Increasing rice productivity by improving population and nitrogen management

C Marchesi[1], J Castillo[2]
[1] Instituto Nacional de Investigación Agropecuaria, Tacuarembó, Uruguay, cmarchesi@inia.org.uy
[2] Instituto Nacional de Investigación Agropecuaria, Treinta y Tres, Uruguay, jcastillo@inia.org.uy

Introduction

- Main goal: reaching high efficiency on rice productivity
- New cultivar: INIA Merín.
- A local objective recommendation system about N fertilization exist (**Fertiliz-Arr**), created with previous cultivar types.
- Management of some basic production factors as plant population and N response have to be assessed in various environments.

Objective

To obtain the best combination of plant population and N fertilization for the novel cultivar INIA Merín in Uruguayan rice production conditions.

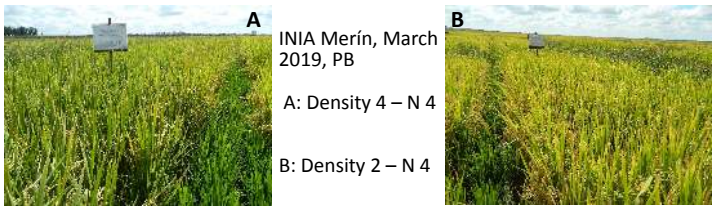
Material and Methods

- 6 experiments, 3 sites (PL, PB and PF, from East to North), 2 years.
- Cultivar: INIA Merín, *indica*, long grain and long cycle, high productive and blast resistant, low risk of lodging and tolerant to shoot diseases.
- Plant densities (4) and N treatments (4) (Table 1), installed over fields where rice rotated with pastures, using direct seeding/minimum tillage over a previous summer preparation.

Table 1. Seed density (viable seeds m^{-2}), seed rate (kg ha^{-1}) and nitrogen fertilization (kg N ha^{-1}) treatments.

Seed density (SD) Viable seeds m^{-2}	Seed rate (SR) Kg seeds ha^{-1}	Nitrogen treatments Kg N ha^{-1}
1: 195	60-70	1: control; 0 (ETI) + 0 (PI)
2: 325	100-110	2: medium; 45 (ETI) + 30 (PI)
3: 488	150-160	3: Fertliz -Arr[1]; X (ETI) + Y (PI)
4:650	190-210	4: high; 68 (ETI) + 45 (PI)

ETI: at early tillering; PI: at panicle initiation; [1] local rice fertilization recommendation system created by INIA Uruguay.



INIA Merín, March 2019, PB

A: Density 4 – N 4

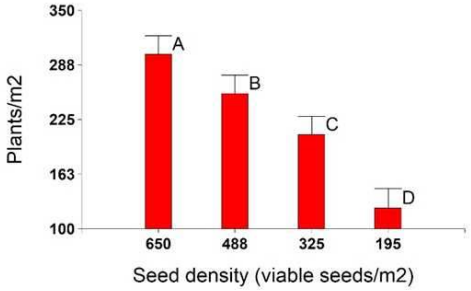
B: Density 2 – N 4

- Experimental design: factorial in randomized blocks, 3 replicates, with all the combinations between plant densities and N treatments;
- 16 m^2 plots.
- Measurements: plant recovery (PR, in number and %), aboveground biomass in PI- R3 (BiR3) and previous harvest (BiHa); NDVI at R3 (NDVIR3), grain yield (Yi), yield components (panicles per area, filled-grains per panicle, 1000 grains weight, floret sterility); harvest index (HI).
- Statistical analyses: mixed models (plant density, N fertilization and interaction as fixed factors; year, site and block as random factors). Regression analysis for grain yield and N.
- Statistical package: Infostat (www.infostat.com.ar).

Results and Discussion

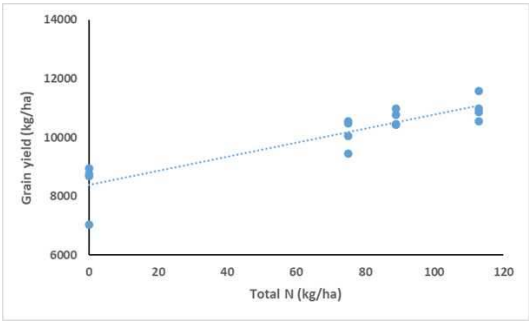
- SD directly influence PR (Figure 1), while the % PR decreased from 195, 325, 488 and 650 vs m^{-2} (64%, 64%, 52% and 46%, respectively).

Figure 1. Average plants recoveries for different viable seed densities.



- For all the other variables, both, plant density and N had significant individual effects. No interactions were detected for any variable analyzed.
- BiR3 was dependent on N, with a significant gap of 700-800 kg ha^{-1} (control vs N). NDVIR3 was also associated by N, with a positive response from 0.53 to 0.70. At harvest, both N and density had effects, with greater differences by N, of 3000 to 4000 kg ha^{-1}. The HI was quite stable (0.51-0.52) among the N treatments.
- For Yi, both density and N were relevant: ⇑ plant density and ⇑ N, increased Yi 9 % and 24%, respectively.
- The association between Yi and N, within each plant density level or in average, adjusted a linear regression (Figure 2).

Figure 2. Linear regression between total N applied and grain yield for all plant densities, INIA Merín.



- From an agronomic approach, an excess of N could induce a decline in grain yields. Therefore, a polynomial model would be more suitable, but higher N rates must be explored to know the region on the equation where the amount of N would be detrimental for Yi in INIA Merín.

Conclusions

- INIA Merín responded to N and seed density for most of the analyzed variables, being the magnitude of the N effect higher, in general.
- Grain yield was affected by both plant density and N, but yield increases were 9 % and 24%, respectively, denoting the relevance of N. Moreover, the adjusted linear regression would imply INIA Merín could be able to explore higher yields if more N is applied, based on the observed data of stable harvest index.