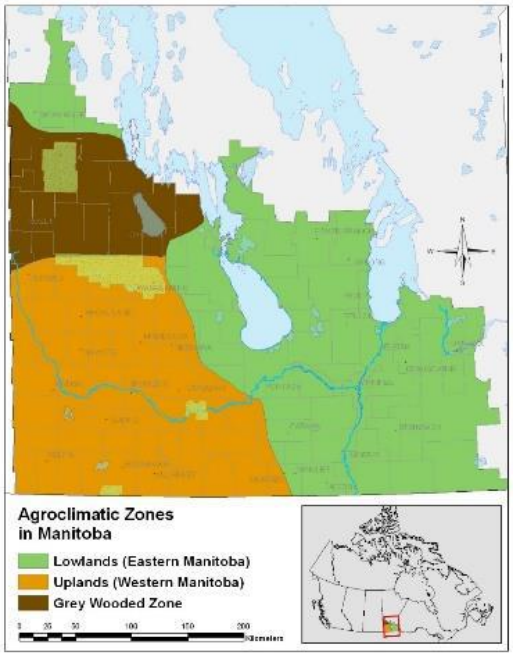
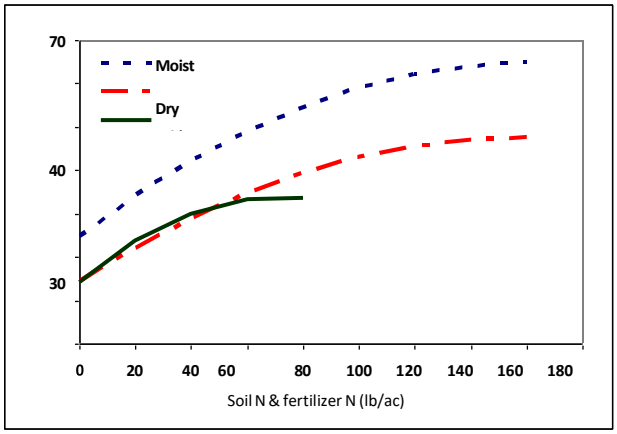
Nitrogen Rate & Timing Strategies for Wheat during Dry Springs

When soil conditions are dry and precipitation is uncertain, some wheat and barley growers may be seeking options to reduce the economic risk of applying high rates of nitrogen (N) to a moisture-limited, lower yielding crop. Past and current research may offer some options.

Traditionally, Manitoba nitrogen recommendations for spring wheat (and barley) were developed according to soil moisture conditions (Figures 1 and 2, and Table 1[1]). Under very limited moisture conditions (ARID) on well drained, sandy, coarse textured soils, yields were low and nitrogen rates modest. DRY recommendations were for modest yields and targeted for coarse soils in the east and northwest, and moderately to poorly drained soils in the west. MOIST recommendations were for heavier texture, more poorly drained soils.

Based on extensive field studies, economically optimum N rates were developed based on N cost, soil test and crop price and are posted at: https://www.gov.mb.ca/agriculture/crops/soil-fertility/nitrogen-rate-calculator.html





Figures 1 and 2. Location of moisture zones and wheat yield response to N supply.

Manitoba

Table 1 Available moisture supply by location and soil characteristics in Manitoba

Moisture	Location	Texture/Drainage
Moist	Lowlands	Any texture, poorly drained
	Uplands	Heavy textured
		Grey wooded soils
Dry	Lowlands	Coarse textured, moderately drained
	Uplands	Coarse textured wooded soils
		Other textures moderately to poorly drained
Arid	Lowlands and Uplands	Coarse textured, well drained soils

Under current production practices and with newer varieties, yield potential is considerably higher than what is provided by these guidelines above. Recent research with wheat, found that under high yield practices and varieties, a nitrogen supply (fertilizer and soil N) of about 2.25 lb N/bu was economically optimum[2]. For an 80 bu/ac crop that would be 180 lb N/ac.

This study also investigated split nitrogen timing options, finding that applying a base N rate of 80 lb N/ac at seeding followed by either 30 or 60 lb N/ac at stem elongation or flag leaf emergence produced equal to higher yields and higher protein than applying all of the N at seedling[2]. What made this so effective was that rainfall was received within days of application.

Risk averse growers may wish to use a strategy such as applying a base fertility program according to the soil moisture criteria, and then later supplementing to the higher rate based on 2.25 lb N/bu, if moisture conditions improve and yield potential is increased.

Now this approach is contingent upon rainfall to move the split N into the soil. Past studies led by Guy Lafond at Indian Head demonstrated this inherent risk, where in 1 of 3 years delayed N was stranded at the surface under dry conditions and yielded 30% less than all N applied at seeding time.[3] However, his subsequent studies showed that as long as a large portion of the required N was applied at seeding (50%+), dribble UAN applications could be delayed for wheat and canola[4] (Tables 2-3).

Table 2. Effect of N timing split on spring wheat yield in bu/ac (mean of 7 sites)[4].

Portion of total N at seeding	At seeding	1-1.5 leaf	3-3.5 leaf	5-5.5 leaf (stem elongation)
----------Yield (bu/ac) ----------				
Check – no N	31			
100%	37			
67%		36	36	37
50%		36	36	35
33%		37	36	35
0%		34	36	34

Table 3. Effect of N timing split on canola yield in bu/ac (mean of 5 sites)[4].

Portion of total N at seeding	At seeding	5-6 leaf	Start bolting	Start flowering
----------Yield (bu/ac) ----------				
Check – no N	31			
100%	45	43	42	39
67%		42	39	36
50%		40	39	36
33%		39	38	35
0%		39	34	32

If farmers choose to use a split application of nitrogen as a management strategy, they should be aware of the risks. When nitrogen is placed at the soil surface, volatilization loss or stranding is more likely.

References:

1. https://www.gov.mb.ca/agriculture/crops/soil-fertility/revised-nitrogen-fertilizer-guidelines-for-wheat-barley-and-canola-in-manitoba.html
2. https://www.mbcropalliance.ca/assets/uploads/images/MCA_factsheet3_nitrogen_FINAL2.pdf
3. https://cdnsciencepub.com/doi/pdf/10.4141/CJPS07169
4. https://cdnsciencepub.com/doi/pdf/10.4141/CJPS07169