25. CROP ROTATIONS 2: ALSIKE CLOVER AND ANNUAL CROP PRODUCTION

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INTRODUCTION

Although legume crops are not commonly grown in rotations by annual crop producers, recent changes in farming economics require that we re-examine the role and benefits of these crops. The greatest stigma that can be attached to annual crops is the apparent view that these crops do not produce the income stream that common annual crops such as canola and spring wheat can. Producers need to consider that while legume crops can be used for livestock feed or grown for seed production (see Table 25.1), there most significant benefit may lie in the nitrogen they are fixing during their lifespan.

Table 25.1 Common Legume Seed Prices

Legume Crop	Current Price*	Long Term*
Red Clover	$ /lb	$ /lb
Alsike Clover	$ /lb	$ /lb
Alfalfa	$ /lb	$ /lb
Sweet Clover	$ /lb	$ /lb

*as supplied by Brett Young, Rycroft, Jan. 2007

While some of this nitrogen is used by the seed or removed in haying/grazing operations, the below ground portion tied up in the root mass can be available for subsequent annual crops to use. This nitrogen can replace some or all of the nitrogen that a producer would normally apply to his annual crops.

In another trial, shown in Table 25.2, wheat was planted the year after legumes to determine the nitrogen replacement value of growing the legume crop.

Table 25.2 Nitrogen replacement value of legumes to following crops at Winnipeg, 2000

N source	N Added to Soil lb/ac	Value of N $/ac*
Chickling Vetch	**26**	**12.48**
Red Clover	**38**	**18.24**
Lentil	**49**	**23.52**
Alfalfa (1 year)	**64**	**30.72**

*46-0-0 nitrogen source used for valuation at $0.48/lb of N)

Unfortunately, we have seen producers move to shorter rotations consisting of spring annual crops solely due to cash flow considerations. Shorter rotations, often involving canola followed by a cereal crop then canola again, can lead to problems with pest and disease outbreaks. As we shorten the period between similar crops we can create the opportunity for problems to occur.

Recent dramatic increases in crop input costs, especially nitrogen (see Table 25.2) and decreases in annual crop prices like canola, are causing producers to re-think their cropping programs.

Table 25.2 Example of Fertilizer Prices

Fertilizer	2000 Price/lb*	2006 Price/lb*
46-0-0	29.1	48.0
11-52-0	28.3	30.0
0-0-62	14.6	22.0
20.5-0-0-24	27.8	24.0

*Prices from spring of the year from Agricore-United in Spirit River/Rycroft

As farming operations become larger and more intense in scope, the pressure to get the crop into the ground in the shortest possible time becomes greater. Often producers are forced to look after farming activities while ignoring other aspects of their lives, such as spending time with their families. Crop rotations can provide producers with the opportunity to spread out their work-load, reduce their crop investment risk and diversify the ecological environment of their land base.

Inclusion of a legume crop, like alsike clover, in crop rotations can pay significant benefits through their ability to fix atmospheric nitrogen. This nitrogen is then maintained in the soil where it can be used by subsequent annual crops thus reducing the nitrogen fertilizer that must be purchased by the producer. Increasing the use of legume crops will help to extend the supply of traditional fertilizer sources manufactured from natural gas.

Table 25.3 below shows estimates of yearly nitrogen fixation by alsike clover. A portion of this fixed nitrogen is removed as hay and does not remain in the soil. But what is left as root exudates, decaying roots and above ground plant mass is significant and helps to maintain soil fertility.

Table 25.3 Estimated Annual Nitrogen Fixation (kg/ha) by Perennial Legumes from Agriculture Canada Research Station, Beaverlodge

Legume Crop	In Grey Soil, lb/ac*
Alsike Clover	135

*Nitrogen fixation estimates include nitrogen in the total plant

Field studies have shown that between 10 and 20 per cent of the total nitrogen added to the soil though by green manure crop is used by the first subsequent annual crop. An additional 64 per cent of the legume nitrogen can be found in the top 1.2 meters (4 ft) of soil 14 months after a green manure crop. This nitrogen becomes available as plant residues continue to decompose.

The timing of legume incorporation should maximize top-growth and nitrogen fixation while minimizing soil moisture depletion. The present recommendation is incorporation at full bloom. After full bloom the plant material becomes tougher and will take longer to decompose and release plant nutrients for subsequent crops. Very young plant material, on the other hand, may decompose quickly after incorporation, leaving the released nitrogen vulnerable to leaching and volatilization.

It is of importance for producers evaluating legume crops in rotation to consider how different legumes vary in terms of both their ability to fix nitrogen and how soon they can do this in the growing season. For example, with red and alsike clover the differences can be dramatic and worth considering. AAFC Beaverlodge trials (Rice and Hoyt,) compared alsike and red clover both for their ability to fix nitrogen (Table 25.7) and how rapidly this is accomplished. In the case of alsike clover, by the end of July it has fixed 85% of its potential yearly total. Red Clover, on the other had, has only managed to fix 73% of its potential yearly total by the end of July. It would appear that when selecting from these two legume crops, producers should opt for alsike clover for its ability to fix more nitrogen and to do so sooner in the growing season than red clover.

