

natural systems agriculture



The Wilsons

Farm



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Field

Wheat with outer rows underseeded to red clover.

Significance

Intercropping plants with different characteristics increases diversity and helps crops compete with weeds. In addition, yield advantages associated with intercrops have been attributed to the enhanced use of growth resources such as light, water, and nutrients.

Because of their small seed size and slow establishing rate, research has debated whether clovers can provide effective weed control. Mustard suppression is attainable by clovers, but competitiveness varies among species (Ross et al. 2001).

Sampling

On June 14, 2006, 20 samples were taken with a 0.25 m² quadrat, with 10 samples in each of the differently managed areas. Quadrat samples were taken in an attempt to represent the whole field and all seedlings in the quadrat were counted and identified to species.

On August 2, 2006, biomass samples were taken with a 1 m² quadrat. Three samples were taken in the area with red clover and four samples were taken in the area without red clover. All plants within the quadrat were cut at ground level, bagged and dried at 70°C for 48hrs. Plants species were separated and dry weights recorded.

Findings

Density and Dry Matter Comparison

Average wheat seedling density was similar between the two areas, with 256 plants/m² or 24 plants/ft² in areas underseeded to red clover, compared to 272 plants/m² or 25 plants/ft² in areas without red clover (Table 1).

Table 1. Average crop seedling density (plants/m²) and mature dry matter (kg/ha) for the Wilson farm in Manitoba, 2006.		
Crop	Density	Dry Matter
With Red Clover		
Wheat	256	3446
Red clover	613	229
Weed	1990	1523
Without Red Clover		
Wheat	272	1615
Weed	2390	2027

Average wheat dry matter production was higher in areas underseeded to red clover at 3446 kg/ha compared to the areas without red clover which had 1615 kg/ha. This may be a result of increased ground cover and weed suppression. Although substantial, this difference is not scientifically significant. In other words, large variation was also noticeable among samples within the same treatments (Table 2),

which means this difference could also be due to chance. Landscape variations in moisture and soil conditions influenced sample measurements considerably. Also, since only a few samples were taken per treatment, it is difficult to conclude undoubtedly whether red clover underseed influenced wheat production.

Table 2. Crop and weed mature dry matter (kg/ha) for wheat on the Wilson farm in Manitoba, 2006.

Weed/crop species	With Red Clover			Without Red Clover			
	1	2	3	1	2	3	4
Wild oat	64	254	1164	778	941	2203	1461
Wild mustard	680	350	242	974	331	38	19
Lamb's quarter	49	401	57	320	98	96	51
Canada thistle	0	754	1	171	0	0	0
Perennial sow thistle	0	49	34	67	165	0	2
Barnyard grass	233	0	20	0	0	0	0
Wild buckwheat	12	34	28	40	44	62	53
Stinkweed	6	38	32	6	12	37	3
Red root pigweed	5	57	0	0	0	0	0
Dandelion	0	15	0	0	25	12	56
Foxtail	0	0	9	0	0	0	42
Unknown	-	-	-	-	-	-	5
TOTAL WEED DRY MATTER	1049	1952	1587	2356	1616	2448	1692
Wheat	2868	5479	1992	1856	1056	2024	1524
Red clover	384	23	280		-	-	-

Both weed density and dry matter production were lower in field areas underseeded to red clover. Average weed density was 1990 plants/m² in samples without red clover compared to 2390 plants/m² in samples with red clover. The average weed dry matter production was 1523 kg/ha in samples without red clover compared to 2027 kg/ha in samples with red clover (Table 3). Because of the extent of variation between samples, these differences are also not significant.

Table 3. Average weed seedling density (plants/m²) and mature dry matter (kg/ha) for the Wilson farm in Manitoba, 2006.

Weed Species	With Red Clover		Without Red Clover	
	Density	Dry Matter	Density	Dry Matter
Wild mustard	570	424	140	341
Barnyard grass	520*	84	90*	0
Foxtail		3		11
Stinkweed	500	25	1460	15
Lamb's quarters	140	169	310	141

Table 3. Average weed seedling density (plants/m²) and mature dry matter (kg/ha) for the Wilson farm in Manitoba, 2006.

Weed Species	With Red Clover		Without Red Clover	
	Density	Dry Matter	Density	Dry Matter
Perennial sow thistle	90*	80	160*	59
Canada thistle		252		43
Red root pigweed	80	21	0	0
Lady's thumb	50	0	0	0
Wild buckwheat	20	25	80	50
Wild oat	10	494	140	1346
Dandelion	10	5	0	23
Shepherd's purse	0	0	10	0
TOTAL	1990	1523	2390	2027

*Seedlings were too small to be distinguished from one another.

Weed Composition

Weed composition varied slightly between the two areas. In samples with red clover, weed density and dry matter production was higher for wild mustard, red root pigweed and barnyard grass. In contrast, weed density and dry matter production was lower for wild oat, wild buckwheat, perennial sow thistle, and shepherd's purse.



Figure 1. Wild mustard plants quickly established before red clover.

Early establishing weeds such as wild mustard were not suppressed well by red clover (Figure 1). This conflicts with a study by Ross et al. (2001) where clovers suppressed mustard growth. In that study weed seeds were sowed in plots after the clover, giving clover a slight advantage. Also, since wild mustard thrives in cool moist conditions, higher densities in the red clover seeded crop would be expected due to lower areas at the south edge of the field.

Barnyard grass existed in patches and seemed to thrive better in the red clover seeded crop. Barnyard grass seeds can float, which means that seeds would collect at the south edge of the field when water drains into its low spots. Also, barnyard grass moves in from field margins increasing the probability that numbers would be higher at edges.

Stinkweed seedlings were far more abundant in areas without red clover. Red clover competition may have affected its germination. If so, greater differences in dry matter production would have been noticeable earlier in the summer, since stinkweed had already set seed and lost its leaves when samples were taken for dry matter.



Figure 2. Wild oat patch in area without red clover.

Wild oats contributed significantly to total plant dry matter, but its growth was less in areas without red clover (Figure 2). Both wild oats and wild mustard produced more dry matter than red clover, which was only 229 kg/ha (Table).

Cropping history probably influenced these results. For example, as discussed, half of the field was seeded to alfalfa in the previous year. The majority of red clover seeded samples were from this section. Alfalfa has an extensive root system, which affects water adsorption and the amount of nutrients brought up from deep soil. It also fixes atmospheric nitrogen, maximizing nitrogen inputs into the farming system. Therefore, higher crop production in red clover seeded areas, as well as differences in weed abundance and composition may have also been influenced by past management.

Summary:

Red clover may have influenced wheat performance by reducing weed competition from annuals such as wild oats and stinkweed. Early establishing weeds such as wild mustard were less affected, but more noticeable effects may be recognisable in subsequent years. To out-compete mustard, practices contributing to quick red clover emergence such as early seeding, would be helpful. Other competitive ground covers such as berseem clover have also shown good mustard suppressing abilities (Ross et al. 2001).

In addition to red clover underseeding, management of thistle patches and wild oats would be beneficial. Competitive crops such as fall rye and winter wheat provide good competition for thistles and wild oats in spring. Mowing also prevents seed set of thistle plants and pulling thistles is easiest just after budding.

Although extreme variation occurred between samples and differences were not statistically significant, results were encouraging and since undersowing cereal crops with red clover decreases resources available to weeds, it is probable that red clover had a positive effect on wheat yield through weed suppression.

References

Ross SM, JR King, C Izaurralde, JT O'Donovan. 2001. *Weed suppression by seven clover species*. Agron. J. 93:820-827.

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