Module 5.1-1 Wheat yield response to a late application of additional nitrogen was predicted by leaf color. The conventionally recommended practice for N fertilization of wheat in northwest India is for a basal application (at sowing) of 50% of the N needed with the remaining 50% applied at the crown root initiation (CRI) stage (Zadoks growth stage 13). As shown in the Table below, an application of N at maximum tillering stage (MT; Zadoks growth stage 22) increased yields in each of 3 years when the basal and CRI rates summed to 80 kg/ha or less, and in 2 of the 3 years at higher rates. Yield responses to the late-applied additional N increased as chlorophyll (SPAD) meter values at the MT stage declined below 44. **Adapted from:** Bijay-Singh, et al. 2002. Agron. J. 94:821–829.

N fertilizer application treatment, kg N/ha				Wheat grain yield, t/ha		
Basal	CRI	MT	Total	1996–1997	1997–1998	1998–1999
0	0	0	0	–	1.7a†	1.8a
0	0	30	30	–	3.1b	2.7b
30	30	0	60	3.3a	3.7c	2.9c
30	30	30	90	4.1b	4.5d	3.7d
40	40	0	80	3.9b	4.2d	3.6d
40	40	30	110	4.5c	5.0e	4.2e
50	50	0	100	4.1b	5.1e	4.4f
50	50	30	130	4.5c	5.2e	4.7g
60	60	0	120	4.6c	5.1e	4.8g
60	60	30	150	4.8c	5.1e	5.1h

† Within a column, means followed by the same letter are not significantly different at the 0.05 level of probability by Duncan's Multiple Range Test .

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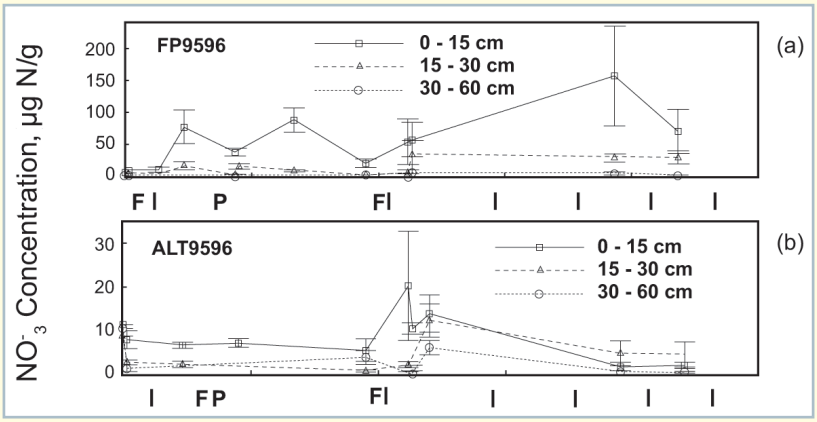
Module 5.1-2 Applying nitrogen in synchrony with crop demand lowered soil nitrate. The highest demand for N by the wheat crop occurs around the onset of stem elongation (Zadoks growth stage 31). Matching N application to crop needs can help improve its utilization efficiency and result in higher profits for the farmer and less adverse effects to the environment.

Wheat farmers in northwest Mexico routinely apply 75% of the recommended N application rate (250 kg/ha) 3 weeks before planting and the remainder 5 weeks following planting. Riley et al. (2001) compared farmers' practice with an alternative that consisted of applying 33% of the N at planting and the remainder 5 weeks following planting. They found the alternative timing improved nutrient uptake and decreased the N leaching loss by about 60% compared to the farmers' practice (see figure) while producing comparable economic returns to the farmer." **Source:** Riley, W. J., I. Ortiz-Monasterio, and P. A. Matson. (2001). Nutrient Cycling in Agroecosystems, 61(3): 223-236.



Mineral N concentrations in soil water measured during the wheat growing season for the typical farmer's practice (FP9596) and alternative practice (ALT9596). F, I, and P refer to fertilization, irrigation, and planting dates, respectively. Mineral N was NO_3^- + NO_2^- measured by lysimeters extracting soil water at 70 cm depth.

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