# Strategies to minimize water used while maintaining grain yields in Uruguayan rice systems

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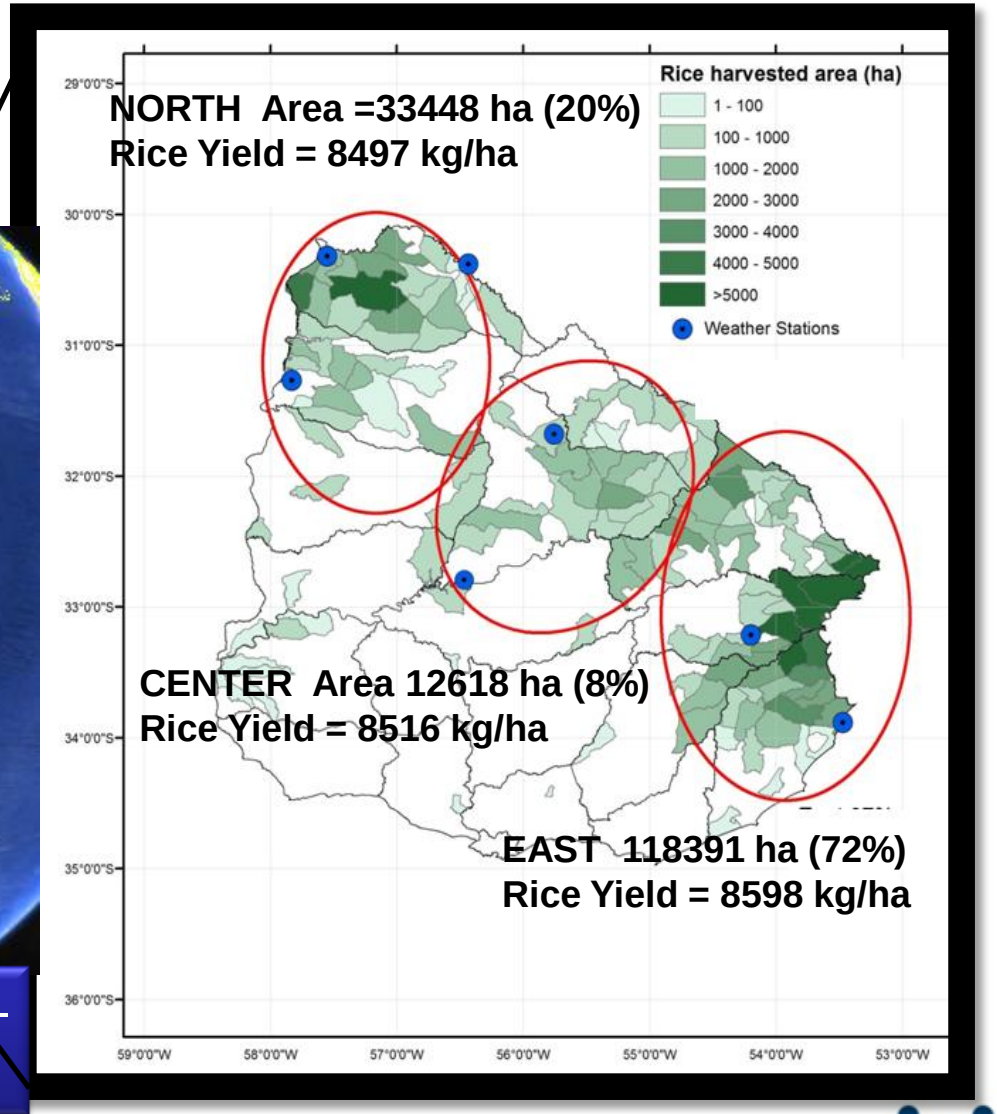
# Rice in Uruguay

**Area: 164.4 miles has**
**Production: 1.410 miles ton**
**Yield: 8571 kg /ha**




- More than 90% is exported – 7th in World export ranking

**Source: 2017. DIEA. MGAP**

# Irrigation Management in Rice

1. The crop is seeded on dry soil by drilling. (Sep-Nov) emergence usually with soil moisture
2. Flushing (1 or 2) maybe required if lack of rainfall before flooding.
3. Permanent flooding is established (tillering) 15-30 days after emergency- after first urea and herbicide -,
4. Flooding period ranges from 70-90 days.
5. Irrigation stops 20 days after flowering and drainage 3 weeks or just before harvest. Harvest is on dry soils.

