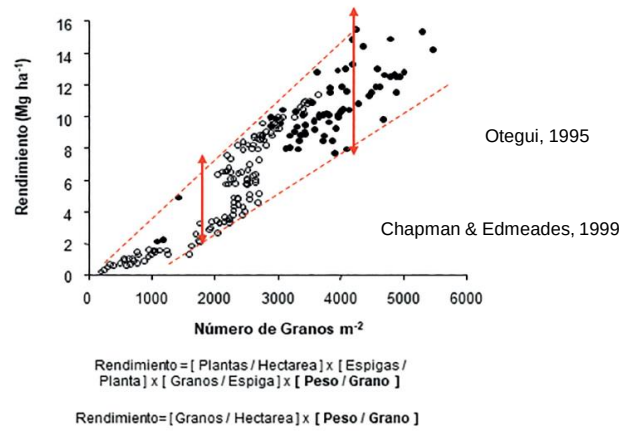
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### Respuesta al riego por fecha de siembra

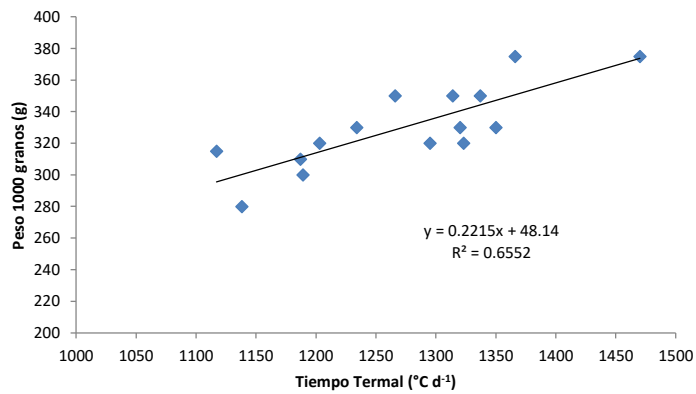


12

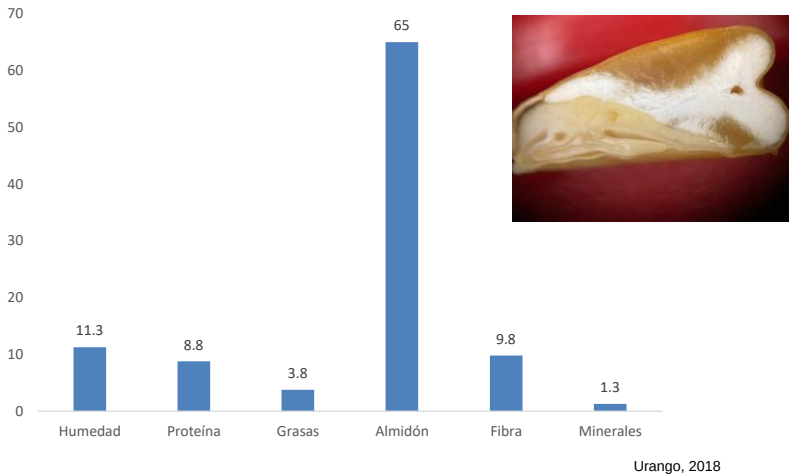
### Componentes del rendimiento



### Peso del grano de maíz según ciclo de crecimiento

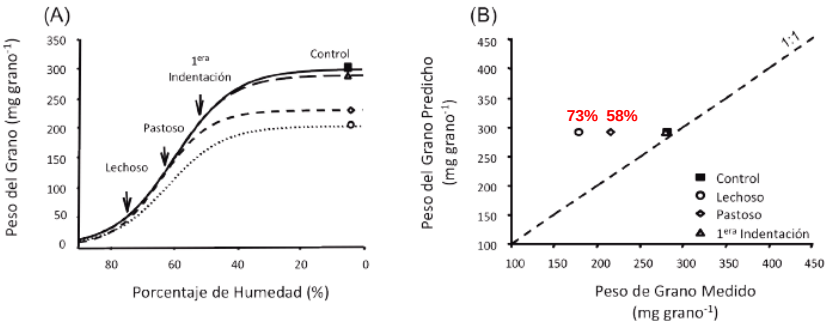


Composición del grano de maíz



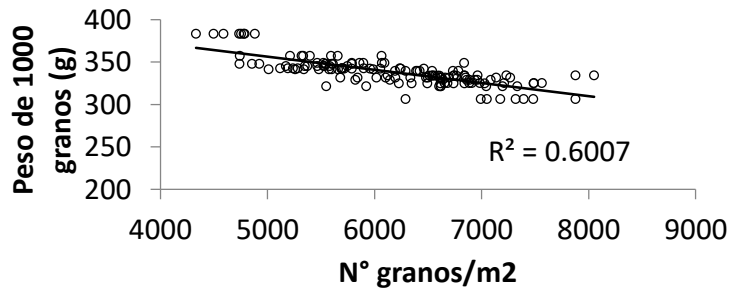
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EFFECTO DEL ESTRÉS SOBRE EL PESO DEL GRANO



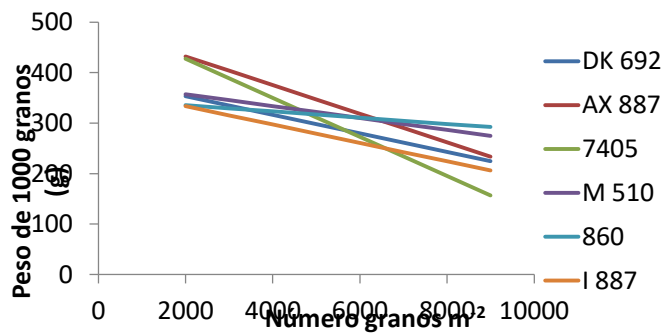
Borrás y Westgate, 2006

## Relación Fuente/Destino



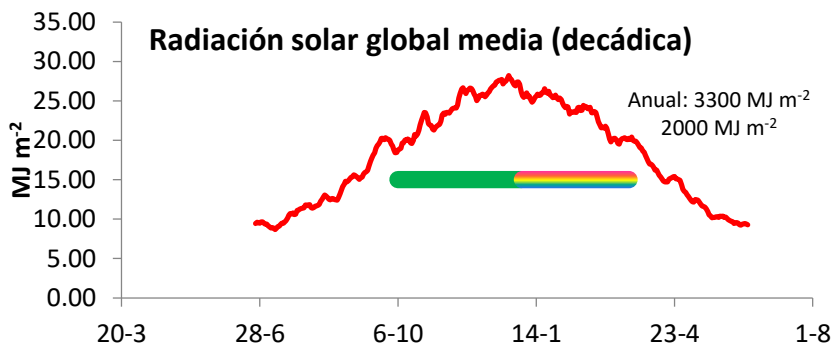
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## Relación Fuente/Destino

