ARBUSCULAR MYCORRHIZAL FUNGI ON WHEAT PERFORMANCE UNDER CROP ROTATION

INTRODUCTION

Canada is one of the world's leading wheat producers, with approximately 29.3 million metric tonnes of spring wheat produced in 2025. However, many regions of western Canada have experienced increasingly frequent and severe drought events over the past several decades, which can result in yield losses of up to 50% in spring wheat. Wheat plants can establish a mutually beneficial symbiosis with **arbuscular mycorrhizal fungi (AMF)**, which form specialized tree-like structures (arbuscules) within the cortical root cells of host plants. It is well established that mycorrhizal plants often exhibit greater tolerance to drought stress compared with non--mycorrhizal plants. Previous studies have demonstrated genotypic variability among durum wheat cultivars in their capacity for AMF root colonization and the subsequent influence on wheat productivity in Canada. These studies have reported positive effects of AMF on plant biomass, nutrient uptake, and grain yield. However, under current crop rotation systems in Alberta, the inclusion of non-mycorrhizal crops can disrupt AMF populations and reduce their stability in the soil. Consequently, the application of effective AMF inoculants may help re-establish and maintain the AMF–plant symbiotic relationship.

Wheat is particularly sensitive to drought stress during critical growth stages, including tillering, heading, and flowering. Numerous studies have shown that AMF can enhance crop performance, particularly under water-limited conditions. As obligate biotrophs associated with approximately 80% of terrestrial plant species, AMF forms extensive hyphal networks in the soil, enabling exploration of soil micropores beyond the reach of plant roots and facilitating access to water and nutrients otherwise unavailable to non-mycorrhizal plants. In addition, AMF can improve soil water retention and modulate physiological responses in plants under drought stress, including protein regulation in wheat roots, thereby reducing osmotic stress and helping maintain cellular integrity. Despite these known benefits, comprehensive multi-year field evaluations are limited for identifying Canadian spring wheat cultivars that promote AMF colonization and enhance drought tolerance under Alberta's soil and climatic conditions. Identifying cultivars with greater compatibility with AMF under drought conditions could help wheat producers mitigate drought-related yield losses while improving plant growth, grain yield, grain quality, and overall profitability.

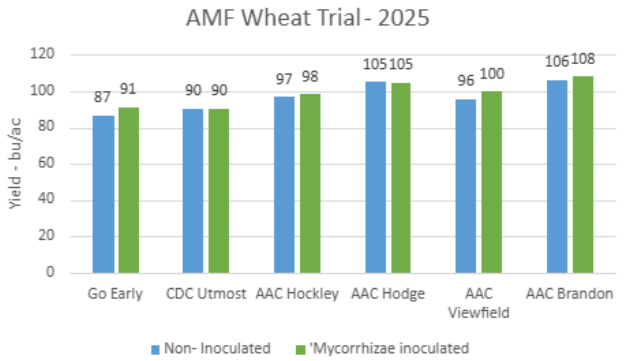
The 2025 growing season represents the second year of study evaluations conducted at two locations; the University of Alberta site and the Gateway Research Organization (GRO) site. This study assesses the performance of six Canadian Western Red Spring (CWRS) wheat cultivars under field conditions. The cultivars evaluated include Go Early, CDC Utmost, AAC Hodge, AAC Hockley, AAC Viewfield, and AAC Brandon. Key parameters measured include AMF root colonization, water-use efficiency, plant growth, nutrient uptake, grain yield, and grain protein content.

The results presented in this report summarize data collected during the current growing season from the GRO site only. A comprehensive summary of results from both locations is not yet available, as a graduate student is currently analyzing the data and preparing the full report.

