

Module 3.5-2 Fertilization with sulfur improves nitrogen use efficiency of wheat in Argentina.

Nitrogen (N) fertilization plays a key role for achieving high wheat yields. Therefore, high N use efficiency (NUE) is desired in order to increase the economic profit and reduce the risk of losses harmful to the environment. Agronomic efficiency (AE), one measure of NUE, indicates how efficiently crops transform applied N into grain yield, and can be separated in two main components: (i) recovery efficiency (RE), i.e., the ratio between the increase in N uptake and the amount of applied N, and (ii) physiological efficiency (PE), which reflects the ratio between the increase in grain yield and the increase in N uptake. Thus, the RE indicates how much of the applied N is absorbed from the soil by the crop, and the PE indicates how much additional grain is produced with the N absorbed in response to fertilization.

In an agricultural system, grain yield will increase when N fertilizer is added, but a leveling off may appear if another nutrient is limiting. This restriction might be overcome when the deficient nutrient is applied and, thereby, an increase in NUE is expected.

Research in Argentina has shown that S addition increased biomass and grain yield in wheat. Nitrogen fertilization increased grain yield, and the magnitude of this increase was higher when S was added (**Figure 1A**). As a consequence, AE was about 50% higher when the crop received S fertilizer than when no S was applied. The uptake of N increased linearly in response to N applied up to a rate of 80 kg/ha (**Figure 1B**), and the slope of this relationship, i.e. RE, increased from 0.4 to 0.7 as a consequence of S application. In contrast, the slope of the relationship between N uptake and grain yield (PE) was unaffected by the different S rates (**Figure 1C**).

Sulfur fertilization apparently increased RE by increasing the crop's ability to take up applied N, possibly by increasing soil exploration by the roots. It did not increase grain N concentration or N harvest index.

From an environmental perspective, a higher RE is a desired feature associated with a higher capacity of the crop to capture N from the soil. Managing S concurrently with N can improve both yield and NUE, reducing risk of N losses that might harm the environment.

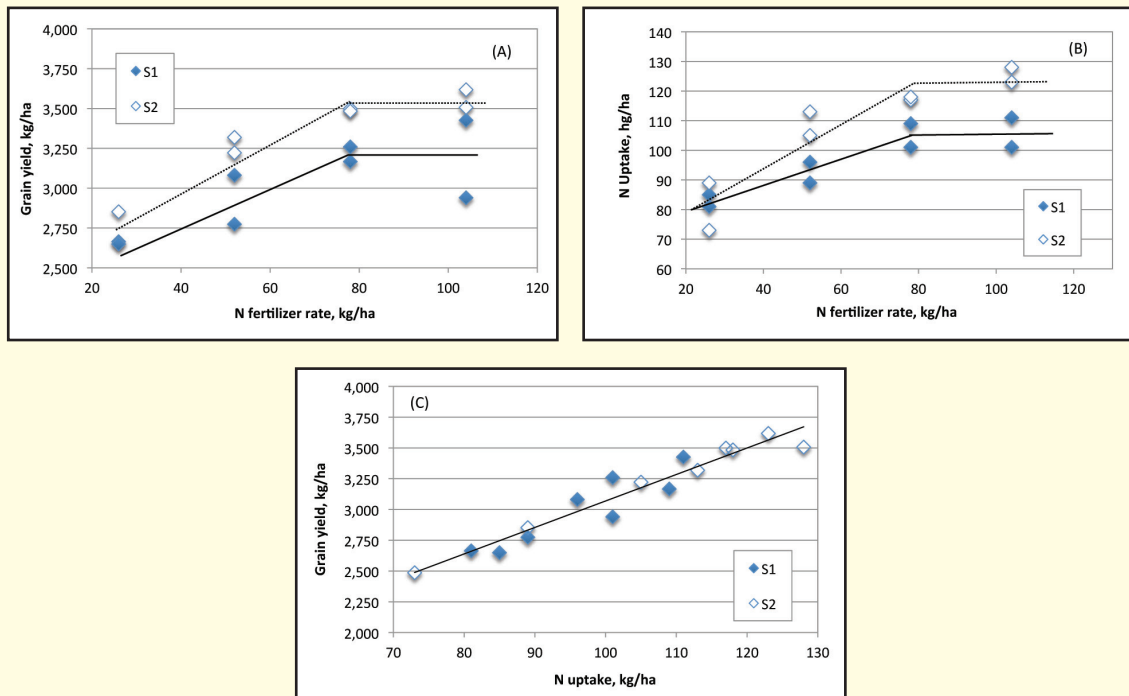


Figure 1. Relationship between grain yield and N fertilizer rate (A), N uptake at physiological maturity and N fertilizer rate (B) and grain yield and N uptake at physiological maturity (C) of wheat grown under two sulfur fertilization rates (S1, without S, and S2, with 30 kg S/ha). **Source:** Salvagiotti et al. (2009).

References

Salvagiotti, F., J.M. Castellarin, D.J. Miralles, and H.M. Pedrol. 2009. *Field Crops Research* 113: 170-177.

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