

Establishment of Annual Crop-Living Mulch System

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Preliminary Results

Highlights

- Wheat biomass, yield and protein content were not impacted by same row seeding of living mulch
- Mulch performance was not equal across sites

Background

- Establishing a Living Mulch at the time of seeding a grain crop may allow for sufficient mulch growth and nitrogen fixation of legumes mulches
- A successful Living Mulch will maintain living roots in the ground without decreasing the performance of the grain crops it is seeded with over two or more years

Study Objective

To study the effect of mulch species and location and their interaction on wheat biomass, wheat yield and wheat protein

To study which mulches produce more biomass when seeded together with wheat at each location in the province

Table 1: Seeding Information

Spacing and Depth	Same row, same depth as wheat
Fertilizer	140 lb/ac Total N (soil + applied)
Seeding Rate	Wheat 250 pl/m ² Alfalfa 12 lb/ac Red Clover 10 lb/ac Sweet Clover 10 lb/ac White Clover 6 lb/ac P. Ryegrass 12lb/ac
Tillage	Direct seeded
Herbicide	Glyphosate burnoff

Treatment	Wheat				Mulch				
	Emergence	Summer Biomass	Yield*	Protein	Emergence	Summer Biomass	Fall Biomass		
	pl/m ²	kg/ha	bu/ac	%	pl/m ²	Group	kg/ha	kg/ha	Group
Wheat only Control	351	9786	92	15	-	-	-	-	-
Sweet Clover	368	8682	91	15	18	b	14	84	b
Alfalfa	401	9006	88	14.2	90	a	121	452	ab
Red Clover	374	8358	91	15.1	12	b	Insufficient to biomass		
White Clover	410	10155	94	15.1	25	b	-		
Perennial Ryegrass	377	8543	83	14.9	37	b	159	1365	a
SEM	27	695	6	0.3	11		34	203	
p-value	0.7	0.4	0.8	0.4	0.02		0.08	0.03	

Treatment	Wheat				Mulch				
	Emergence	Summer Biomass	Yield *	Protein	Emergence	Summer Biomass	Fall Biomass		
	pl/m ²	kg/ha	bu/ac	%	pl/m ²	Group	kg/ha	kg/ha	Group
Wheat only Control	255	6733	37	12	-	-	-	-	-
Sweet Clover	225	7713	38	12	110	a	820	273	
Alfalfa	276	7120	39	12	148	a	895	301	
Red Clover	266	6733	33	13	49	bc	Insufficient to biomass		
White Clover	264	7532	40	12	22	c	-		
Perennial Ryegrass	280	6990	40	12	97	ab	-		
SEM	2	571	2	1	13		337	83	
p-value	0.4	0.8	0.2	0.6	0.0002		0.9	0.8	

Treatment	Wheat				Mulch
	Emergence	Summer Biomass	Yield*	Protein	Emergence
	pl/m ²	kg/ha	bu/ac	%	pl/m ²
Wheat only Control	234	7213	60	12.4	-
Sweet Clover	224	6412	53	12.0	148
Alfalfa	248	7281	59	12.8	158
Red Clover	254	7728	66	11.8	101
White Clover	251	7296	53	13.4	145
Perennial Ryegrass	253	7059	60	12.0	130
SEM	21	588	5	0.7	20
p-value	0.9	0.7	0.5	0.6	0.3

Treatment	Wheat				Mulch						
	Emergence	Summer Biomass	Yield*	Protein	Emergence	Summer Biomass	Fall Biomass				
	pl/m ²	Group	kg/ha	bu/ac	%	pl/m ²	Group	kg/ha	Group	kg/ha	Group
Wheat only Control	122	a	7774	60	12.9	-	-	-	-	-	-
Sweet Clover	80	ab	7128	61	13.2	89	c	94	a	290	bc
Alfalfa	56	b	6715	53	13.6	193	ab	153	a	557	a
Red Clover	81	ab	7291	57	12.9	128	bc	125	a	339	b
White Clover	76	ab	7357	58	13.0	206	a	10	b	118	c
Perennial Ryegrass	72	ab	6981	60	13.3	167	ab	11	b	297	b
SEM	12		409	2	0.3	15		18		40	
p-value	0.03		0.9	0.4	0.5	0.0007		0.0002		0.0001	

Materials and Methods

- Field Studies** at four Manitoba locations with different background soils and environments
- Treatments of Living Mulch species** included Red Clover, White Clover, Sweet Clover, Alfalfa, and Perennial Ryegrass.
- Experimental Design:** RCBD with four replications
- Data Collected:** Wheat and mulch emergence plant counts; mid summer plant counts; mid summer biomass for wheat and mulch; wheat yield; wheat protein; fall plant counts; fall regrowth biomass

Conclusions

- Compared to wheat controls wheat emergence, wheat biomass, wheat yield and wheat protein were not significantly affected by the presence of the living mulch, even in dry conditions
- Establishment of living mulch species varied by site

Next Steps

- Contact herbicide applied prior to seeding of Year 2 canola
- Intention to set back mulch growth so that canola can establish, but then reestablish mulch
- Use of Plant Root Simulator Probes ® to measure nitrification from spring melt through seed set
- Biomass sampling of ¹⁵N in wheat and mulches
- Soil measurements of nitrate and potentially mineralizable nitrogen

Arborg

- No impact on wheat establishment, biomass or yield
- Better Alfalfa emergence than other treatments
- Mid-summer Red Clover and White Clover largely died out.
- Fall PRG produced more biomass than Alfalfa and Sweet Clover



Left: Aerial image, Roblin, July 2023
Right: Plot harvest, Roblin, August 2023



Melita

- No impact on wheat establishment, biomass, yield or protein
- No difference for mulch spring establishment
- Herbicide application killed mulch three weeks after establishment



Carberry

- No impact on wheat establishment, biomass, yield or protein
- Sweet Clover and Alfalfa established better than Red Clover, White Clover, and P. Ryegrass
- Sweet Clover and Alfalfa produced comparable biomass in summer and in fall



Roblin

- Higher wheat emergence for wheat-only control above wheat-mulch crops
- No difference for wheat-only for summer biomass, yield, or protein
- White clover established better than other mulches
- Summer Sweet Clover, Red Clover and Alfalfa produced more biomass than White Clover or P. Ryegrass