AGRONOMIC INFORMATION

Seeded: May 7, 2025
Seed Depth: 1 ¼ inches
Seeding Rate: 350 plants/m^2
Rainfall Recorded: May 1 to August 26, 2025: 192.2 mm
Fertilizer:
Side banded: 25.75-4.50-15.45-5.15 @ 388.32 lbs/ac
100.0 lbs/ac Actual N; 17.5 lbs/ac Actual P; 60.0 lbs/ac Actual K; 20.0 lbs/ac Actual S
***Phosphorus (P) was applied at 50% of the recommended rate based on soil test results
Mycorrhizae Block - AGTIV® REACH™ G @ 40 lbs/ac at seeding
Herbicides: 2,4-D @ 300 ml/ac on June 3, 2025
Harvested: August 27, 2025

RESULTS AND DISCUSSION:



Results from the 2025 Westlock wheat trial indicate that the benefits of AMF inoculation were cultivar and site dependent. At the Westlock site, the overall yield increase from AMF inoculation was modest. Significant positive responses were observed in certain cultivars, particularly AAC Viewfield and Go Early, which showed noticeable yield improvements compared with their non-inoculated counterparts. Other cultivars showed minimal or no response to AMF treatment. Therefore, AMF inoculation should not be considered a blanket solution for improving wheat productivity. Instead, targeted cultivar selection and site-specific management are important to maximize the potential benefits of AMF in wheat production systems.

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ARBUSCULAR MYCORRHIZAL FUNGI ON WHEAT PERFORMANCE UNDER CROP ROTATION CONTINUED

MYCORRHIZAE WHEAT TRIAL - WESTLOCK - 2025

Trt	Treatment		Height		Lodging		Yield @13.5% Moisture				Test Weight				1000,KWT		Protein		Gluten	
No.	Name		cm		1-9		kg/ha		bu/ac		lb/bu		kg/HL		g		%		%	
1	Go Early	Non- Inoculated	101	a	1	c	5841	c	87	d	65.2	b	80.4	b	33.03	d	15.2	a	36.1	a
2	CDC Utmost	Non- Inoculated	100	a	2	a	6084	c	90	cd	66.1	b	81.5	b	34.86	bcd	14.4	c	35.1	bc
3	AAC Hockley	Non- Inoculated	85	c	1	c	6507	b	97	b	65.9	b	81.3	b	34.55	bcd	14.5	c	34.2	c
4	AAC Hodge	Non- Inoculated	94	b	1	c	7080	a	105	a	67.7	a	83.5	a	37.20	ab	13.5	d	33.2	d
5	AAC Viewfield	Non- Inoculated	81	d	1	c	6462	b	96	b	65.1	b	80.3	b	35.83	bcd	14.5	c	34.7	bc
6	AAC Brandon	Non- Inoculated	91	b	1	c	7142	a	106	a	65.3	b	80.7	b	39.38	a	14.4	c	34.9	bc
7	GO Early	Mycorrhizae inoculated	101	a	1	c	6126	c	91	c	65.0	b	80.3	b	33.13	d	15.0	ab	35.6	ab
8	CDC Utmost	Mycorrhizae inoculated	101	a	1.8	b	6058	c	90	cd	65.7	b	81.1	b	33.43	cd	14.7	bc	35.6	ab
9	AAC Hockley	Mycorrhizae inoculated	85	c	1	c	6620	b	98	b	65.3	b	80.6	b	34.74	bcd	14.5	c	34.5	bc
10	AAC Hodge	Mycorrhizae inoculated	94	b	1	c	7040	a	105	a	68.0	a	83.9	a	34.64	bcd	13.4	d	33.2	d
11	AAC Viewfield	Mycorrhizae inoculated	85	c	1	c	6723	b	100	b	65.6	b	80.9	b	36.37	bc	14.6	c	34.6	bc
12	AAC Brandon	Mycorrhizae inoculated	93	b	1	c	7270	a	108	a	65.7	b	81.1	b	39.48	a	14.4	c	34.8	bc
LSD P=.05 (% mean diff)			2.65 (3%)		0.21 (19%)		216.68 (4%)		3.12 (4%)		0.89 (2%)		1.10 (2%)		2.00 (6%)		0.36 (3%)		0.74 (3%)	
Standard Deviation			1.84		0.14		150.62		2.17		0.61		0.77		1.39		0.25		0.52	
CV			2		12.6		2.29		2.22		0.93		0.94		3.92		1.74		1.49	

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).