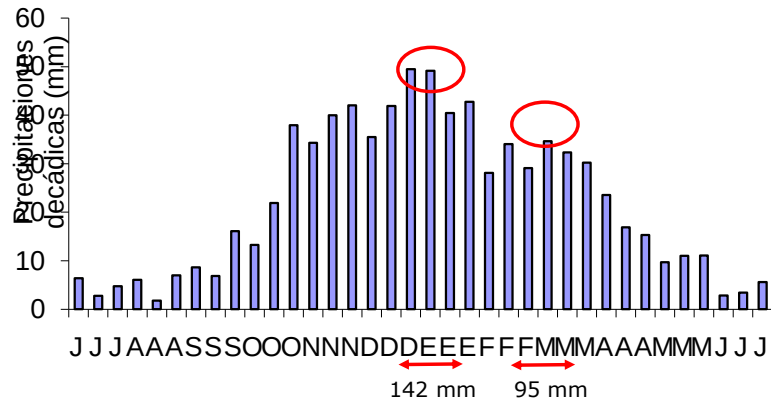


Fecha de siembra

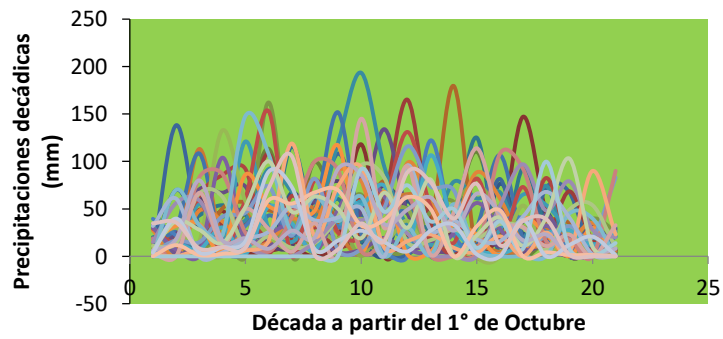
Fecha de siembra

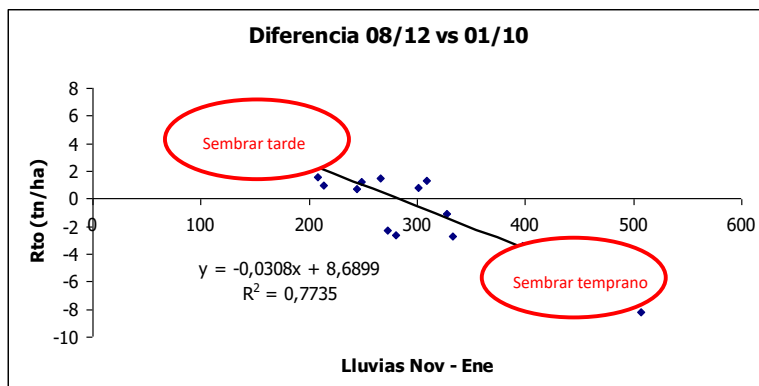


## Distribución de precipitaciones



## Precipitaciones decádicas Octubre - Abril





Por debajo de los 282 mm de lluvias entre Noviembre y Enero (+/- 100 mm por mes) es más conveniente la siembra del 08/12 que la del 01/10

## Rendimiento según fecha de siembra

|                                  | 01/10 | 08/12 |
|----------------------------------|-------|-------|
| <b>Años secos</b>                | 5.2   | 6.9   |
| 96/97 00/01<br>01/02 03/04 05/06 |       |       |
| <b>Años húmedos</b>              | 11.5  | 8.1   |
| 97/98 99/00<br>02/03 04/05 06/07 |       |       |

# CREA Oeste

## MAÍZ 1° vs MAÍZ TARDÍO (8 años)

- En promedio, el Maíz Tardío estaría un 9% por debajo del rinde del Maíz 1ª (tener en cuenta que son diferentes ambientes explorados).
- Pero los rindes potenciales del Tardío un 24% mas abajo.

| Campaña     | MAÍZ 1°      |               |            | MAÍZ TARDÍO  |               |            |
|-------------|--------------|---------------|------------|--------------|---------------|------------|
|             | PROM.        | MAX.          | CV%        | PROM.        | MAX.          | CV%        |
| 2007-08     | 8,360        | 15,020        | 27%        | 9,164        | 12,500        | 23%        |
| 2008-09     | 7,278        | 14,530        | 31%        | 7,104        | 11,905        | 46%        |
| 2009-10     | 9,528        | 16,902        | 21%        | 7,322        | 11,250        | 20%        |
| 2010-11     | 8,063        | 14,765        | 30%        | 7,561        | 11,870        | 26%        |
| 2011-12     | 6,166        | 12,812        | 36%        | 8,023        | 11,552        | 21%        |
| 2012-13     | 8,686        | 16,364        | 25%        | 6,733        | 12,570        | 36%        |
| 2013-14     | 7,488        | 13,069        | 34%        | 6,836        | 12,920        | 35%        |
| 2014-15     | 9,792        | 15,411        | 19%        | 7,433        | 12,212        | 27%        |
| <b>PROM</b> | <b>8,054</b> | <b>16,902</b> | <b>31%</b> | <b>7,367</b> | <b>12,920</b> | <b>30%</b> |

Niña  
Niña  
Niño  
Niña  
Niña  
Neutro  
Niño

(Granieri y Graviña, 2015)

bom.gov.au/climate/enso/outlook/

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**ENSO Outlook**  
An alert system for the El Niño–Southern Oscillation

Issued 1 September 2020 Next issue 15 September 2020

Outlook Criteria ENSO Outlook history About ENSO and the Outlook

**Climate**

Outlooks & drivers

Rainfall & temperature outlooks

Outlook video

Climate driver update

Streamflow outlooks

Tropical monitoring

Northern rainfall onset

Tropical cyclone outlook

Climate model summary

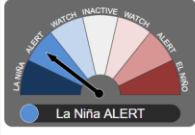
**La Niña ALERT continues**

The La Niña ALERT remains, meaning the chance of La Niña forming in the coming season is around 70%—roughly three times the normal likelihood.

Although key indicators of the El Niño–Southern Oscillation are generally within neutral bounds, there continues to be signs consistent with the development of La Niña. There has been further cooling in the central tropical Pacific Ocean over the past fortnight while the Southern Oscillation Index (SOI) has been at La Niña values for the last few days.

The majority of climate models indicate further cooling is likely, with six of eight international models surveyed by the Bureau suggesting sea surface temperatures will exceed La Niña thresholds by the end of southern hemisphere spring.

Bureau climatologists will continue to closely monitor model outlooks and conditions in the tropical Pacific for further signs of La Niña development.



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## ENSO Outlook

An alert system for the El Niño–Southern Oscillation

Issued: 12 October 2021 Next issue: 26 October 2021

Outlook Criteria **ENSO Outlook history** About ENSO and the Outlook

### La Niña ALERT activated



The ENSO Outlook has been raised to La Niña ALERT. This means that the El Niño–Southern Oscillation is currently neutral, but the chance of La Niña forming in the coming months has increased to around 70%. This is roughly three times the normal likelihood of an event forming in any year.

This status change follows continued cooling in the tropical Pacific Ocean towards La Niña thresholds, and an increase in trade wind strength during September. Climate models indicate further cooling is likely, with the majority of models meeting La Niña criteria from November.

A La Niña ALERT is not a guarantee that La Niña will occur, rather it is an indication that most of the typical precursors of an event are in place. La Niña events increase the chance of above average spring and summer rainfall in northern and eastern Australia.

Bureau climatologists will continue to closely monitor model outlooks and conditions in the tropical Pacific for further signs of La Niña development.

Details: [Climate Driver Update](#)

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## ENSO Outlook

An alert system for the El Niño–Southern Oscillation

Issued: 19 July 2022 Next issue: 2 August 2022

Outlook Criteria **ENSO Outlook history** About ENSO and the Outlook

### La Niña WATCH continues



The ENSO Outlook continues at La Niña WATCH. This is due to the persistence of some La Niña-like signals in the atmosphere, and a restrengthening of ocean indicators of La Niña in some model outlooks. La Niña WATCH means there is around a 50% chance of La Niña forming later in 2022. This is approximately double the normal likelihood.

Most ENSO indicators are currently at neutral levels. Sea surface temperatures of the tropical Pacific Ocean are cooler than average but within ENSO-neutral levels. Though equatorial temperatures below the surface are warmer in the eastern Pacific, they are close to average when averaged over the basin. However, some atmospheric indicators continue to show a La Niña-like signal, including the Southern Oscillation Index (SOI).

Four of seven models indicate La Niña could return in the southern spring with the remainder maintaining ENSO-neutral until the end of 2022.

Bureau climatologists will continue to closely monitor conditions in the tropical Pacific as well as model outlooks for signs of La Niña re-emergence.

bom.gov.au/climate/enso/outlook/

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## ENSO Outlook

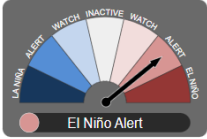
An alert system for the El Niño–Southern Oscillation

Issued 18 July 2023 Next issue 1 August 2023

ENSO Outlook Criteria About ENSO and the Outlook

The status of the ENSO Outlook is determined using set [Criteria](#) and expert analysis by climatologists at the Bureau of Meteorology.

### El Niño Alert continues



The ENSO Outlook is currently at El Niño Alert, having met criteria 1, 3 and 4 – see below. When El Niño Alert criteria have been met in the past, an El Niño event has developed around 70% of the time.