Irrigation Water used : 12000 - 15000 $m^3$ per ha

Average Rainfall during crop season (Oct-March): 624mm

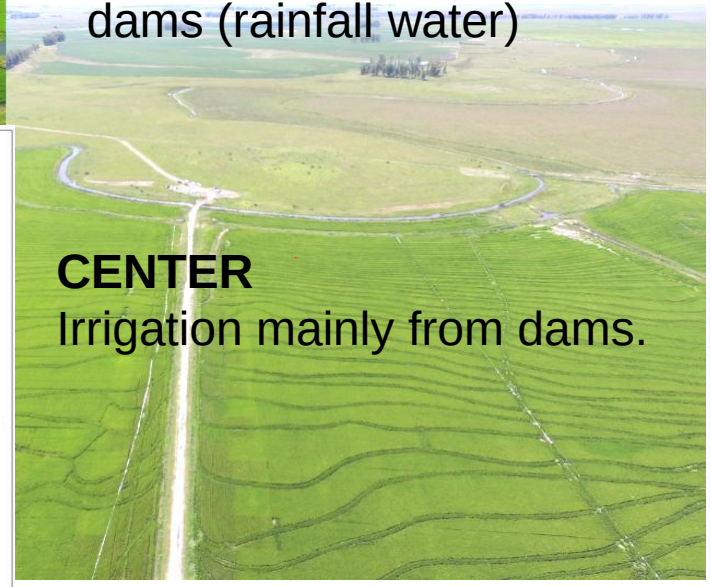
# RICE IN URUGUAY is 100 % Irrigated



Source: DIEA - ACA

# Rice irrigation in Uruguay is done mainly with water stored in dams 54%





**NORTH**
Higher slopes.
Irrigation mainly from dams (rainfall water)

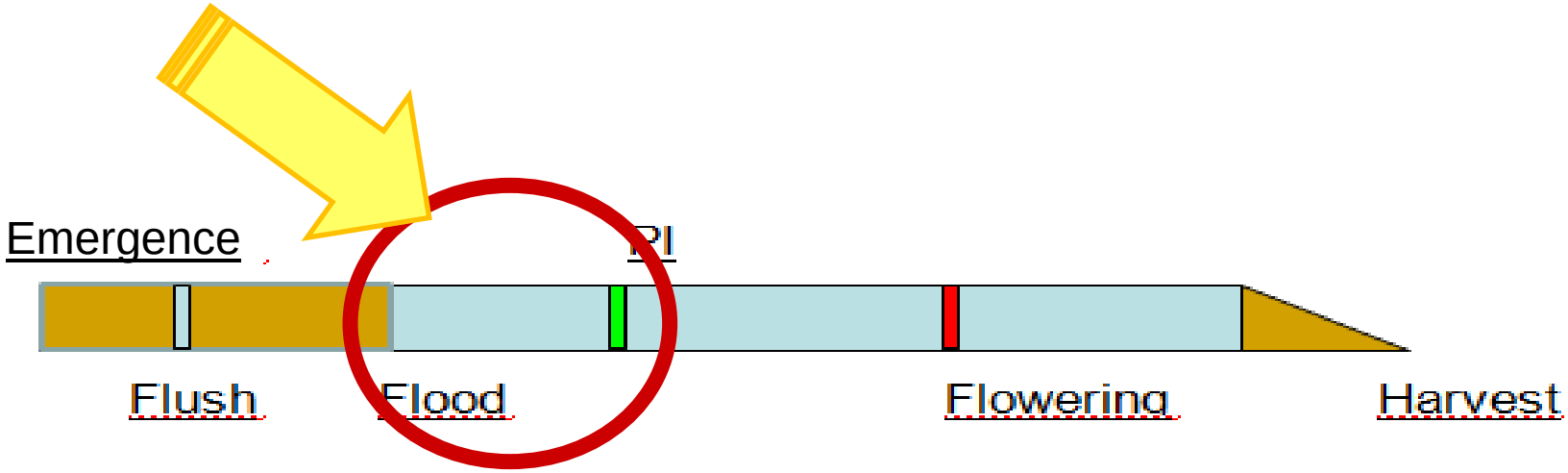
**CENTER**
Irrigation mainly from dams.

**EAST**
Flat
Irrigation mainly pumped from rivers

Source: MGAP – DIEA

# HYPOTHESIS

Previous research studies indicated that during **crop vegetative phase**, it would be possible to adjust the traditional water management, **reducing irrigation water used** without affecting grain yield, and therefore **increasing water productivity**




# OBJECTIVE

Determine irrigation management practices that increase Water Productivity (WP) allowing a reduction in water used without negatively affecting grain yield.

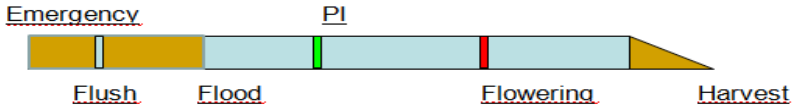
Water Productivity (WP) = Kg Rice per $m^3$ of water (irrigation and rainfall)

Maximizing water productivity would :

- reduce the costs of pumping irrigation,
- Increase rice area planted annually
- improve economic results and sustainability of the rice sector
- allow to irrigate other crops in a rotation
- irrigate properly the entire rice planted area during all the crop cycle, while minimizing risks and securing rice yield potential

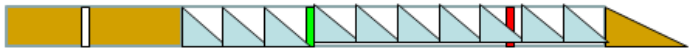
# Irrigation Treatments:

**1.Continuous (C),**

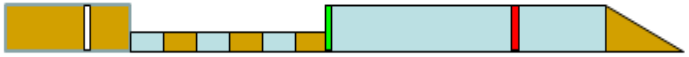



**2.Intermittent until panicle initiation (IP)**

3a.Intermittent during all crop cycle (I)
(only North and Center))



3b. Alternate Wetting and Drying (AWD)
(only East)



# METHODS

- NORTH and CENTRE (3 seasons)

Irrigation Treatments :

**1.Continuous (C),**
**2.Intermittent until panicle initiation (IP)**
3.Intermittent during all crop cycle (I)


- EAST (3 seasons)

Irrigation treatments :

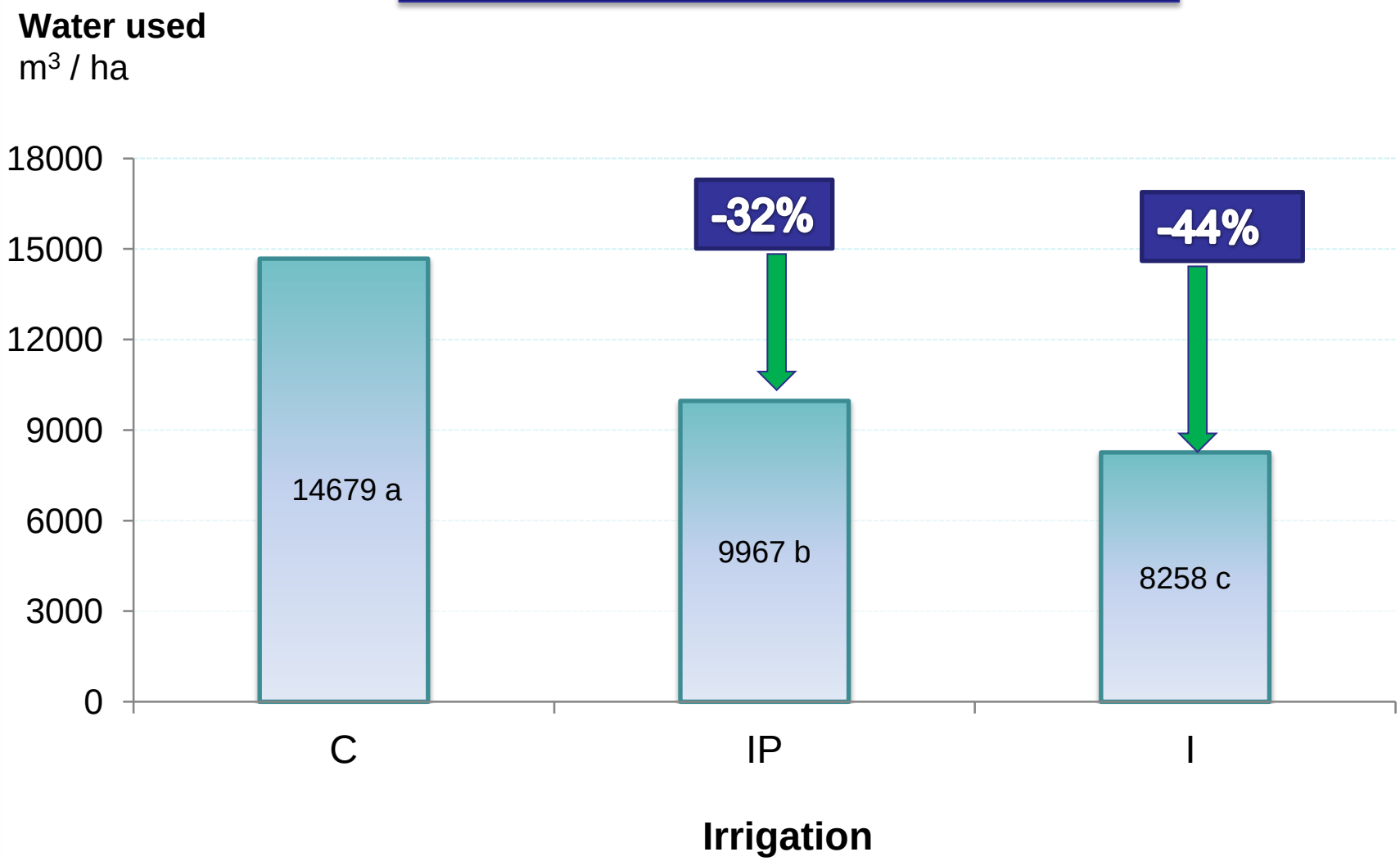
**1.Continuous (C),**
**2.Intermittent until panicle initiation (IP)**
3.Alternate wetting and drying (AWD)

