Water Productivity, Irrigation Management and Systematization for Rice Farming Systems in Central Region of Uruguay

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Introduction

A high proportion of rice farming irrigation in the Central Region of Uruguay is done with water stored in dams (rainfall).

Maximizing water productivity would : reduce the costs of pumping irrigation, increase rice area planted annually allow to irrigate other crops in a rotation

Objective

The aim of the experiment is to determine irrigation management practices and systematization field layout techniques that allows to obtain:

More or Equal Rice yield per Hectare with less Water

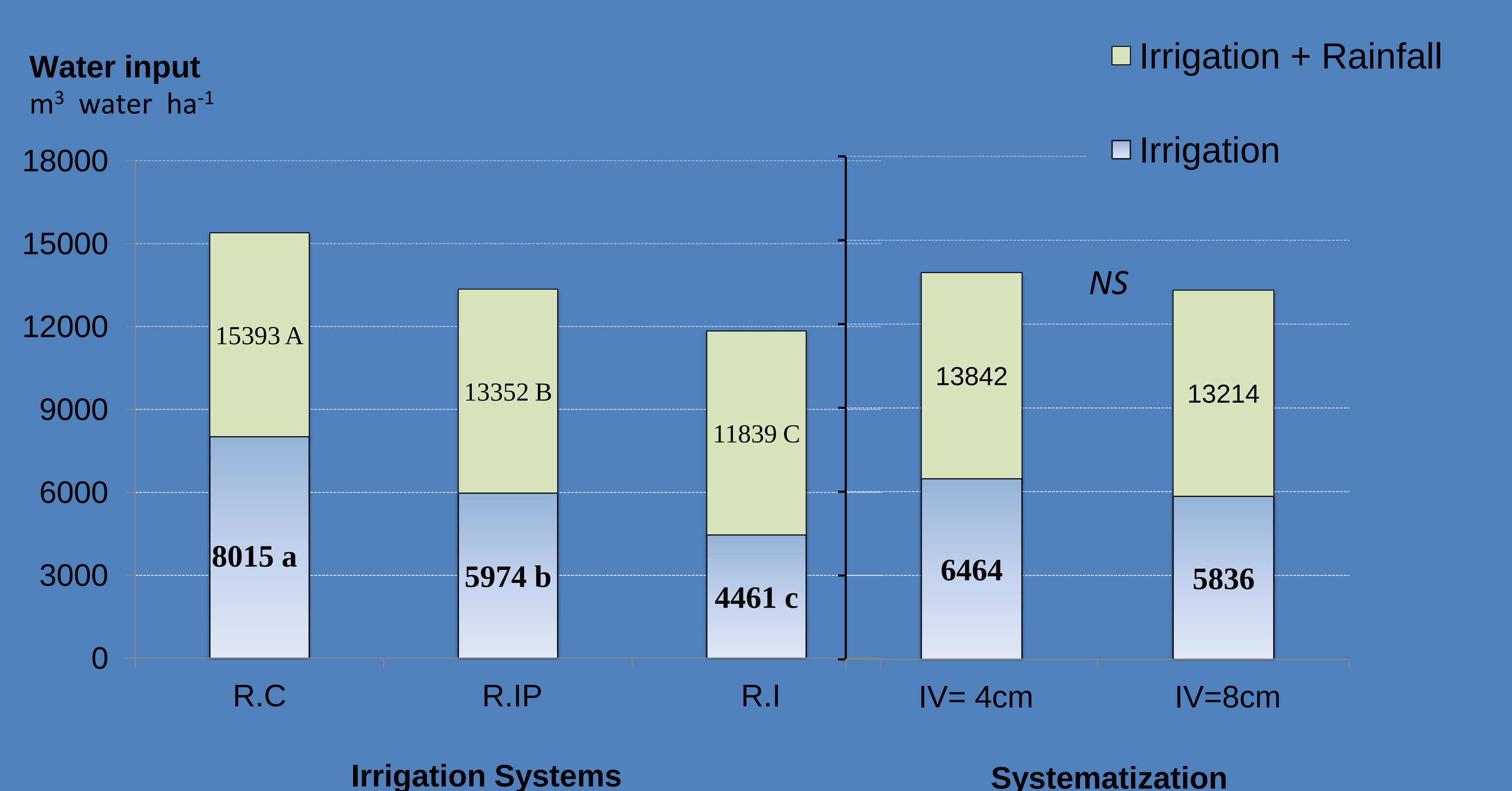
Methodology

A split plot experimental design trial was conducted in Tacuarembó Experimental Station (32.18S, 55.17W). Treatments included two types of systematization with different vertical interval between levees (big plots)l: I. Conventional (IV-8cm) and II. Alternative (IV-4cm) and three irrigation management practices (small plots): 1.Continuous (RC), 2.Intermittent until panicle initiation (RIP), and 3.Intermittent during all crop cycle (RI). In RC a water layer of 10cm is maintained after flooding throughout all the crop cycle. In RIP and RI the water layer alternates between 10 and 0cm and is re-established when the soil is still saturated. The results of the joint analysis of the previous three seasons (2012-2013-2014) were evaluated by analysis of variance and mean separation test of Fisher 5% using statistical package InfoStat (www.infostat.com.ar).

Results

Intermittent irrigation systems led to significant water inputs savings in relation to continuous irrigation RC, 2041 and 3554 m^3 water ha^{-1} less for RIP and RI respectively (Figure 1) ($P<0.05$). Precipitations during the crop cycle were high , average=738 mm $year^{-1}$. There were no differences in rice grain yield between irrigation treatments ($P< 0.05$) (Table 1).

Figure 1. Irrigation Water Input and Total Water Input (Irrigation plus Rainfall) for different irrigation systems and systematization, Tacuarembó, Uruguay (average 3 seasons 2011-14).