Details: [Climate Driver Update](#)

#### El Niño Alert

The chance of an El Niño developing in the coming season has increased. When these criteria have been met in the past, an El Niño event has developed around 70% of the time.

bom.gov.au/climate/enso/outlook/

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## ENSO Outlook

An alert system for the El Niño–Southern Oscillation

Issued 23 July 2024 Next issue 6 August 2024

ENSO Outlook Criteria About ENSO and the Outlook

The status of the ENSO Outlook is determined using set [Criteria](#) and expert analysis by climatologists at the Bureau of Meteorology.

### ENSO is neutral; potential La Niña development delayed



The ENSO Outlook is currently at 'La Niña Watch', meaning there are some signs that a La Niña may form in the Pacific Ocean later in 2024. A La Niña Watch does not guarantee that a La Niña will develop.

The La Niña Watch is based on climate model forecasts and current atmospheric and oceanic conditions in the Pacific. Atmospheric and oceanic indicators are currently within ENSO-neutral thresholds.

While ENSO is likely to remain neutral until at least early spring, from October, 4 of 7 climate models suggest the possibility of SSTs cooling to La Niña levels (below  $-0.8^{\circ}\text{C}$ ). The remaining models maintain ENSO-neutral conditions throughout the forecast period.

Details: [Climate Driver Update](#)

## INTRODUCCION

Variación de la fecha de siembra intralote



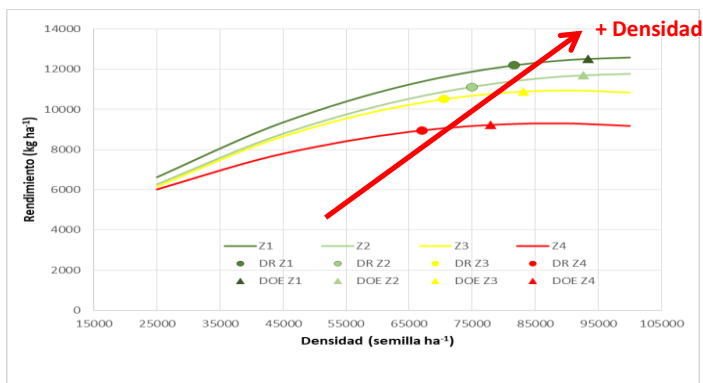
Evaluar el impacto económico de modificar la fecha de siembra entre ambientes presentes dentro de lotes comerciales de producción

Cegarra (2019)

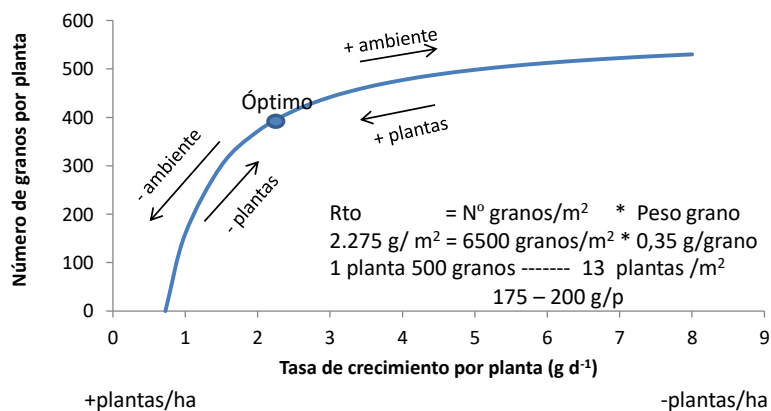


## Densidad de siembra

## Manejo densidad variable en maíz



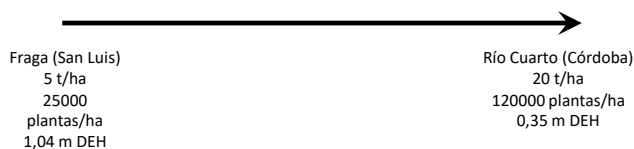
## Cálculo de la densidad óptima



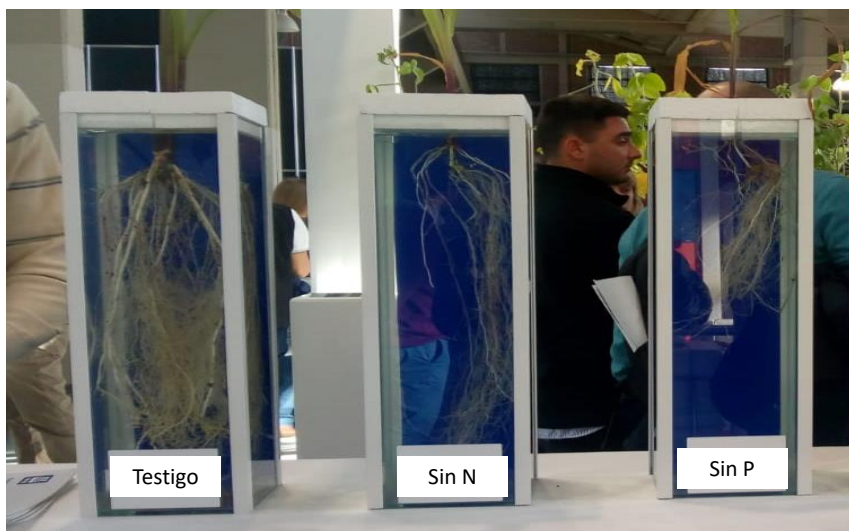
## Estructura del cultivo (DEH) 120.000 plantas/ha

| Año     | Tratamientos<br>DEH | Rendimiento<br>(kg ha <sup>-1</sup> ) | Nº granos m <sup>-2</sup> | Peso 1000<br>granos (g) |
|---------|---------------------|---------------------------------------|---------------------------|-------------------------|
| 2010/11 | 0,35 m              | 22 157 a                              | 6 638 a                   | 334 a                   |
|         | 0,52 m              | 21 055 b                              | 6 424 b                   | 329 b                   |
| 2011/12 | 0,35 m              | 16 683 a                              | 6 129 a                   | 274 a                   |
|         | 0,52 m              | 16 837 a                              | 5 879 a                   | 287 a                   |
| 2012/13 | 0,35 m              | 19 763 a                              | 6 867 a                   | 287 a                   |
|         | 0,52 m              | 18 485 b                              | 6 595 b                   | 282 b                   |
| 2014/15 | 0,35 m              | 17 706 a                              | 5 925 a                   | 299 a                   |
|         | 0,52 m              | 15 896 b                              | 5 578 b                   | 287 b                   |
| 2015/16 | 0,35 m              | 18 756 a                              | 5 520 a                   | 340 b                   |
|         | 0,52 m              | 14 276 b                              | 4 020 b                   | 363 a                   |

## Interacción Densidad x DEH

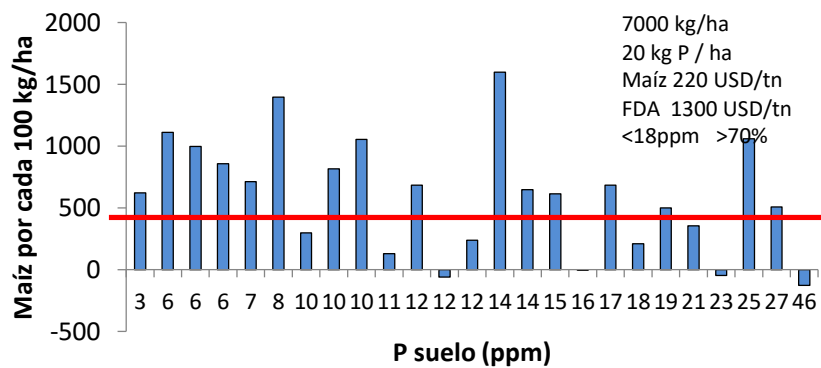


## Manejo de la Nutrición

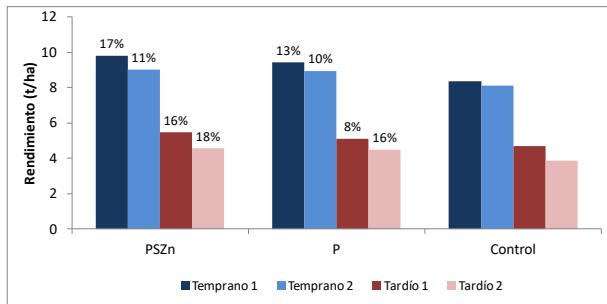




## Respuesta al P en maíz



## Respuesta a P, fecha de siembra y condición hídrica



| Ensayos    | MO (%) | N-NO3 (ppm) | P (ppm) | S-SO4 (ppm) | Zn (ppm) |
|------------|--------|-------------|---------|-------------|----------|
| Temprano 1 | 1,12   | 22,92       | 6,7     | 7,15        | 0,52     |
| Temprano 2 | 1,05   | 22,92       | 7,4     | 8,20        | 0,45     |
| Tardío 1   | 1,15   | 15,01       | 8,8     | 10,20       | 0,84     |
| Tardío 2   | 1,50   | 20,46       | 8,1     | 8,43        | 0,68     |