# RESULTS

## NORTHERN REGION

# 1. RESULTS NORTH REGION (Average 3 Seasons)

## IRRIGATION WATER USED

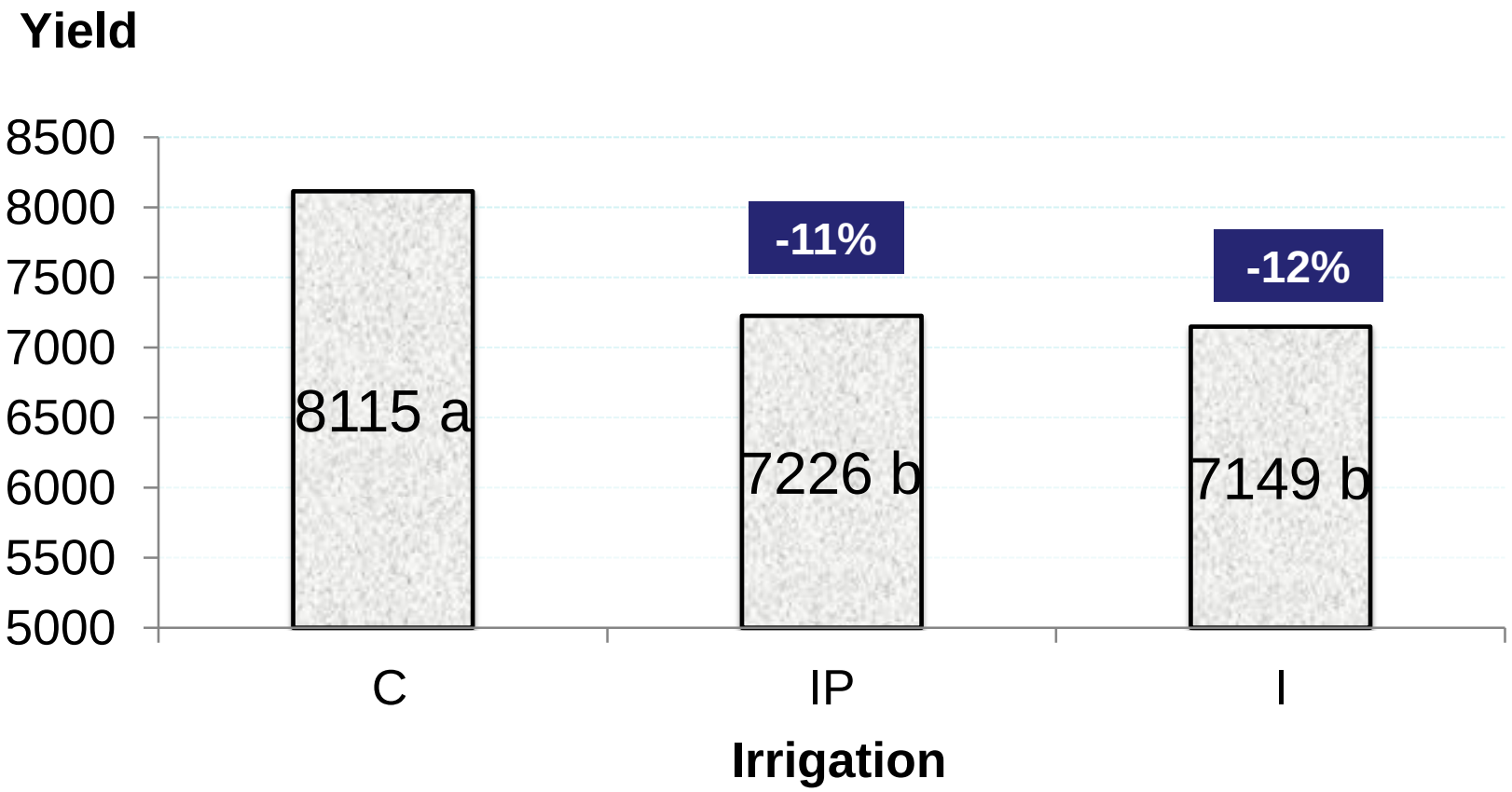



Equal letters between bars are not significantly different from each other (P<0.05)

