Adaptation of fertilizer application strategies to low temperatures at high altitude sites in lowland rice

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Introduction

Even though significant differences in the thermal growth environment for rice cultivars grown at the different altitudes are acknowledged, official fertilizer application recommendations often do not reflect this. The consequence is a mismatch between nutrient requirements in specific growth stages of the plant and fertilizer application strategies.

Conclusion

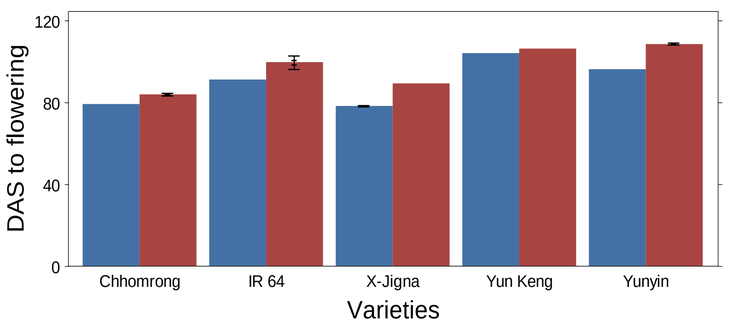
- The duration to panicle initiation and flowering differed as function of planting dates and genotypes
- Low temperatures at high altitude sites limit the uptake of N during the earlier growing stages
- The **basal application can be omitted** without affecting the grain yield in the **high altitude** site

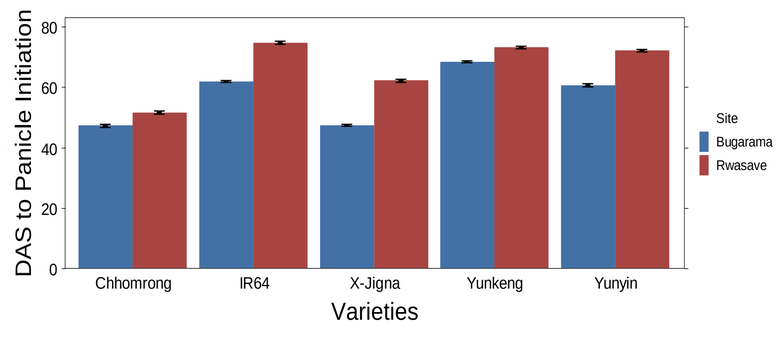
Results and Discussion

The duration to panicle initiation and flowering differed as function of sowing dates and genotypes. Root zone temperatures were lower at the 1600 m site compared to the 900 m site. The omission of the basal N fertilization and the increase of N dosage at mid-tillering and panicle initiation increased the grain yield, and the number of panicles. This effect was more significant at the high altitude than at the low altitude site during the second sowing date. Apparently the application of nitrogen under low root zone temperature conditions does not effectively benefit the plant during early growth stages

Table : Yield and yield parameters as affected by basal N application at Low and High altitude sites. Lsd was used for mean separation between treatments with and without basal N. Means with same letter are not significantly different at 95% C.I

	First sowing date				**Second sowing date**			
Sites	Low altitude		High altitude		Low altitude		High altitude	
Basal N	Yes	No	Yes	No	Yes	No	Yes	No
Grain Yield (t ha-1)	5.72 a	6.06 a	5.56a	5.73 a	5.26 a	5.14 a	**4.79 a**	**5.28 b**
1000-grain weight (g)	30.7 a	31.2 a	30.9 a	30.8 a	30.9 a	31.0 a	**30.8 a**	**30.9 a**
Panicle number	**297 a**	**342 b**	256 a	283 a	307 b	308 b	**262 a**	**304 b**





Figs.1 and 2: Days after sowing (DAS) to Flowering and DAS to Panicle initiation for the first planting date. Bars represent standard errors.

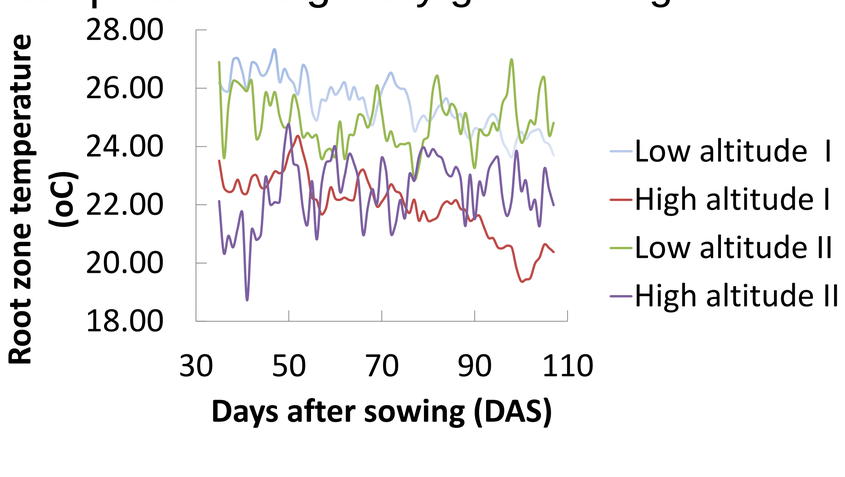


Fig.3: Root zone temperatures during two sowing dates (I and II) in Bugarama (low altitude) and Gikonko (high altitude)

Figs.4 and 5: Days to Flowering and panicle initiation across sowing dates. The bars represent standard errors.

Material and Methods

This experiment was conducted in two marshlands located at 1600 and 900 m asl in Rwanda. Tinytags recorded root zone temperature every 30 minutes. Phenological observations were recorded for each genotype. Fertilizer treatments consisted of three N rates (80,120 and 160 kg ha^{-1}) in different splits, with and without basal application.

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