Peq = 2 kg/ppm

Pc = 18 ppm

Dosis =  $(18 - 6,7) * 2 = 22,6$  kg P / ha

## Fuente de P

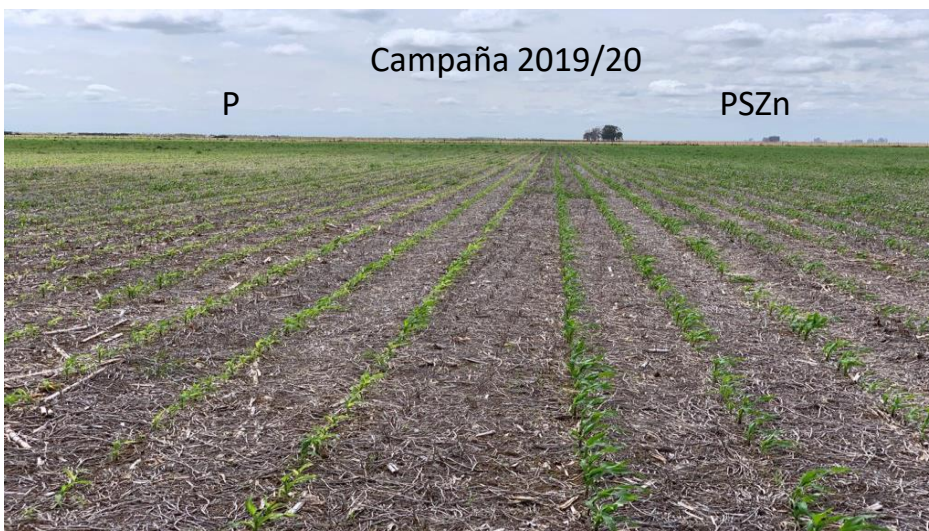
| Profundidad | P (P- Bray I) ppm | Zn (ppm) | MO (%) | pH   |
|-------------|-------------------|----------|--------|------|
| 0 - 20      | 15                | 0.65     | 1,56   | 6,12 |
| 20 - 40     | 6,55              |          | 1      | 6,59 |

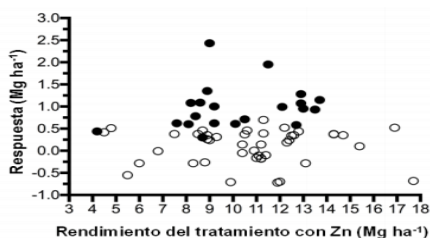
NP



NPSZn



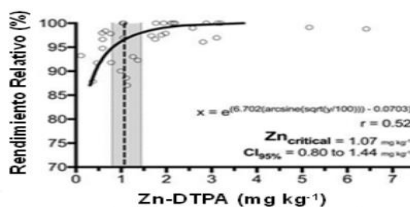




La respuesta al Zn “**NO**”  
depende del rendimiento  
del maíz

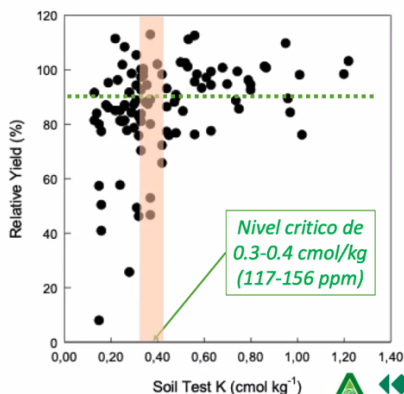
La respuesta al Zn “**SOLO**”  
depende de la  
disponibilidad del suelo

Barbieri *et al* (2017)



### K en Uruguay Calibración de análisis de K intercambiable

Fuente: Barbazán et al. (2017)



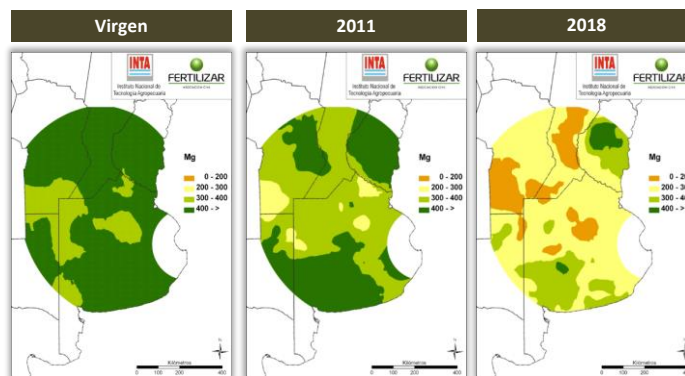
1 meq/100 g = 1 cmol/kg = 390 ppm



INTERNATIONAL  
PLANT NUTRITION  
INSTITUTE



MO  
pH  
Ca<sub>i</sub>  
**Mg<sub>i</sub>**  
K<sub>i</sub>  
Ca<sub>i</sub>, Mg<sub>i</sub>  
K<sub>i</sub>  
K<sub>T</sub>  
K<sub>T</sub> / K<sub>i</sub>



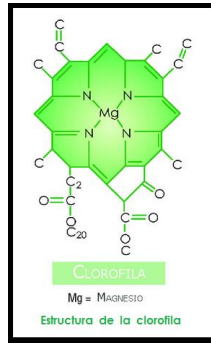
## Condiciones nutricionales nuevas en Córdoba

| n: 35 análisis | Promedio | Desvío | Saturación | Casos de deficiencia |      |
|----------------|----------|--------|------------|----------------------|------|
| Ca (cmol/kg)   | 6.39     | 1.47   | 52.5%      | 4.62                 | 4.23 |
| Mg (cmol/kg)   | 1.96     | 0.52   | 16.1%      | 1.31                 | 1.14 |
| K (cmol/kg)    | 1.54     | 0.49   | 12.6%      | 0.84                 | 0.94 |
| Na (cmol/kg)   | 0.42     | 0.38   | 3.5%       | 0.11                 | 0.11 |
| CIC (cmol/kg)  | 12.17    | 2.75   |            | 11.8                 | 9.55 |

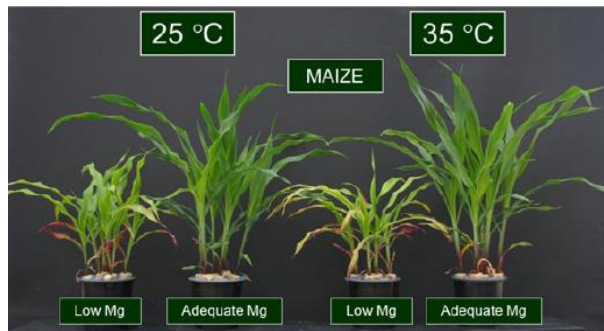
  

|                   | Promedio | Desvío |                      |
|-------------------|----------|--------|----------------------|
| Mg/K (2.5-15)     | 1.28     | 0.36   | 1° Deficiencia de Mg |
| (Ca+Mg)/K (10-40) | 6.45     | 5.69   | 2° Deficiencia de Ca |
| Ca/K (5-25)       | 5.17     | 5.65   |                      |
| Ca/Mg (2-5)       | 4.18     | 4.90   |                      |

## Deficiencia de Mg en Maíz



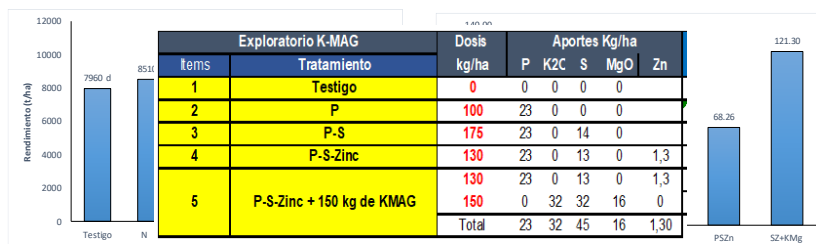
## Deficiencia de Mg en Maíz



Mayor actividad de enzimas ROS (reactivas al metabolismo del Oxígeno - superóxido dismutasa, catalasa y glutatión peroxidasa) en plantas con deficiencia sometidas al estrés térmico.