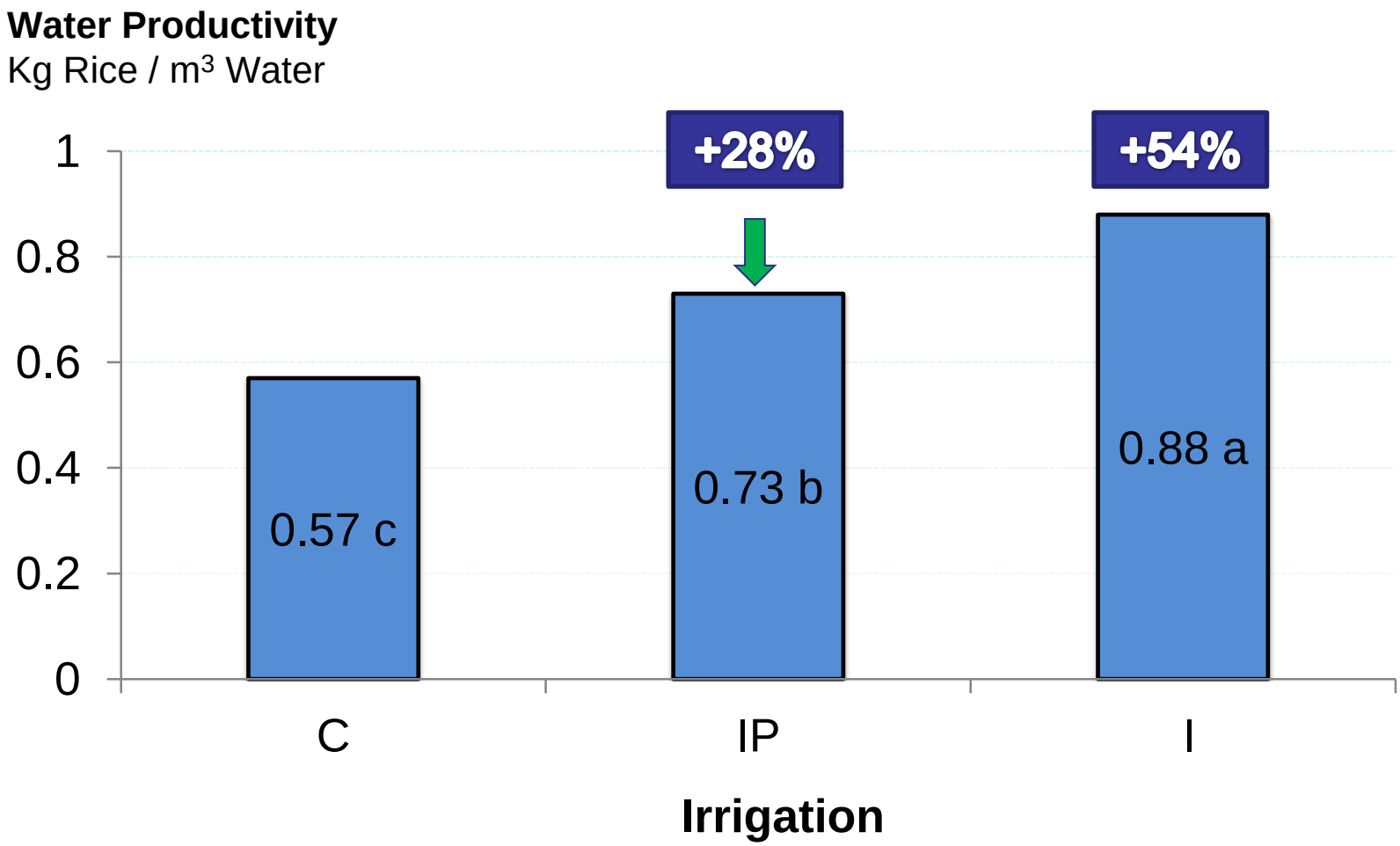
**Rainfall = 7328 m3/ha**

# 2. RESULTS NORTH REGION

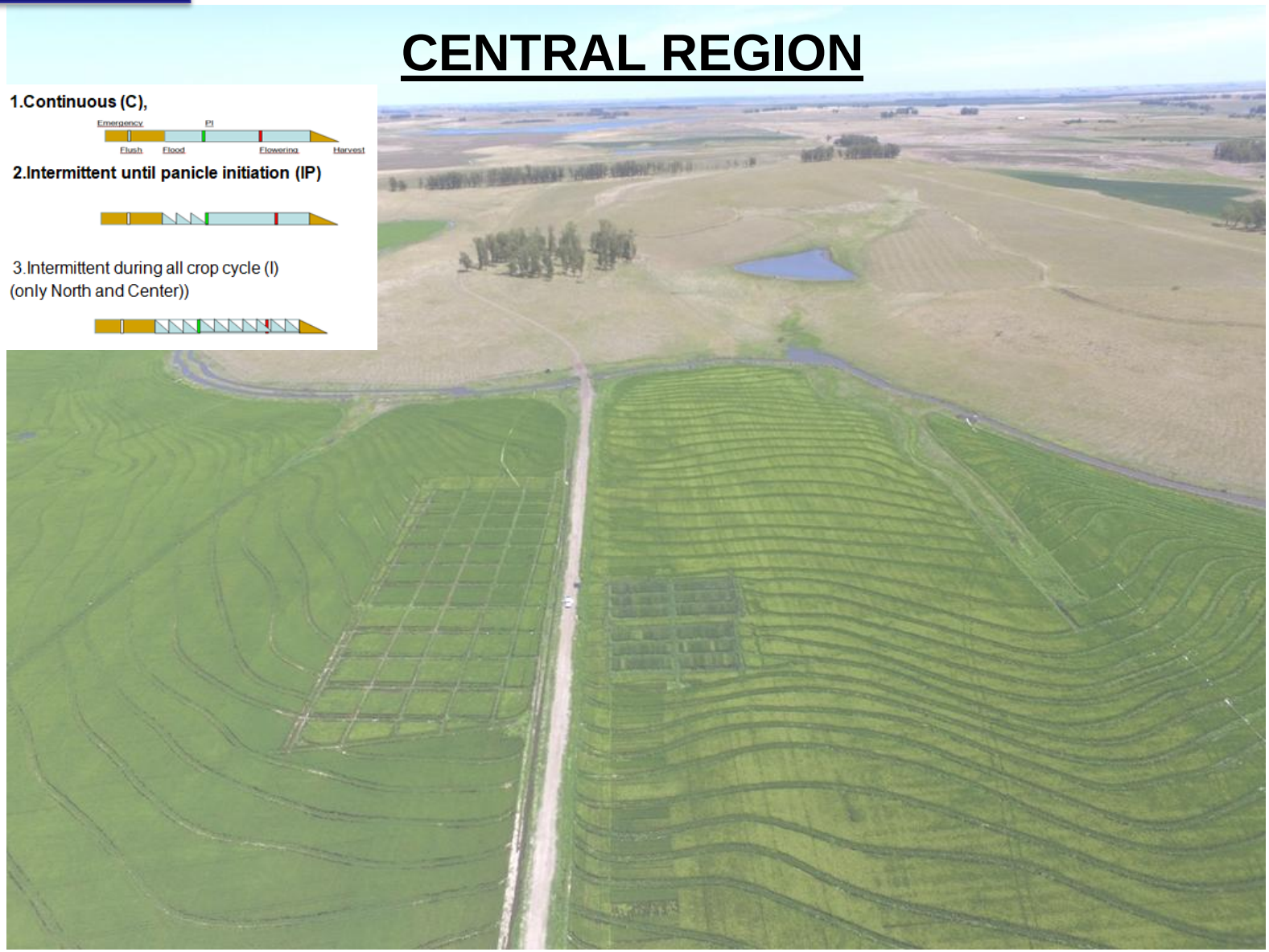
## RICE YIELD



# WATER PRODUCTIVITY (Irrigation)

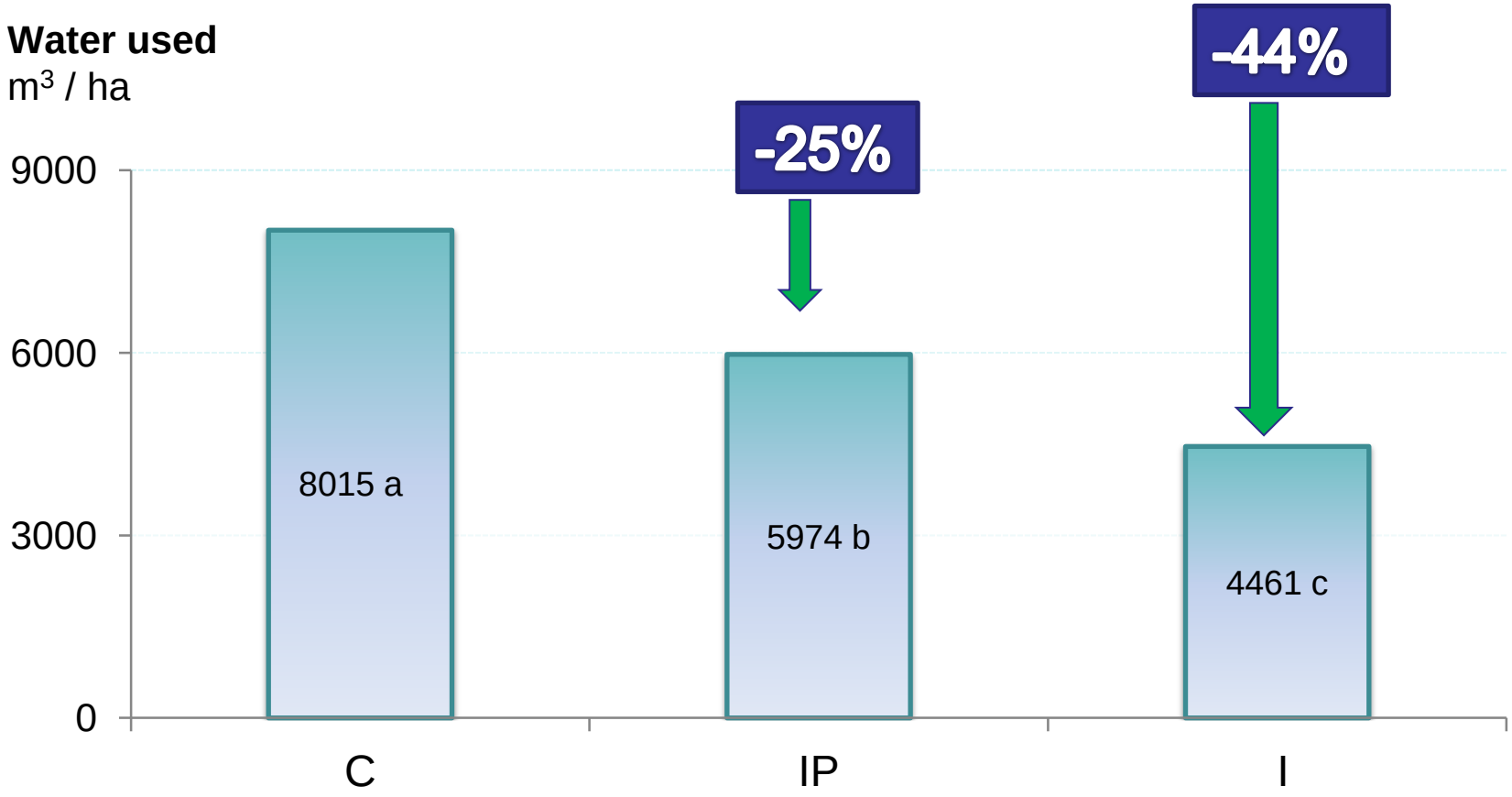


