

Feasibility of a single side-dress of stabilized nitrogen in maize under semiarid irrigated conditions



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Introduction

- The use of fertilizers with **nitrification inhibitors** aims to increase the lifetime of ammonium in the soil, to **improve the synchronization** between crop demand and available soil nitrogen (Ladha *et al.*, 2005).
- Potential advantages are the **reduction** of the number of fertilizer applications, the **increase of nitrogen use efficiency**, the **decrease** of the risk for nitrate leaching, and the **reduction** of gas emissions (N₂O).

Objective:

- To assess, in **two contrasting soil types**, if a **single side-dress application** of N fertilizer with inhibitor can **replace the standard double side-dressing N fertilizer application** of maize under semiarid irrigated conditions.

Materials and methods

- Experimental field located in the middle Ebro River Basin (Zaragoza, Spain) - semiarid Mediterranean climate, during two years (2015 and 2016).
- Long season maize crop (hybrid 'Pioneer P1758') under sprinkler irrigation. Water irrigation needs were calculated weekly according to FAO methodology.
- In two soil types, 'Deep' vs. 'Shallow' with contrasting soil water holding capacity (223 vs. 64 mm).
- Fertilizer treatments:
 - 'Urea': urea split into two applications at V6 (mid-June) and V13 (mid-July).
 - 'DMPP': a single application (V6) of urea with 3,4-dimethyl pyrazole phosphate (nitrification inhibitor).
- Fertilizer rate based in 250 kg N ha⁻¹ available to the crop = N fertilizer + soil nitrate at pre-planting.
- Nutritional status of maize was evaluated with periodic measurements of leaf greenness (SPAD-502®, Minolta) at different vegetative and reproductive stages.
- Grain yield, total aerial biomass and total N uptake were measured, and nitrogen use efficiency was calculated as total N uptake/N applied.

Results and Discussion

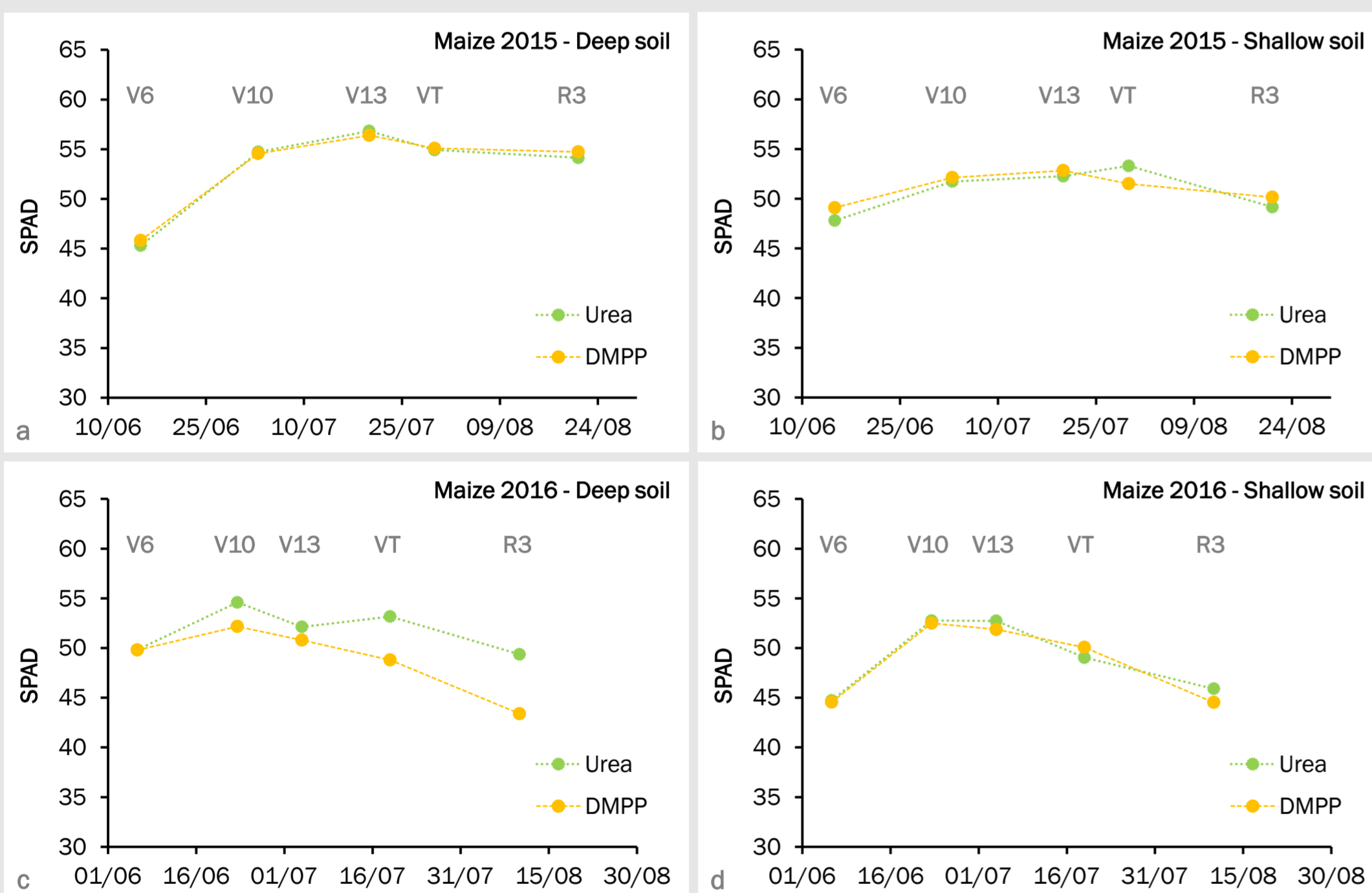


Figure 1. Average (n=3) chlorophyll meter readings (SPAD) in different maize stages (V6, V10, V13, VT, and R3) during the two growing seasons and the two type of soils.