Table 25.7 Annual Nitrogen Fixation By Alsike Clover Grown On A Gray Luvisol Soil.

Year Planted	Year Measured	Alsike Clover lb/ac
72	73	74
72	74	89
73	74	122
73	75	19
74	75	55
74	76	74
	Average	72

Source: Rice and Hoyt,

Winter crops such as fall rye or winter wheat involve field operations that are potentially less busy than the spring, by moving the seeding and harvesting operations from May and October to August. Winter crops begin growing much earlier in the spring and can usually be vigorously growing prior to most annual weeds. It is not uncommon for producers who grow winter wheat to report that there is no need for a grassy weed herbicide due to the competitive nature of the winter wheat choking out the wild oats.

OBJECTIVES

The objective of this trial is to compare the economics of seeding annual crops into Alsike clover stubble grown for seed production over several years using three different producer fertilizer regimes. Initially HRS wheat will be grown, followed by canola.

METHODS

2006 Brett Young Site

The plot area was seeded to alsike clover for seed production in 2003. Seed crops were harvested in 2004 and 2005. John Barbarich custom combined the alsike clover in 2005 with a John Deere 9750 combine and it did a superior job with very fine straw chopping, a consideration for producers who wish to direct seed annual crops.

On May 3rd a burnoff herbicide application was made consisting of the recommended rate of Eclipse (0.5 l/ac Roundup Transorb with 0.113 l/ac clopyralid/Lontrel). This product was selected for the improved clover control that would be achieved by having clopyralid in the tankmix and it is more affordable than buying the two herbicides separately (this is a hint people!). The clover at this time was about 15 cm/6 inches in height.

The 0-6” soil test revealed the following information:

- Nitrogen: 64 lb/ac, deficient.
- Phosphorus: 48 lb/ac, marginal.
- Potassium: 857 lb/ac, optimum.
- Sulfur: 68 lb/ac, optimum.

- EC: 0.38, good.
- pH: 5.5, acidic.
- Organic Matter: 10.0 %.

The target yield of 50 bu/ac of HRS wheat called for:

57lb N, 21 lb P_20_5, 0 lb K_2O and 19 lb S /ac.

CDC Imagine HRS Wheat was seeded at a rate of 120 lb/ac on May 15th at a depth of 0.5” using a Haybuster 8000 zero till hoe drill with 10” spacing and 3" paired rows. There were three different fertilizer treatments used:

1. 0-0-0-0
2. 40-0-0-0
3. 80-0-0-0

A randomized complete block design was utilized with three replicates.

PLOT PLAN:

north side

40-0-0-0
0-0-0-0
80-0-0-0
80-0-0-0
0-0-0-0
40-0-0-0
40-0-0-0
80-0-0-0
0-0-0-0

south side

The fertilizer was deep banded at the time of seeding 1.5" below the middle of each paired seed row.

Observations made at the time of seeding found that the burnoff herbicide performed remarkable well, there were a few areas at the edges of the plot area where the sprayer had not been turned on fast enough and it was easy to see that the clover was actively growing in these areas.

Observations made during the growing season found that we could not tell visually between the three treatments.

The plots were swathed on August 22nd and combined on September 17th. The strips were weighed with a weigh wagon and samples were retained to determine % dockage, % moisture and grade. The results are given in Table 25.9 and Figure 25.1.

Above: The 40-0-0-0 treatment on August 22nd, 2006.

Above: The 0-0-0-0 treatment on August 22nd, 2006.

Above: The 80-0-0-0 treatment on August 22nd, 2006.

TABLE 25.9 Effect of Nitrogen Rate on HRS Wheat Seeding Into Alsike Clover Stubble, Brett Young Site, 2006

Treatment	Yield bu/ac*	% Moist.*	% Dock.*	Bu. Weight lb/bu*	% Protein*	Treatment Cost $/ac	Cont. Margin $/ac
0-0-0-0	42.1a	16.5a	1.4a	60.2a	13.3a	0.00	118.58
40-0-0-0	46.3 b	16.6a	1.5a	60.2a	13.8 b	19.20	114.00
80-0-0-0	48.8 b	16.8a	1.6a	60.1a	14.4 c	38.40	105.10
P	0.01	0.73	0.89	0.92	0.001		
CV	3.3%	2.2%	28.7%	0.5%	0.9%		

*means followed by the same letter are not significantly different at P=0.05, #3 HRS Wheat 13.3% Protein @ $2.82/bu, #3 HRS Wheat 13.8% Protein @ $2.88/bu, #3 HRS Wheat 14.4% Protein @ $2.94/bu, spring 2006 46-0-0 @ $0.48/lb of N