# CENTRAL REGION



# 1. RESULTS CENTRAL REGION (Average 3 Seasons)

## IRRIGATION WATER USED



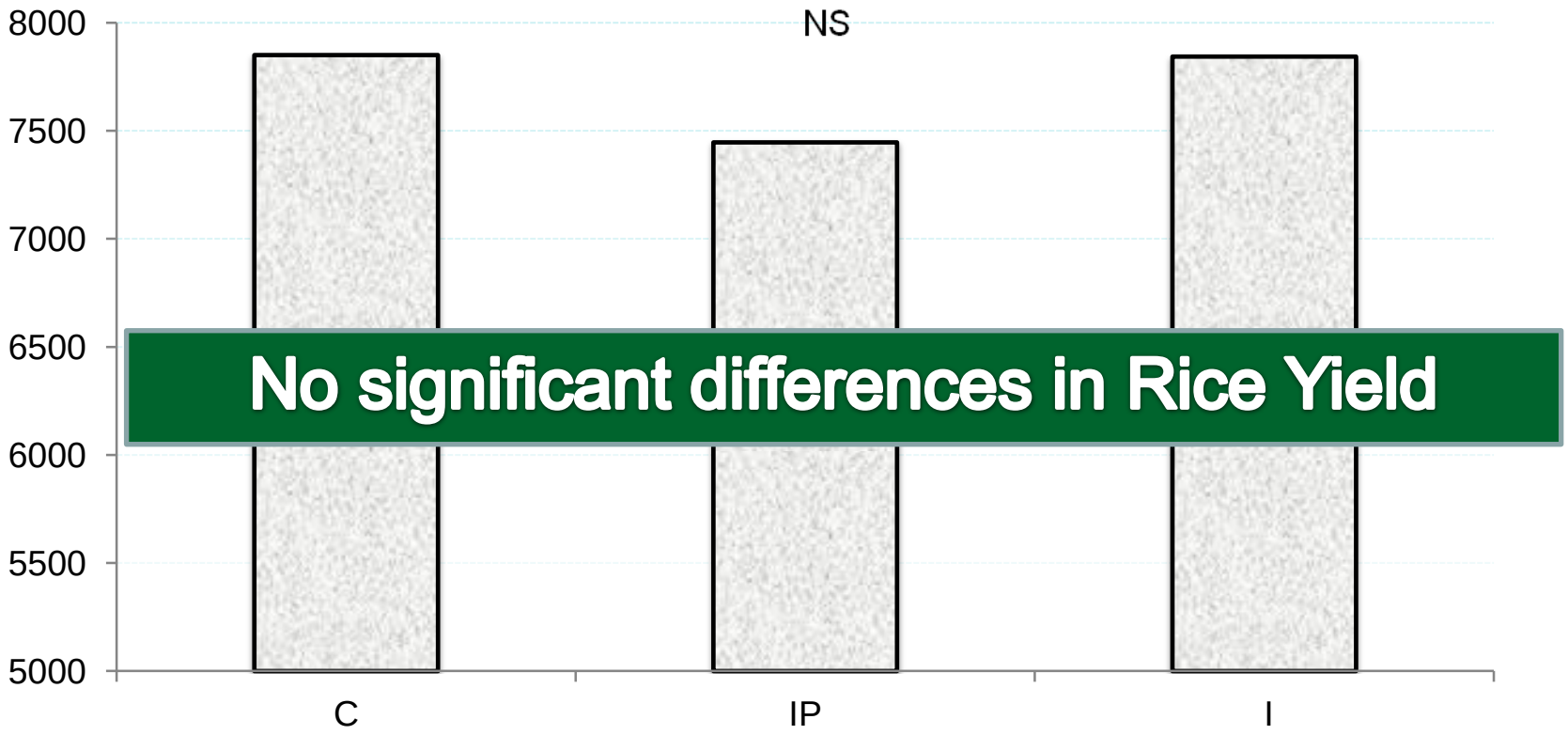

Equal letters between bars are not significantly different from each other (P <0.05)..

