



Module 7.1-3 Wheat yield response to nitrogen rate increases with irrigation in Morocco.

Wheat is the main annual crop in Morocco. More than 80% of wheat is cultivated under rainfed growing conditions. Due to the increase in frequency of drought over the last 25 years, wheat production has been affected by high variability in year-to-year grain yields. As a result, more importance has been given to wheat production in the main irrigated areas of Morocco. This strategy is based on supplemental irrigation, which consists of the addition of small amounts of irrigation water during the critical stages of crop growth, to target optimal yields.

Research conducted in Morocco showed that irrigation water added under supplemental irrigation is limited to an average of three irrigations to wheat with an amount of irrigation varying from 60 mm to 120 mm per irrigation. Compared to water constraints, nitrogen (N) is considered the second most important limiting factor for wheat growth. As a result, N should be carefully managed. While fertilizer N response is directly related to rainfall under dryland conditions, N rate should be greater when supplemental irrigation is applied. The strategy is to apply the right rate of N at the right time. In general, 30% of the required N rate is applied at planting (November) and 70% at top dressing prior to stem elongation (January to February). The rate of N applied just prior to stem elongation has a significant effect on grain yield by increasing the number of kernels per unit area (Mossadeq and Smith, 1994). While research conducted in Morocco with wheat under supplemental irrigation showed a significant effect of N on grain yield (Bendidi et al., 2013), the beneficial effects of N depend on supplemental irrigation regimes.

In irrigated area of Morocco where wheat is grown in rotation with cash crops (e.g., sugar beet) research have shown no advantage to adding N in the absence of water, or 1/3 FI (full irrigation) as yields increased only slightly (Figure 1) but with no economic benefit (Table 1). At 2/3 FI the crop responded to the first increment of N (60 kg/ha) with higher yield and economic benefit. However, no further gain was achieved with higher N rates (180 kg N/ha). Only with full irrigation did the wheat crop show a consistent yield and economic benefit to increasing N rate up to 180 kg N/ha.

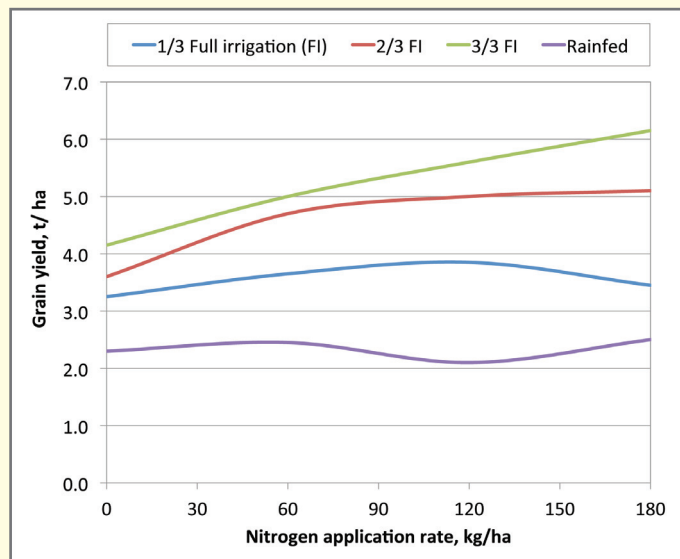


Figure 1. Wheat response to nitrogen rates and water regimes, Morocco (Adapted from Boutfirass et al., 2014 *In Press*)

Hence the best practice in wheat is to manage N rate based on supplemental irrigation supply to reach optimum yield and a positive economic response with less risk of losses and groundwater pollution.

Table 1. Effects of Nitrogen rates and irrigation regimes on gross return over N costs* (US\$/ha) of wheat. (Adapted from Boutfirass et al., 2014 *In Press*).

Nitrogen rates,kg/ha	Water regimes			
	Rainfed	1/3 FI	2/3 FI	3/3 FI**
0	805	1,138	1,260	1,452
60	781	1,201	1,568	1,673
120	581	1,194	1,596	1,806
180	645	977	1,555	1,922

*Gross return over N costs = (yield x US\$350/mt) - (N rate x \$1.28/kg)

**FI = full irrigation

References

- Bendidi, A., K. Daoui, A. Kajji, R. Dahan, and M. Ibriz. 2013. *Am. J. Exp. Ag.* 3(4):904-913.
- Boutfirass, M., M. Karrou, and A. Bahri. 2014. Benchmark project report, ICARDA ed. *In Press*
- Mossadeq, F., and D.H. Smith, 1994. *Agron. J.* 86:221-226.

Submitted by Dr. Hakim Boulal, IPNI North Africa, Morocco, October 2014.

