Legume Cover Crops

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There has been a growing interest in recent years on the use of cover crops for the purpose of protecting and/or improving the soil. Other possible benefits of cover crops include increased soil nitrogen levels, weed and pest suppression and prevention of soil erosion by wind and water.

Looking through sources of information on growing cover crops, one quickly realizes a lot of the management information on the topic comes from areas that aren't similar to Manitoba and although the information may be interesting, it needs to be dialed back to fit within our environment.

One of the local sources that I found quite useful came from University of Manitoba's Plant Science Department. Dr Martin Entz and his research team are working on natural systems agriculture.

In this article I will look at some of their work using cover crops after crop harvest to improve soil fertility utilizing legumes. Seeded cover crops can be grown during the cropping year in two ways: as relay crops or double crops. With relay cropping a legume is seeded directly into the established crop and allowed to continue growing after the first crop is removed in the fall. With double cropping the legume (cover crop) is seeded after the initial crop is removed.

In both systems there needs to be adequate time after the crop is removed in the fall for the legumes to grow so that they can add a significant amount of N to the soil. Generally this is a period of 4-6 weeks and an accumulation of 400 growing degree days (GDD).

Again, if we look at what is being talked about in the popular press, it seems that the main area of interest is with double cropping. Most of the information I see comes out of the US and southern Ontario and when we look at their situation and ours, we are comparing apples to oranges.

If you are interested in establishing a legume in the fall after a cereal crop with the intension of improving your soil, you need to consider two things:
1) Will there be adequate time for the crop to establish?
2) Will there be adequate moisture for it to germinate and grow?

Generally winter wheat or fall rye are crops that have the potential to be harvested early enough in the late summer to allow enough time to consider double cropping a forage.

Table 1 shows the number of growing degree days (GDD) and precipitation available after winter wheat harvest at various locations in Manitoba. 400 GDD are considered necessary to grow a late-season cover crop.

Location	Heat (GDD)	Rain (mm)
Morden	662	87
Steinbach	461	104
Portage	532	99
Arborg	291	84
Dauphin	376	70
Brandon	446	77

Table 1 source: natural systems agriculture

Because the fall harvest of winter cereals can vary from year to year, you can also use the seasonal reports from Manitoba Agriculture to determine the normal GDD's for your area when deciding to seed a cover crop in the late summer. You can visit their web site and enter your information at: http://tgs.gov.mb.ca/climate/SeasonalReport.aspx

The work carried out through Natural Systems Agriculture (NSA) looked at nitrogen credits from legumes to subsequent grain and oilseed crops in 2 areas: a clay soil with good moisture and a sandy-loan soil with dry conditions.

Alfalfa is a legume. Legumes co-exist with Rhizobium bacteria which form nodules on the roots of the plant. In the nodules, the bacteria convert atmospheric nitrogen into a form which is useable by the plant – a process called nitrogen fixation. The Rhizobium is applied to the seed through inoculants. Under proper management, alfalfa derives most of its nitrogen from nitrogen fixation. Nitrogen is also added to the soil by the plant. The amount of nitrogen added to the soil is approximately three per cent of legume dry matter produced.

In the field, small nodules can be seen 2–3 weeks after planting, depending on legume species and germination conditions. When nodules are young and not yet fixing nitrogen, they are usually white or gray inside. As nodules grow in size, they gradually turn pink or reddish in color, indicating nitrogen fixation has started.

Looking at Table 2 below you can see that the fertilizer replacement value (FRV) is higher in the clay soils with good moisture than in the sandy-loam soils. This can be

attributed to drier conditions and much lower legume dry matter yields at Carman. Under ideal moisture conditions, alfalfa fixed the largest amount of nitrogen per 1000 lb dry matter produced. When conditions were dry, alfalfa produced very little nitrogen and red clover used more than it produced. The annual legumes - chickling vetch and black lentil - were better nitrogen producers under dry conditions. In fact, chickling vetch produced nearly 50% more nitrogen under dry conditions.

	Winnipeg	Carman
Alfalfa	48	2.5
Red Clover	14	-33
Chickling Vetch	28	53
Black Lentil	30	25

Table 2. The FRV (LB/ac) of different legumes per 1000 lbs of dry matter produced.
Source NSA

With the relay seeding of legumes the presence of cover crops reduced winter wheat and fall rye grain yield by 3.4 to 3.8% when compared to these cereals grown without the cover crops. This yield reduction was not significant and was similar to that found by other researchers. The potential for reduction in grain yield is greater where soil moisture is limiting. Cover crop yield potential is also greater when moisture is not limiting.

When considering a cover crop here are some recommendations to consider:

- If moisture and heat are not limiting in your area try a cover crop after cereal harvest.
- Cereal and cover crops can be planted at 100% recommended rates.
- Legume cover crops must be inoculated with proper bacteria to achieve N benefits.

For more information:

Seeded Legume Cover Crops for Late Season Production

Fertilizer Replacement Value of Legume Green Manure Crops

Fertilizing Alfalfa Forage

Biological Nitrogen Fixation