**Rainfall = 7380 m3/ha**

# 2. RESULTS CENTRAL REGION

## RICE YIELD

**Yield**
Kg Rice/ ha

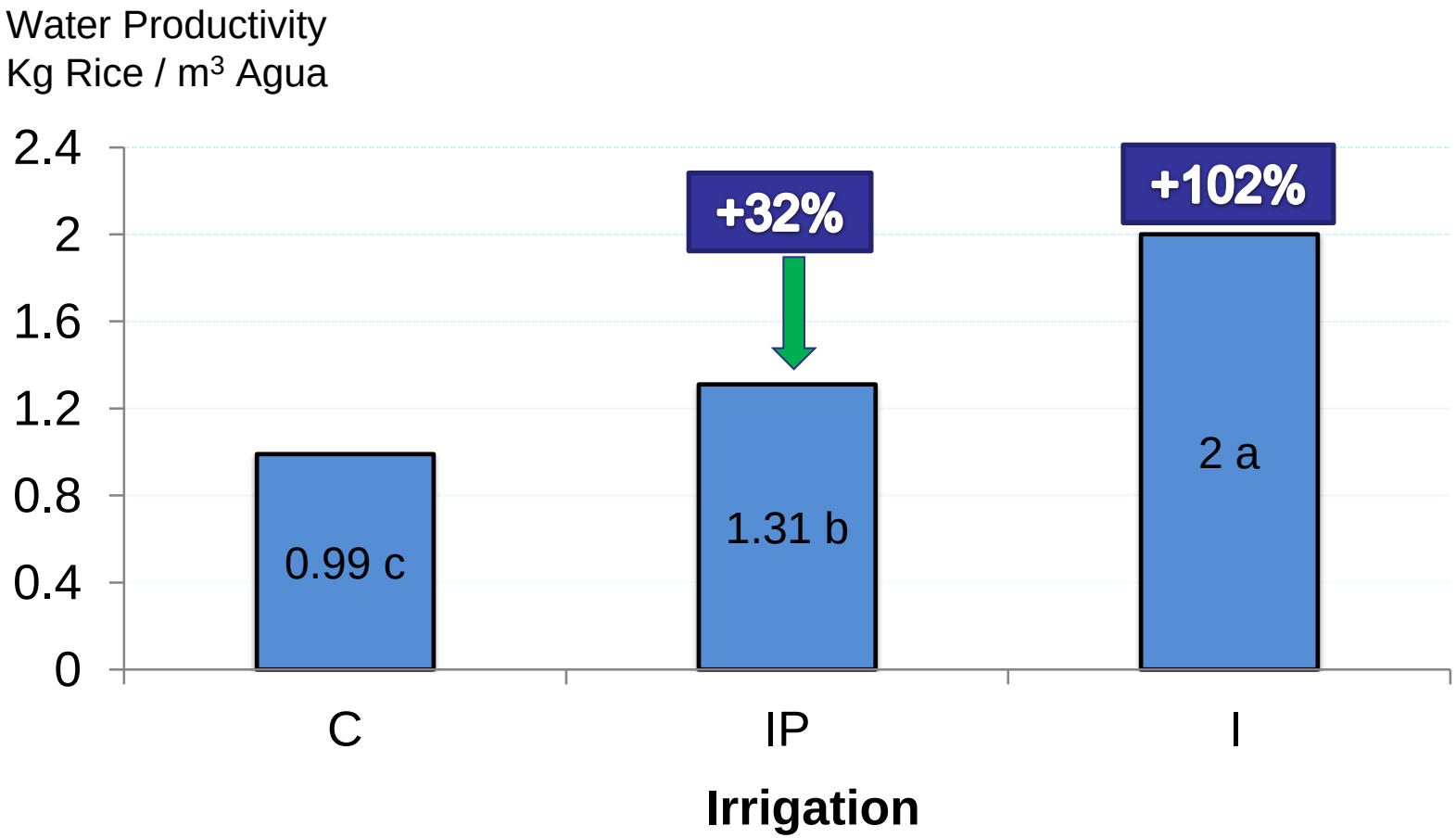



**No significant differences in Rice Yield**

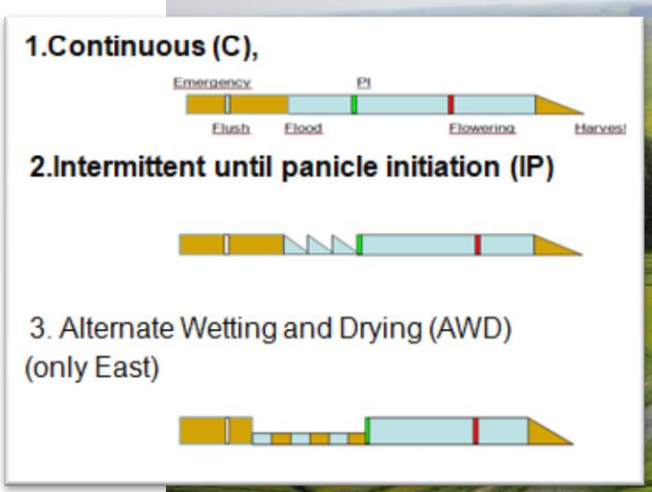
NS: non significant.