Different letters are significantly different with a probability less than 5% (P < 0.05) . NS: non-significant differences . LSD (least-square difference) Irrigation Systems = 460

Table 1. Rice Yield, Grain Quality and Water Productivity compared with three irrigation systems and two types of systematization, Tacuarembó, Uruguay 3 seasons 2011-14).

Site= Central Region, Tacuarembó.	Rice Yield (kg ha^{-1})	Industrial Quality		Water Productivity (WP) Kg grain / m^3	
		White Grain %	Whole Grain %	Irrigation	Irrigation + Rainfall
Irrigation Systems					
1.Continuous (RC)	**7850**	**69.22**	**62.73 a**	**0.99 c**	**0.52 c**
2. Intermittent until panicle initiation (RIP)	**7446**	**69.17**	**62.17 ab**	**1.31 b**	**0.57 b**
3. Intermittent during all crop cycle (RI)	**7843**	**69.08**	**61.94 b**	**2.00 a**	**0.68 a**
MDS (P<0.05)	*NS*	*NS*	*0.63*	*0.17*	*0.04*
Systematization - Field Layout					
I. Conventional - IV=8cm	**7735**	**69.2**	**62.61**	**1.57**	**0.60**
II. Alternative - IV= 4cm	**7691**	**69.1**	**61.95**	**1.30**	**0.57**
MDS (P<0.05)	*NS*	*NS*	*NS*	*NS*	*NS*
CV %	*12.12*	*0.71*	*1.95*	*22.44*	*12.16*

Different letters in the same column are significantly different with a probability less than 5% (P<0.05) LSD : least square deviation. NS: non significant differences. CV : coefficient of variation

Conclusions

Intermittent irrigation in low-infiltration rate soils (planosols), allowed for significant savings in water input of 35% on average without reducing rice grain yield relative to continuous irrigation, thus determining a significant increase in water productivity (P <0.05).

In relation to industrial quality, intermittent irrigation (RI) determined a lower percentage of whole grain in relation to continuous irrigation RC (P <0.05).

There were no significant differences in water input, grain yield, industrial quality and water productivity between the different systematizations-field layouts treatments(P <0.05).

3rd INTER-REGIONAL CIGR CONFERENCE ON LAND AND WATER CHALLENGES: "TOOLS FOR DEVELOPMENT"

28, 29 y 30/9 DE 2015 | 27 RECEPCIÓN LA ESTANZUELA, COLONIA - URUGUAY