Mengutay *et al* (2013)

## Ensayo arrancadores (20/21)



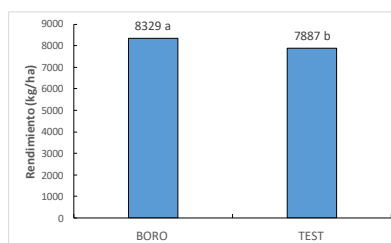
| Prof | MO (%) | P (ppm) | S (ppm) | Cu (Cmol/kg) | Mg (Cmol/kg) | B (ppm) | Zn (ppm) |
|------|--------|---------|---------|--------------|--------------|---------|----------|
| 0-20 | 1,71   | 7,4     | 6,3     | 4,57         | 1,12         | 0,67    | 0,82     |

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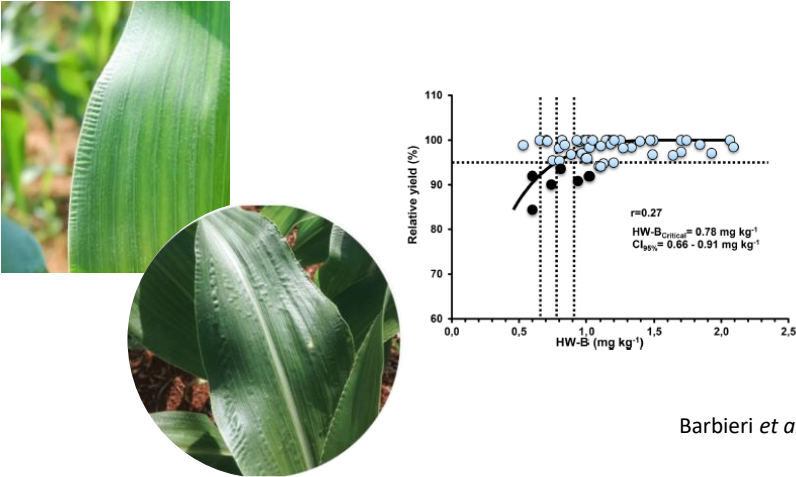
## Ensayos de fertilización con Boro en maíz 2018/19 – 2020/21 (2) – 2021/22

2018/19: B (1.05 ppm)  
2020/21: B (0.75 ppm)  
2020/21: B (0.81 ppm)  
2021/22: B (0.76 ppm)

Respuesta promedio  
442 kg/ha



El Boro es un nutriente de alta movilidad en el suelo y rendimiento dependiente.  
Tener presente que si se pasa de dosis es fitotóxico



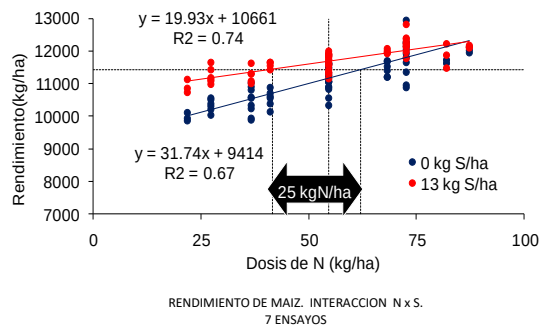
Barbieri *et al* (2024)

60

| Muestra Id 22000103 |              | Etapa Vegetativa: V5 Fifth Leaf |              |              |              |              |              |          |          |               |            | Parte de la planta: Leaf below whorl (10+) |              |                      |               |           |  |  |  |  |  |
|---------------------|--------------|---------------------------------|--------------|--------------|--------------|--------------|--------------|----------|----------|---------------|------------|--------------------------------------------|--------------|----------------------|---------------|-----------|--|--|--|--|--|
|                     | Nitrógeno %  | Azufre %                        | Fósforo %    | Potasio %    | Magnesio %   | Calcio %     | Sodio %      | Boro ppm | Zinc ppm | Manganeso ppm | Hierro ppm | Cobre ppm                                  | Aluminio ppm | Nitrógeno nitalo ppm | Molibdeno ppm | Cloro ppm |  |  |  |  |  |
| Analisis            | 4.54         | 0.27                            | 0.37         | 1.81         | 0.39         | 0.56         | 0.02         | 7        | 23       | 50            | 190        | 14                                         | 127          |                      |               |           |  |  |  |  |  |
| Rango Normal        | 3.00<br>4.00 | 0.15<br>0.40                    | 0.30<br>0.50 | 2.00<br>3.00 | 0.15<br>0.60 | 0.25<br>0.80 | 0.00<br>0.03 | 5<br>26  | 20<br>71 | 20<br>151     | 30<br>251  | 5<br>26                                    | 5<br>301     |                      |               |           |  |  |  |  |  |
|                     | N/S          | N/K                             | P/S          | P/Zn         | K/Mg         | K/Mn         | Ca/B         | Fe/Mn    | Ca/K     | Ca/Mg         |            |                                            |              |                      |               |           |  |  |  |  |  |
| Rel Actual          | 16.8         | 2.5                             | 1.4          | 160.9        | 4.6          | 362.0        | 800.0        | 3.8      | 0.3      | 1.4           |            |                                            |              |                      |               |           |  |  |  |  |  |
| Rel Esperada        | 12.7         | 1.4                             | 1.5          | 87.9         | 6.7          | 292.4        | 338.8        | 1.6      | 0.2      | 1.4           |            |                                            |              |                      |               |           |  |  |  |  |  |
| Muy Alto            |              |                                 |              |              |              |              |              |          |          |               |            |                                            |              |                      |               |           |  |  |  |  |  |
| Alto                |              |                                 |              |              |              |              |              |          |          |               |            |                                            |              |                      |               |           |  |  |  |  |  |
| Suficiente          |              |                                 |              |              |              |              |              |          |          |               |            |                                            |              |                      |               |           |  |  |  |  |  |
| Bajo                |              |                                 |              |              |              |              |              |          |          |               |            |                                            |              |                      |               |           |  |  |  |  |  |
| Deficiente          |              |                                 |              |              |              |              |              |          |          |               |            |                                            |              |                      |               |           |  |  |  |  |  |
|                     | N            | S                               | P            | K            | Mg           | Ca           | Na           | B        | Zn       | Mn            | Fe         | Cu                                         | Al           | NO <sub>3</sub> -N   | Mo            | Cl        |  |  |  |  |  |

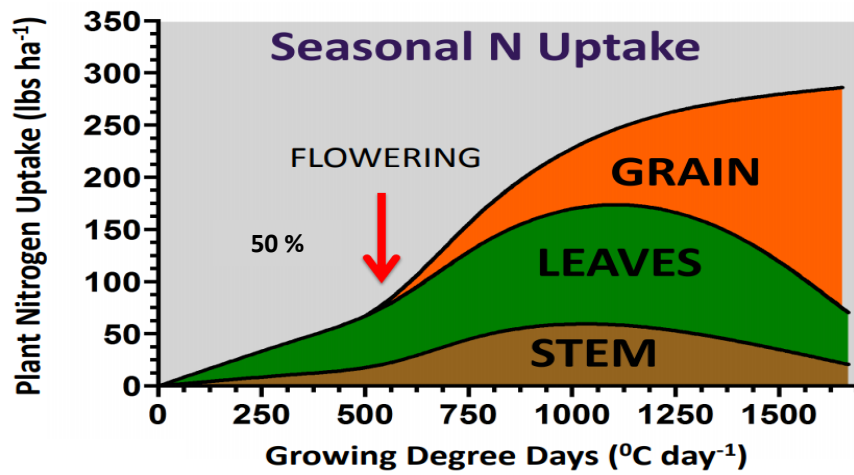
61

## Interaccion N x S en maíz



## Manejo del Nitrógeno

### Momento y forma



Balboa & Ciampitti (2017)

