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Effects of nitrogen fertilization on yield and nitrogen-use efficiency of durum wheat in Tunisia: a meta-analysis

Amir Souissi[1,2], Haithem Bahri[3], Hatem Cheikh M'hamed[1], and Mohamed Annabi[1]
[1]National Institute of Agricultural Research of Tunisia (INRAT), Carthage University, Agronomy Laboratory (LR16INRAT05), Hedi Karray Street, 2049 Ariana, Tunisia (mannabi@gmail.com)
[2]National Institute of Agronomy of Tunisia, Carthage University, Avenue Charles Nicolle 1082 Tunis Tunisia (souissiamir89gmail.com)
[3]National Research Institute for Rural Engineering, Water and Forests (INRGREF), Carthage University, Agronomy Laboratory (LR16INRAT05), Hedi Karray Street, 2049 Ariana, Tunisia (haithem.bahri@gmail.com)

Durum wheat (*Triticum durum* Desf.) is a crucial food crop and has occupied important areas in Tunisia. However, its production remains low and unstable even though the effort of intensification of this crop has been undertaken for many decades. Likewise, Nitrogen (N) is a major limiting input factor for the crop production. In this vein, the main objective of this meta-analysis is to quantify N-use efficiency of N-fertilizer (NUE) of durum wheat in Tunisia from published studies according to the type of crop management and bioclimatic zone. Nine hundred thirty-six observations (including grain yield and NUE as dependent variables) were extracted from 51 published studies, corresponding to trials conducted in rain-fed or irrigated, and conducted in conventional system or no-tillage. The results demonstrated that yields obtained within the experimental studies were below the cultivar potential yield, even at irrigated conditions. The grain yields obtained in no-tillage trials were lower (-26%) than those in conventional tillage ones. On the other hand, N-use efficiency was small and varied between 36 and 58 kg kg^{-1} N depending on the bioclimatic zone. Overall, the effect of irrigation on N-use efficiency was significantly positive (+16.4 kg kg^{-1} N; $p < 0.05$) under conventional systems. Whereas NUE response to no-tillage was significantly negative (-12.1 kg kg^{-1} N; $p < 0.001$) under rain-fed conditions. This latter is due mainly to the limitation of conservation agriculture (CA) in Tunisia to only no tillage practice and the negligence of the two other principles of CA namely crop rotations/species diversity, and soil cover by crop residues (at least 30% of the soil surface covered by crop residue at crop sowing). Therefore, enhancing N-use efficiency of durum wheat in Tunisia is paramount to increase production and avoid nitric pollution issues. This feature involves a best management of N-fertilization via synchronizing the timing and quantity of the nitrogen supply with the plant needs, and via using decision-making tools such as chlorophyll meter SPAD and GreenSeeker®, in order to accomplish this synchronization. The nexus between water and nitrogen in the soil is essential since it has conditioned the nitrogen use by durum in Mediterranean conditions.