# 3. RESULTS – CENTRAL REGION

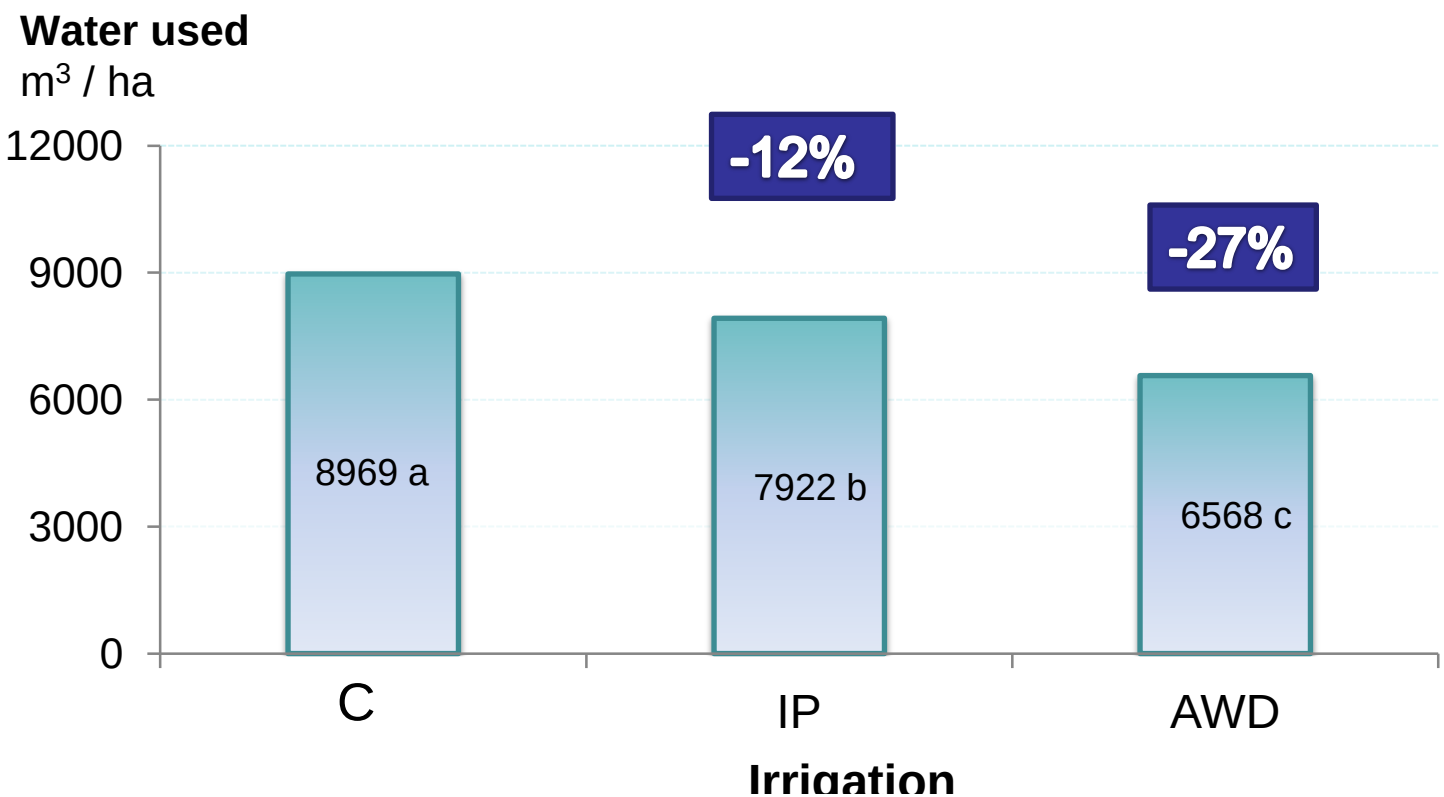
## WATER PRODUCTIVITY (IRRIGATION WATER)