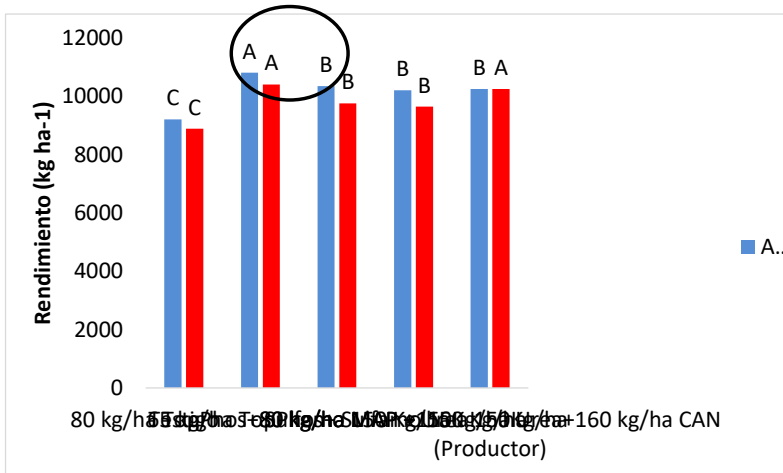
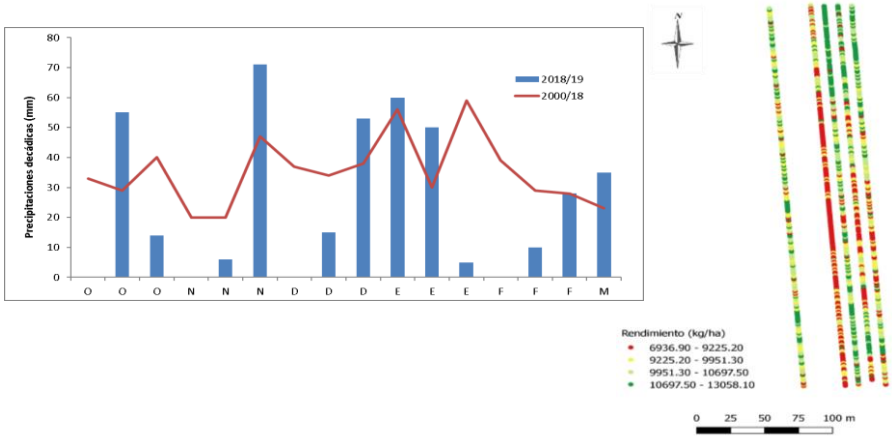


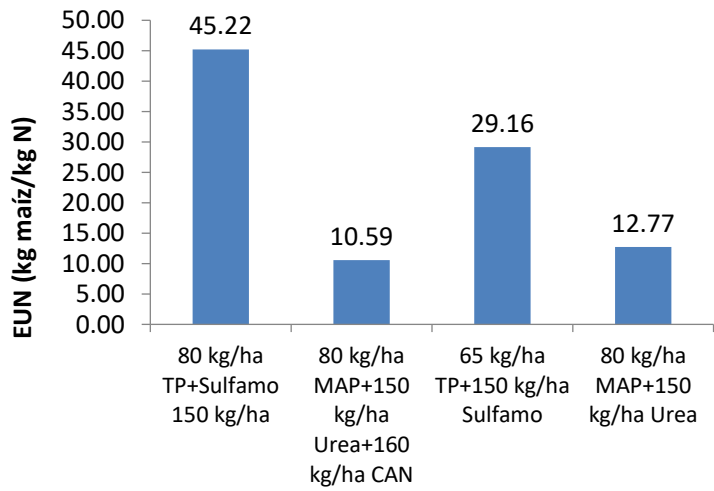
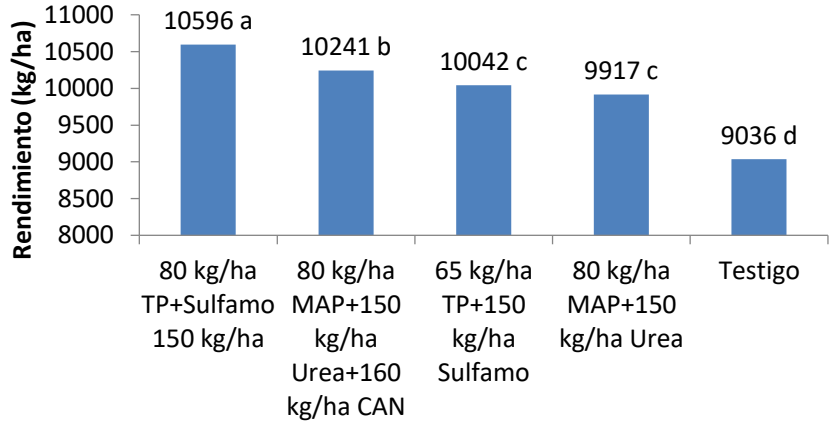
**RIO CUARTO, MARZO**



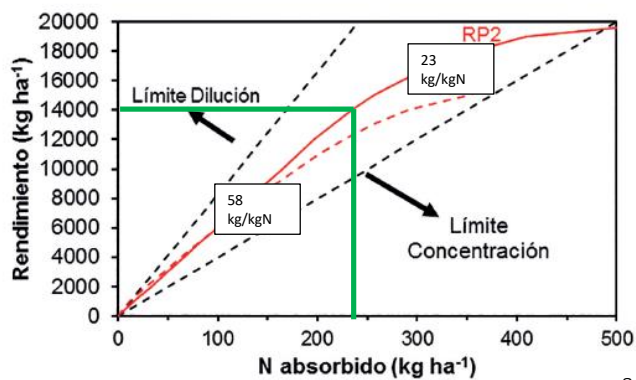
## Características de suelo Chaján (2018/19)

| ZM | Prof. | P ppm | MO % | N-<br>NO3<br>ppm | S-SO4<br>ppm | pH  | Zn<br>ppm |
|----|-------|-------|------|------------------|--------------|-----|-----------|
| AP | 0-20  | 14,7  | 1,43 | 33,5             | 7,50         | 5,8 | 0,50      |
| BP | 0-20  | 22,9  | 1,45 | 19,6             | 13,00        | 5,7 | 0,50      |





