Effect of Black Medic Cover Crop on N Supplying Power of Prairie Soils

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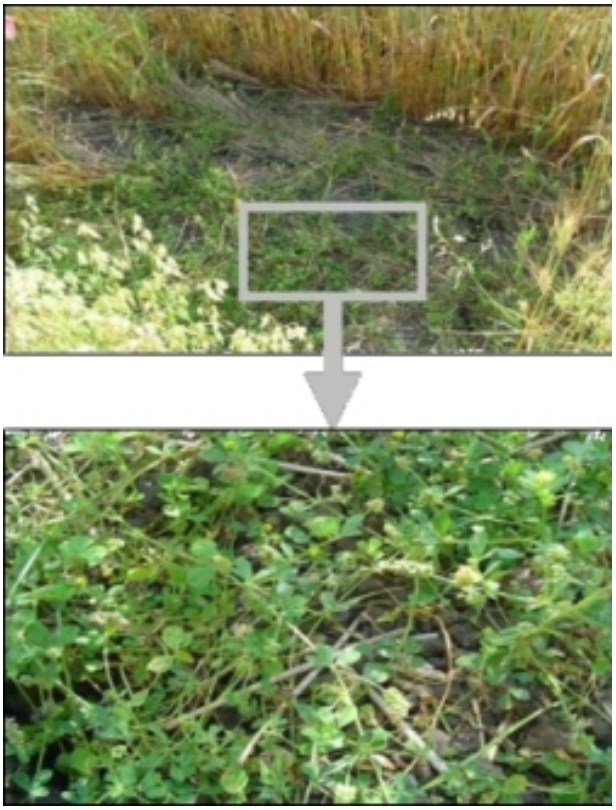
Background

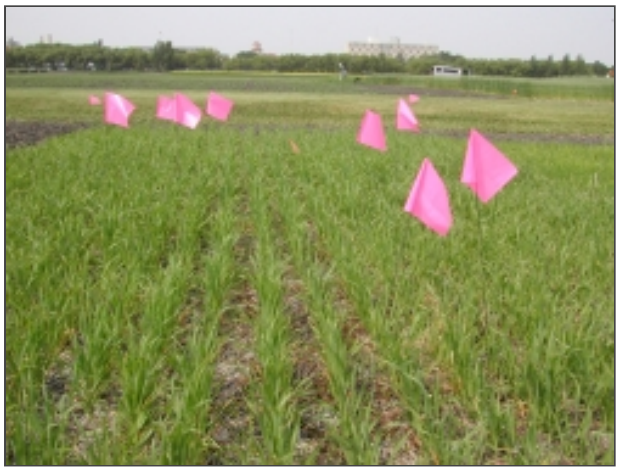
Black medic (*Medicago lupulina*) is an annual legume cover crop that has the ability regenerate itself from the seedbank every year. Producers in Europe, North Dakota, and Canada have already experimented with black medic as a cover crop. Organic farmers, in particularly in dry areas, have used black medic successfully as a self-regenerating legume during the summerfallow year. See also Self-Seeding Cover Crops for Late Season Production for more information on relay cropping with black medic.



Black medic under oats, Indian Head, 2006.

There are still many questions regarding the use of black medic as a self-regenerating cover crop in grain cropping systems. How much can a black medic cover crop contribute to the N-supplying power of the soil? How does N fertilizer affect black medic performance as an understorey cover crop?

Experiment Description



Winnipeg site.

Black medic (*Medicago lupulina,* cv George) was evaluated to quantify its soil N supply potential using long-term no-till field experiments in Manitoba (established in 2000) and

Saskatchewan (established in 2001). In each of these experiments, black medic was grown as an understorey crop in an annual crop rotation of flax-wheat-oat.


Indian Head site.

The experiment evaluated two factors in combination:

1. the main plot effect was presence or absence of medic
2. the subplot effect was N fertilizer rate: 2 levels at Winnipeg (with and without fertilizer) and 3 levels at Indian Head (20%, 60% and 100% N fertilizer rate).

Two experiments were carried out.