Chlorophyll meter readings did not display significant differences ($p > 0.05$) between treatments in any year for the two soil types. Overall, both treatments followed a parallel trend; SPAD values in Deep soil during the second season showed the most divergent tendency (Figure 1c), in spite of this, statistics did not show differences between treatments in maize stages in any sampling time.

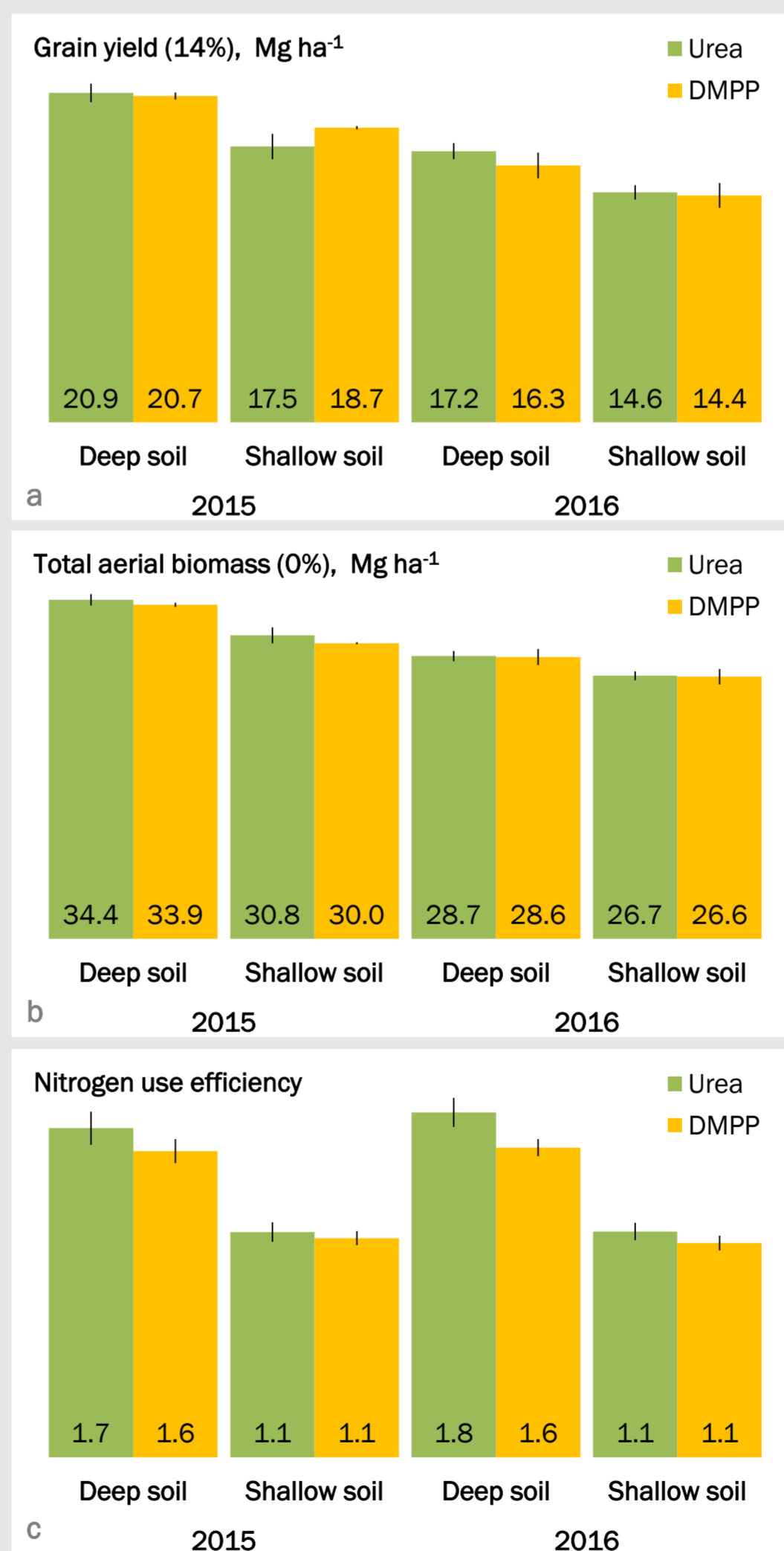


Figure 2. Average (n=3) production grain yield, total aerial biomass, and NUE in the fertilizer treatments and soil types during two seasons. Vertical lines indicate standard error.

No differences ($p > 0.05$) were found in grain yield (GY) and total aerial biomass (TAB) among treatments in the two seasons and for the two soils. Average values of GY and TAB were slightly lower in DMPP than Urea except GY value in Shallow soil during the first season.

Differences in nitrogen use efficiency (NUE) among treatments were not detected for any soil and season. DMPP did not affect NUE, in agreement with the meta-analysis study of Abalos *et al.* (2014).

Conclusion

The use of urea with DMPP allows reducing the number of side-dress N applications in maize without compromising grain yields under good irrigation practices.

References:

- Abalos, D., Jeffery, S., Sanz-Cobena, A., Guardia, G., Vallejo, A., 2014. Meta-analysis of the effect of urease and nitrification inhibitors on crop productivity and nitrogen use efficiency. *Agric. Ecosyst. Environ.* 189, 136-144.
- Ladha, J.K., Pathak, H., Krupnik, T.J., Six, J., van Kessel, C., 2005. Efficiency of fertilizer nitrogen in cereal production: Retrospect and prospects. *Adv. Agron.*, 87, 85-156.