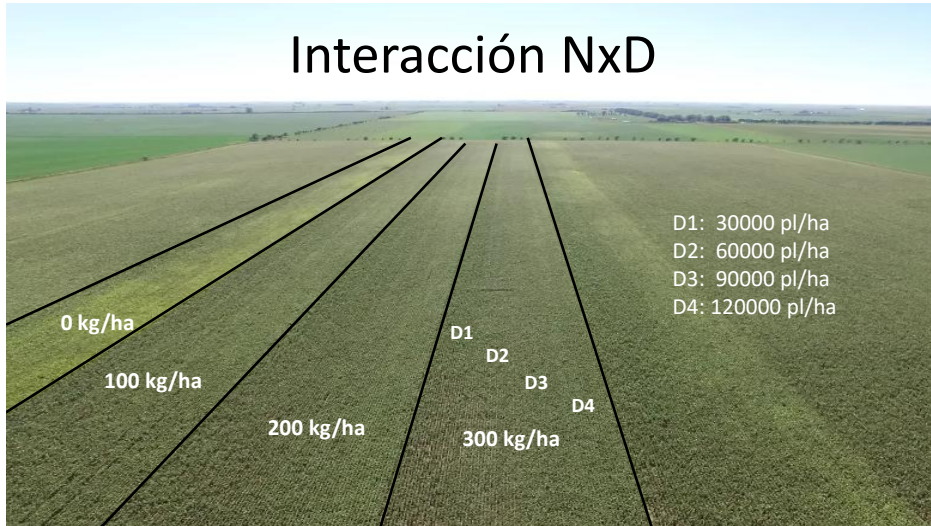
## Eficiencia fisiológica de N

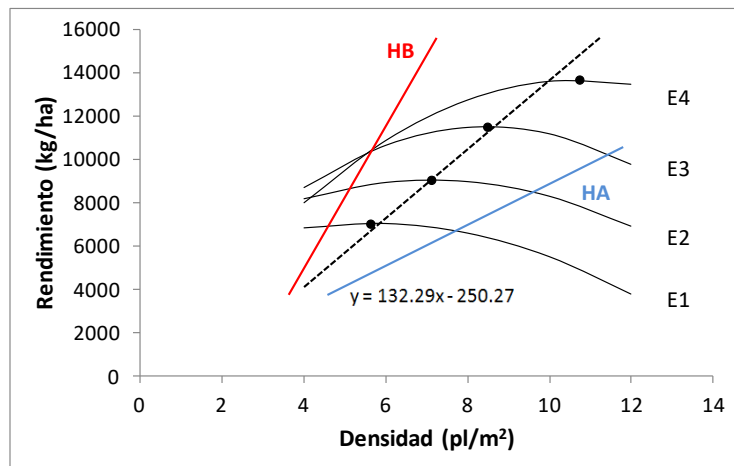
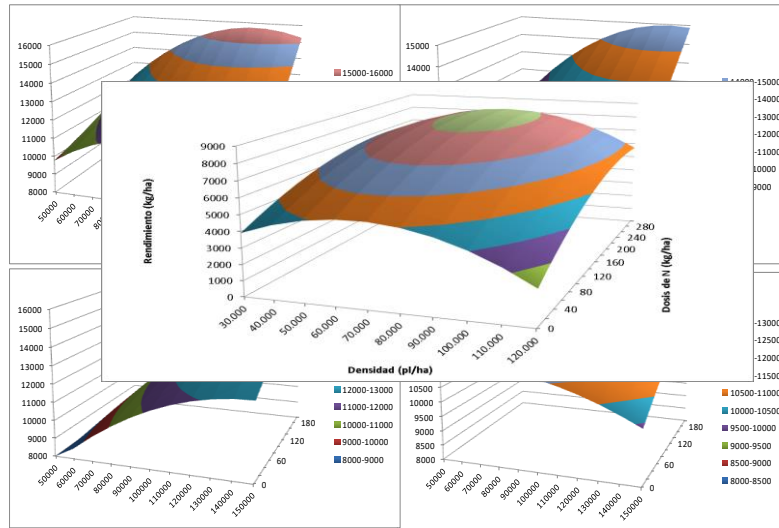


Setiyono et al (2010).

## Agenda de fertilización con N

|         |           |        |
|---------|-----------|--------|
| Siembra | 50 kg/ha  | 12,5 % |
| V5      | 180 kg/ha | 45,0 % |
| V10     | 120 kg/ha | 30,0 % |
| R1      | 50 kg/ha  | 12,5 % |



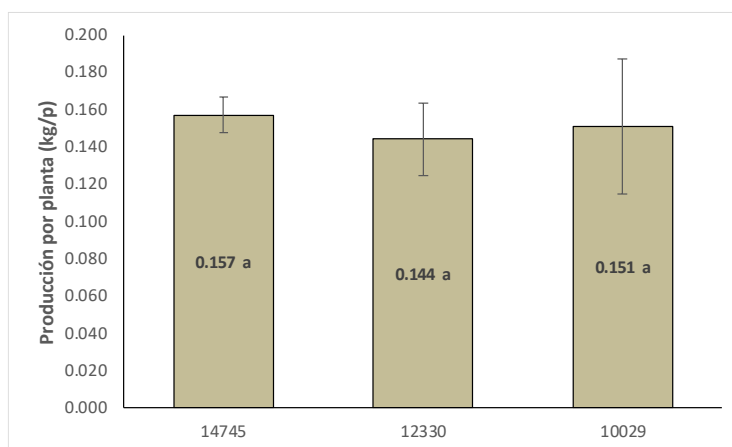


| Hibrido              | 2013/14 | 2013/14 | 2014/15 | 2014/15 | 2014/15 | 2014/15 | 2014/15 | 2015/16 | 2015/16 | 2015/16 | 2015/16 | 2015/16 | 2015/16 | 2015/16 | 2015/16 | 2016/17 | 2016/17 | Media | SD   |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------|------|
| LT 722 VT3PRO        |         |         |         |         |         |         |         | 147     | 153     | 142     |         |         |         |         |         |         |         | 147   | 5,4  |
| LT 719 VT3PRO        |         |         |         |         |         |         |         | 140     |         |         | 192     |         |         |         |         |         |         | 166   | 37,2 |
| SYN 840<br>VIPTERA 3 | 133     | 139     | 107     | 87      | 115     |         |         | 133     | 126     | 124     |         | 160     |         |         |         |         |         | 125   | 20,7 |
| DOW 505 PW           |         |         | 175     | 140     |         | 130     |         |         |         |         | 184     |         |         |         |         |         |         | 157   | 26,4 |
| SPS 2721 TDTG        |         |         |         |         |         |         |         | 118     | 117     | 126     |         |         |         |         |         |         |         | 120   | 4,7  |
| KWS 4321<br>MGRR     |         | 120     |         | 113     | 116     | 138     | 147     | 113     | 108     | 109     |         |         |         |         |         |         |         | 120   | 14,4 |
| Arvaes 2458<br>HXRR  |         |         |         |         | 108     | 144     |         | 116     | 118     | 117     | 100     |         |         |         |         |         |         | 117   | 14,6 |
| Dow 510 HXRR         |         |         |         | 125     | 85      | 124     |         |         |         |         |         |         |         |         |         |         |         | 111   | 22,9 |
| DK 7010 VT3P         |         |         |         | 140     | 180     | 135     |         |         |         |         |         |         |         |         |         |         |         | 152   | 24,7 |
| KWS 3800<br>MGRR     |         | 123     | 160     | 145     | 99      | 116     | 117     |         |         |         |         |         | 118     | 140     | 122     | 111     |         | 126   | 17,8 |
| LT 626 VT3P          | 124     | 166     | 178     |         |         | 154     |         |         |         |         |         |         |         |         |         |         |         | 156   | 23,3 |
| LT 623 VT3P          | 158     | 132     | 116     |         | 126     | 94      |         |         |         |         |         |         |         |         |         |         |         | 125   | 23,5 |
| KM 4200              |         | 130     |         |         |         |         | 115     | 115     |         |         |         |         |         |         |         |         |         | 120   | 8,7  |
| KM 4500              |         | 150     |         |         |         |         | 135     |         |         |         |         |         | 162     | 163     | 140     | 160     |         | 152   | 12,0 |
| KM 1516              |         |         |         |         |         |         | 120     |         |         |         |         |         | 142     |         |         |         |         | 131   | 15,6 |
| DK 7310              |         |         |         |         |         |         |         |         |         |         |         |         | 122     | 144     |         |         |         | 133   | 15,6 |

Cerliani *et al.* (2018)

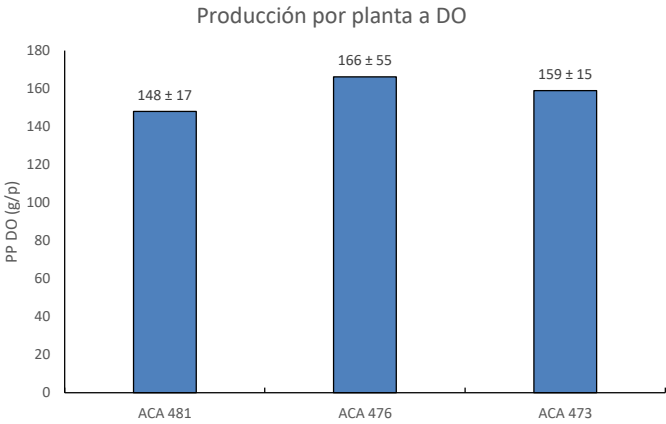
78

## Estabilidad en la producción por plantas según ambientes

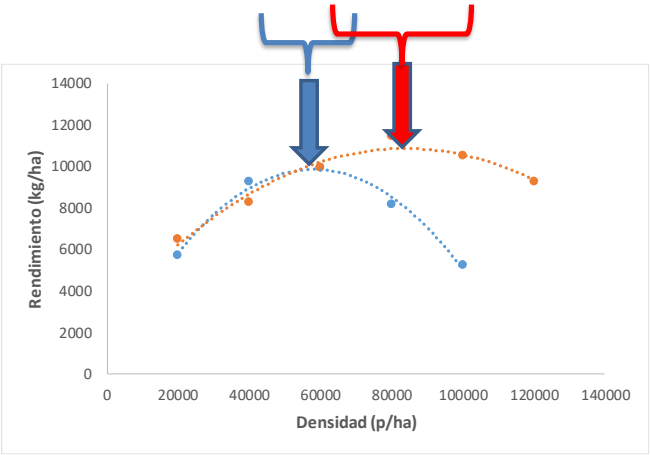


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# Producción por planta híbridos