1. A field experiment was conducted in 2006, to determine the effect of medic on soil nitrate-N and on crop N content, biomass accumulation, N uptake and grain yield. Medic density and biomass were also evaluated.
2. Plant bioassays were conducted under controlled environmental conditions to measure the N supply potential of surface soil (0-15 cm) collected from the field experiments in late autumn 2005 and 2006.

What is the goal of this research?

The overall purpose of the research was to determine the effect of an understory crop, black medic, on soil N supply potential in different geographic regions and in different N fertilizer regimes.

What are the major findings?

Field Experiment

According to field experiment results, medic had little influence on crop performance. Grain yield reduction due to medic was observed at one of three instances.

Black medic had a significant effect on soil nitrate-N at crop tillering and maturity stages. At Indian Head, medic increased total N (plant uptake + soil nitrate-N) available at maturity by 48 kg ha^{-1}. Medic did not have a significant effect at Winnipeg due to drought conditions.

At Indian Head, medic showed highest density and biomass in 20% N fertilizer treatment and at Winnipeg density and biomass were higher in N fertilized plots compared to no N plots.


Soil sampling and tissue sampling at the Winnipeg and Indian Head sites in 2006.

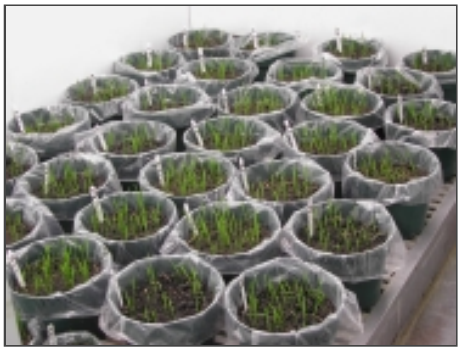
Bioassay Experiment

In the bioassay studies, medic soil from both sites showed a highly significant increase in N supply potential compared to soils without medic (Table 1). Unlike the field experiment, medic soils from both sites showed equal measure of N supply potential in the bioassay since there were no differences in growing conditions.

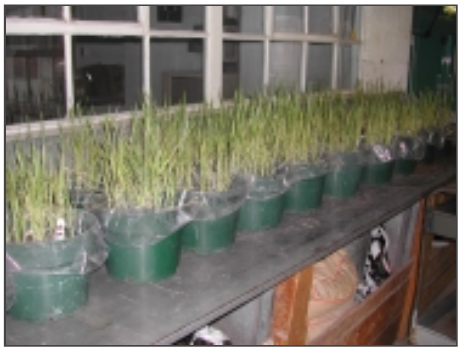
Table 1. Increase in N supply potential of soils with medic compared with soils without medic.

	Increase in N supply potential (kg N ha^{-1})	
Site	**2005**	**2006**
Winnipeg	33	38
Indian Head	32	48

Plant growth difference in medic (right) and non-medic (left) soils.



Wheat in the growth chamber.



Wheat from the growth chamber ready for harvesting.

What can black medic growers learn from this study?

Black medic performance did not appear to be affected by N fertilizer, as there were no significant interactions between medic and N fertilizer regimes in either experiment. This means that black medic is adapted to cropping systems with different types of N fertilizer management, including high and low rates of N fertilizer, as well as organic systems where no N fertilizer is applied.

The major conclusion of this research is that the black medic significantly increased N-supply potential of soils by an average of 38 kg N ha^{-1} under favorable prairie growing conditions. In this situation, farmers using black medic could save 40-60% on N fertilizer costs.

Future Research Needs for Black Medic on the Prairies

- Since black medic is a new crop to the Prairie region, it needs some introduction through extension work.
- Suitability of black medic for forage production on the prairies and also its nutritional quality need to be analyzed.
- Development of a commercial hybrid cultivar of black medic for higher biomass (and thus higher herbage N) production is needed.
- Quantification of non-N benefits from black medic cover crop has to be done.
- Evaluation of black medic performance with other prairie crops in diverse environments and management systems is required.

See also Cover Crops and Green Manures for more information on cover crop research at the University of Manitoba.

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