# EASTERN REGION



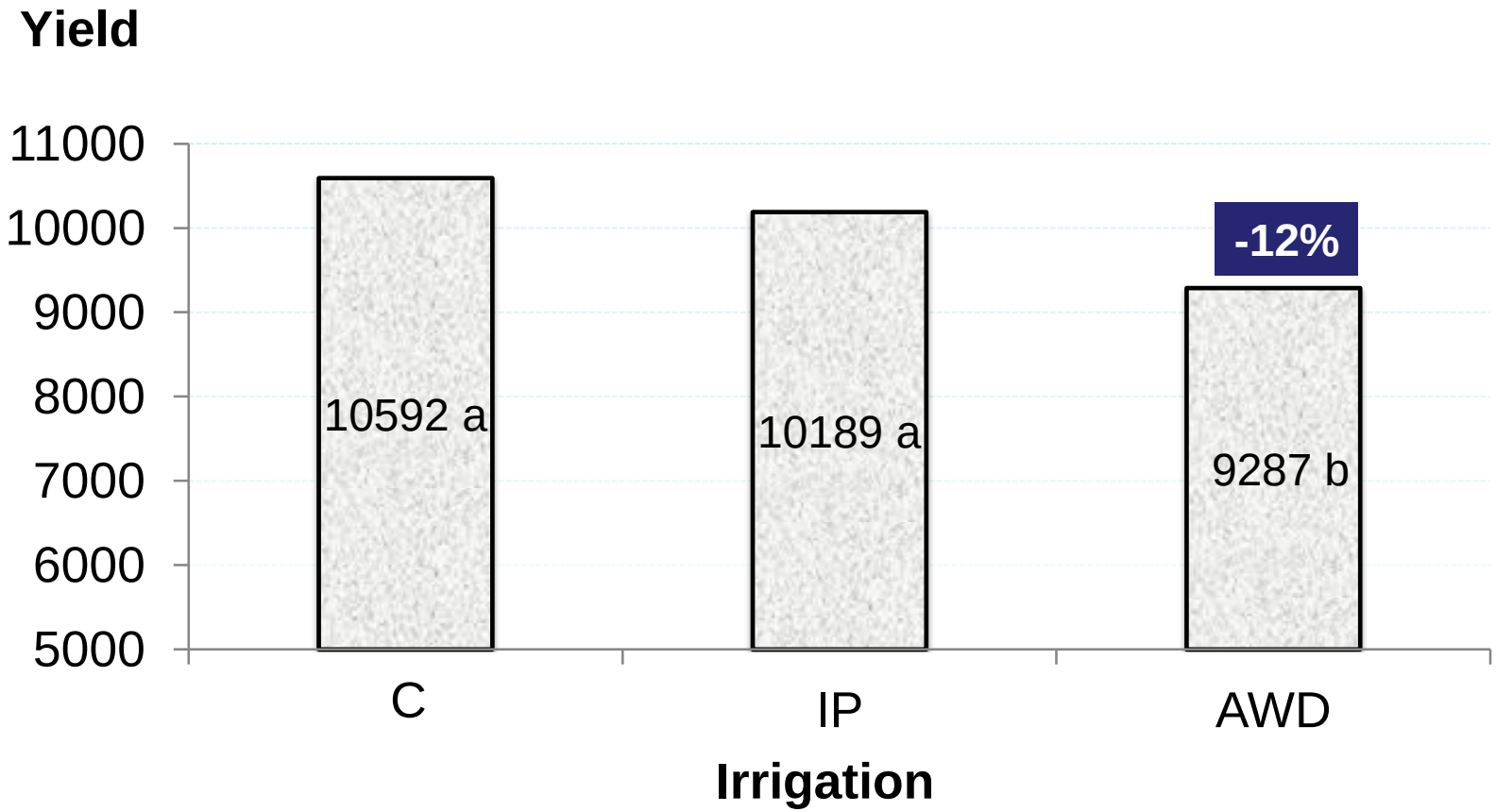

# IRRIGATION WATER USED



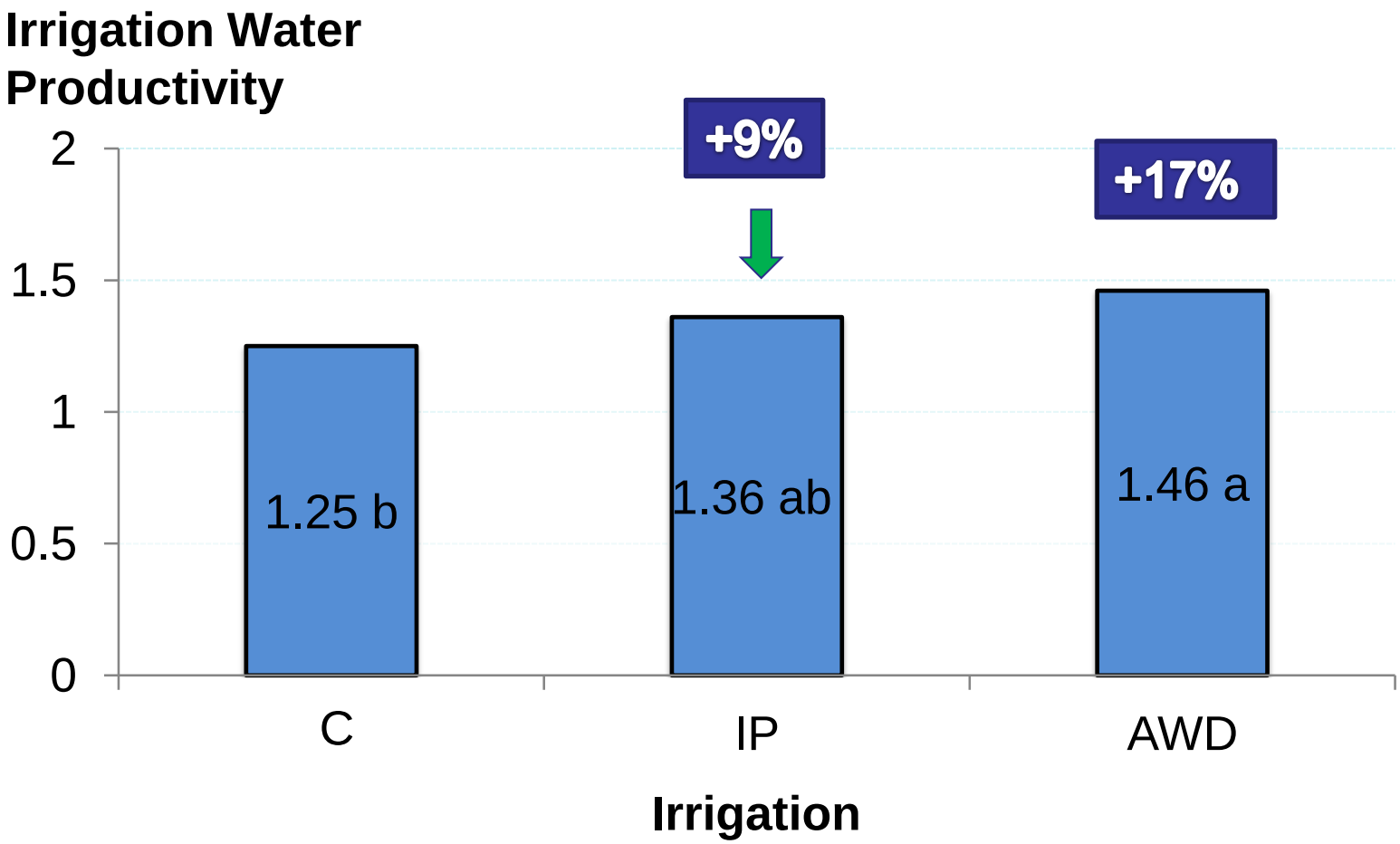

Equal letters between bars are not significantly different from each other (P <0.05).

**Rainfall = 3480 m3/ha**

# RICE YIELD


Yield
11000
10000
9000
8000
7000
6000
5000
10592 a
10189 a
-12%
9287 b
C
IP
AWD
Irrigation

# WATER PRODUCTIVITY (IRRIGATION WATER)



# SUMMARY OF RESULTS

| Region | Rainfall mm | Water used Irrigation $m^3\ ha^{-1}$ | | Yield ton Rice $ha^{-1}$ | | Water Productivity kg Rice / $m^3$ | |
|---|---|---|---|---|---|---|---|
| | | C | IP | C | IP | C | IP |
| **East** | 348 | 8969 a | 7922 b | 10.6 a | 10.2 a | 1.25 a | 1.36 a |
| **Central** | 738 | 8015 a | 5974 b | 7.9 a | 7.5 a | 0.99 b | 1.31 a |
| **North** | 732 | 14679 a | 9967 b | 8.1 a | 7.2 b | 0.57 b | 0.73 a |

Equal letters by rows are not significantly different from each other (P <0.05)

## Effect of Irrigation - IP vs Continuous-

| | North | Central | East |
|---|---|---|---|
| Water Used = | -32 % | -25% | -12% |
| Grain Yield = | -11% | -5% | -4% |
| Water Productivity (I)= | +28% | +32% | +9% |

IP would determine yield losses for farmers up to -11%, around 1 ton /ha less, limiting the implementation of IP on farms in some regions

# CONCLUSIONS

Implementing non traditional irrigation systems like **intermittent (I) or alternate wetting and drying (AWD)** can **improve water productivity** and significantly **reduce the amount of water used** on rice fields in Uruguay. As **rice grain yield can be affected negatively,** the implementation of this systems on commercial farms would be limited.

**Intermittent irrigation (IP)** during vegetative phase until panicle initiation can **improve water productivity, reduced water used without affecting significantly grain yield** in some regions (East and Center). However, rice yield can significantly be reduced on higher infiltration soils and slopes in the North.

CHALLENGE

Identify water Management strategies that maintain soil water depletion in a range that does not reduce rice grain yields and quality in both, experimental and commercial conditions. Fine tune AWD techniques to Uy farming systems.

Further research and validation on commercial farms is required.

Opportunity for a Scientist **Irrigation Engineer / Hydrologist** to join our team in Uy

link: www. inia.uy

www.inia.uy/inicio/Llamados/Abiertos

**Irrigation Engineer / Hydrologist**

Sede: INIA Treinta y Tres

RTWG
Long Beach, CA
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# Many Thanks

DEAKIN UNIVERSITY AUSTRALIA

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