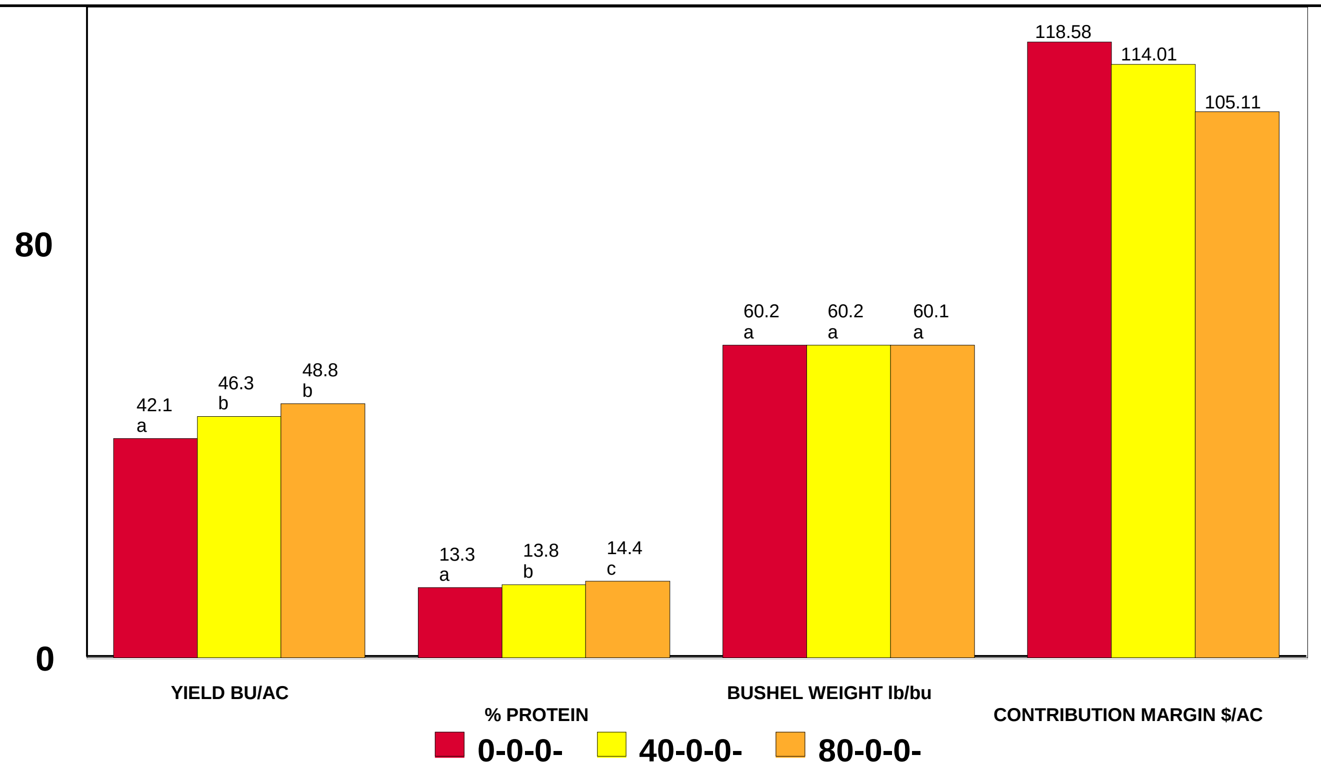

FIGURE 25.1 EFFECT OF N FERTILIZER RATE ON HRS WHEAT GROWN ON ALSIKE CLOVER STUBBLE, BRETT YOUNG SITE, 2006

RESULTS AND DISCUSSION

2006

At the Brett Young site in 2006 there were significant differences in yield (P=0.01) and in % Protein (P=0.001) of the three treatments. The 40-0-0-0 and 80-0-0-0 yielded higher than the 0-0-0-0 treatment. The 80-0-0-0 treatment had a higher % Protein than the 40-0-0-0 and 0-0-0-0 treatments. The 40-0-0-0 treatment had a higher % Protein than the 0-0-0-0 treatment. There were no significant differences in % Moisture (P=0.73), % Dockage (P=0.89) and Bushel Weight of the three treatments. Contribution Margin decreased as N rate increased.

CONCLUSIONS

2006

Legumes can be an overlooked component of an annual cropping program. With the current trend to increasing fertilizer prices, it may be time to rethink the value of these crops. While planting legume crops like alsike clover can generate income through seed production, they can also be providing an economic benefit in the years after they have been removed from production through the N mineralization that occurs to the alsike clover plant matter (especially the roots).

In order to evaluate the total benefit of these legume crops, it will be necessary to look at their benefit over several years. It is hoped that we will continue with this trial in 2007 when we will plant Argentine canola.

Based on the 2006 results, there appear to be significant benefits from planting an annual crop into alsike clove stubble without adding any supplemental fertilizer. While both fertilizer treatments (40-0-0-0 and 80-0-0-0) resulted in the wheat having significantly higher protein values and higher yields, this was not able to offset the higher costs associated with the N fertilizer used.

REFERENCES

HOYT, P.B. and HENNING, A.M.F. 1971. Effect of alfalfa and grasses on yield of subsequent wheat crops and some chemical properties of a grey-wooded soil. Can. J. Soil Sci. 51:177-183.

RICE, W. and HOYT, P.B. Forage seed notes. Alberta Forage Seed Council.

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