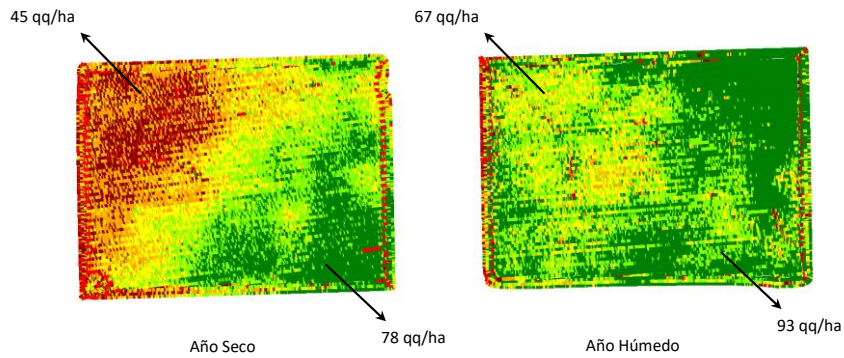


80



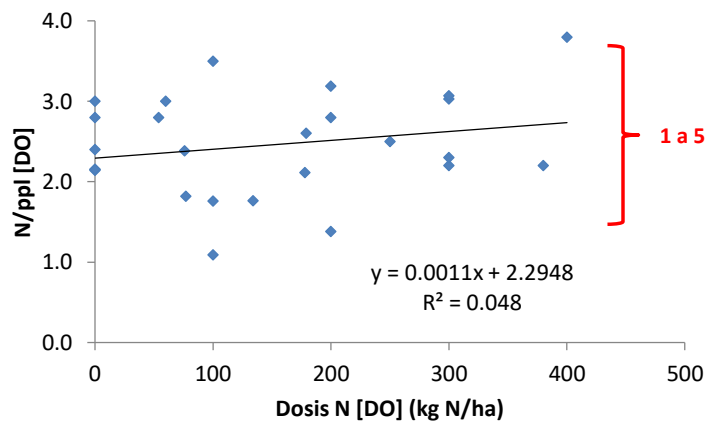
81

## Definir rendimientos “objetivo”



82

## Nitrógeno por planta a densidad óptima



83

# Oferta de N por planta en V<sub>6</sub> N-NO<sub>3</sub><sup>-</sup> perfil (0-60cm)

En general un mayor rendimiento potencial tiende a aumentar el NPP  
Existe un efecto híbrido sobre el NPP  
No se verifica efecto de la fecha de siembra del maíz

| Antecesor                  | NPP S+F (gN/pl) |
|----------------------------|-----------------|
| Vicia                      | 1 – 1,5         |
| Soja                       | 2 – 2,5         |
| Gramínea servicio temprana | 2,5 – 3         |
| Gramínea servicio tardía   | 3 – 3,5         |
| Trigo/soja                 | 3,5             |
| Trigo/Cebada de cosecha    | 3,5 – 4         |
| Maíz                       | 4 – 5           |

84

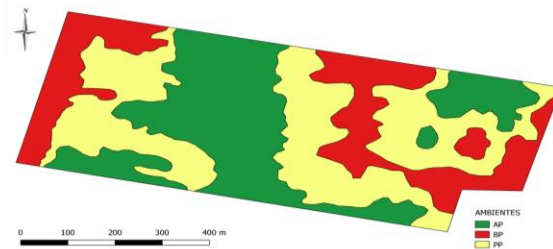
## Como haríamos el diagnóstico

| Rto   | D                           | N/Pl requerido<br>Antecesor soja | N/Pl Suelo V6<br>[0-60 cm) | N/Planta Total     |
|-------|-----------------------------|----------------------------------|----------------------------|--------------------|
| 12000 | 12000/0.16=<br>75000 pl/ha  | 3 x 7.5 =<br>22.5                | 90 kg/ha =<br>9 g/m²       | 22.5 – 9 =<br>13.5 |
| 17000 | 17000/0.16=<br>106250 pl/ha | 3.5 x 10.625 =<br>37.2           | 90 kg/ha =<br>9 g/m²       | 37.2 – 9 =<br>28.2 |

12000 kg/ha con 75000 pl/ha más 135 kg N/ha  
17000 kg/ha con 106250 pl/ha más 282 kg N/ha

85

## Modelos agronómicos



- Rendimiento Objetivo:

AP=9900 kg ha<sup>-1</sup>

PP= 9000 kg ha<sup>-1</sup>

BP= 8100 kg ha<sup>-1</sup>

- Híbrido:

PPP= 160 g pl<sup>-1</sup>

### DENSIDAD DE SIEMBRA

54169

60188

66206

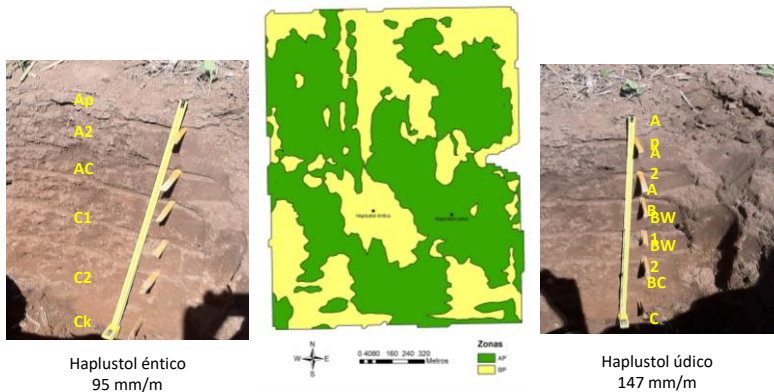
### DOSIS DE UREA

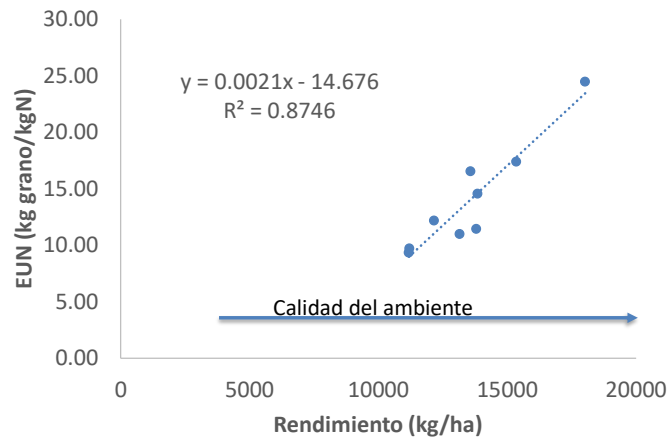
109

130

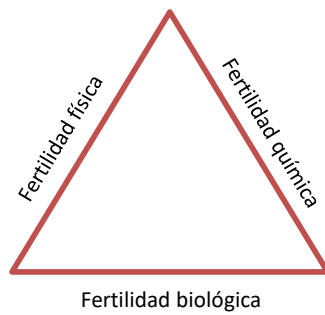
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## Variabilidad de suelos en el espacio





### Calidad del ambiente





**Muchas Gracias**

<https://www.youtube.com/user/ProdVegetalUNRCZeaU-UNRC>

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