Wheatland Conservation Area Inc. – Project Results from the Dry Brown Soil Zone

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Abstract

The Wheatland Conservation Area Inc. manages and operates the brown soil zone Agri-ARM program in southwest Saskatchewan. Our non-profit organization conducts producer driven applied research and extension. The majority of the work done is large plot, replicated studies using field scale equipment. Small plot replicated studies are done to a lesser extent, as well as a few non-replicated demonstrations. Results are extended to producers at tours, workshops, and trade shows, as well as by newsletters, fact sheets, and a weekly radio segment called "Walk the Plots". Partnerships with government and non-government organizations, as well as industry, and producers are a large part of our overall success. Since we are the only site in the dry brown soil zone we run satellite sites throughout the south west in addition to the main site at Swift Current. This is to insure a wider audience and increased adoption rates by producers in the south west. These sites are located near Assiniboia, Frontier, Aneroid, and Success. Small, single study sites are also located in the area. Approximately forty trials are conducted annually involving pulse crops, forages, oilseeds, cereals, cereal recrops, and many others.

Resent projects include "Cereal Response to Nitrogen on Pulses Stubbles", "Cereal / Pulse Response to Swine Manure", and "Cropping for Flexible End Use Options". The various treatments are discussed in this paper.

Study Results

The "Cereal Response to Nitrogen on Pulses Stubbles" study was conducted at Swift Current, Saskatchewan from1998 - 2002. The trial consisted of seven stubbles (chickpea, pea, lentil, fenugreek, durum, oriental mustard, coriander) and replicated three times. Kyle durum was seeded at 80 lbs/ac, and Harrington barley was seeded at 80 lbs/ac into the seven different stubbles with three different rates of nitrogen. The three different rates of actual nitrogen are, high rate 70 lbs/ac, medium rate 45 lbs/ac, low rate 30 lbs/ac. The 45 lbs/ac rate is an average soil test recommended level. The crop was seeded using a Flexi-Coil 5000 air drill with double shoot stealth openers. The fertilizer was placed down the point of the openers. The main study parameters were grain yield and protein.

Moisture conditions were generally adequate for all five years of the study, with the exception of 2001. In all stubbles, both durum and barley showed a significant yield advantage to increasing rates of nitrogen. In addition, using higher levels of nitrogen on pulse stubbles seems to have

greater benefit than using extra fertilizer on cereal stubbles. This may be an indirect result of a break in disease, weed, and pest cycles along with additional moisture in the pulse stubbles. Both the durum and barley yields responded best on chickpea stubble. In general, durum responded favourably to pulse stubbles when compared to cereal stubbles, as they were able to take advantage of extra moisture and nitrogen fixing benefits of the previous year's pulse. When observing yield and protein, durum on lentil stubble proved to have the most consistent advantage (Fig. 1).

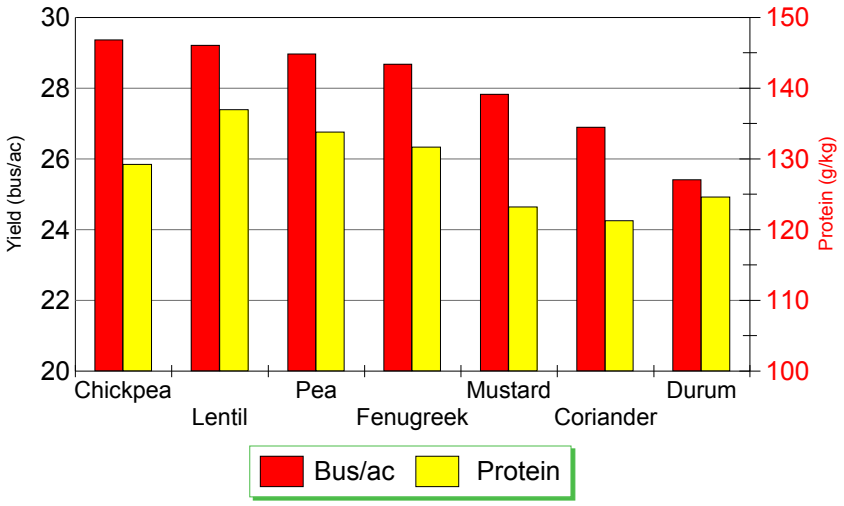


Figure 1. Durum yield and protein on various stubbles.

The barley was included in the test for the last two years only, one better than average precipitation years and one dry year. In the two years of the study looking at barley, we were unable to see a yield response to pulse stubbles verses cereal stubble. We did, however, see a protein response, with cereal stubbles showing evidence of lower proteins compared to pulse stubbles. Lower proteins would be beneficial to growers interested in malting barley.

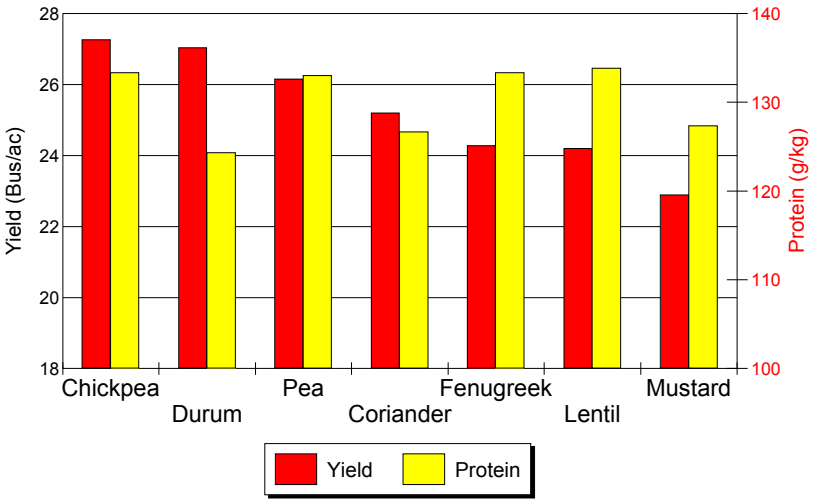


Figure 2. Barley yield and protein on various stubbles

The "Swine manure" project

Over the past few years, the Wheatland Conservation Area has been working with the Prairie Agriculture Machinery Institute (PAMI) on a Swine Manure Injection project near Swift Current. With a rapid increase in hog production in the area the need for environmentally sustainable manure management is required. This has led to producer and public demand that swine manure be applied to the soil with the least possible nutrient escape and odour. PAMI has worked to develop technology which addresses these concerns and, along with the Wheatland Conservation Area, realized the need to further examine the agronomic issues that still exist with the use of swine manure as a fertilizer.

PAMI has determined that the most efficient use of swine manure is achieved when it is injected into the soil on as narrow row spacing as possible. This conflicts with the philosophy and cultural practices in direct seeding and zero tillage systems. The farmers involved with these tillage systems require a low disturbance method of manure injection. Some low disturbance opener systems are already available but farmers are generally unaware of them. In this study, Wheatland will determine the proper amount of manure to applied, and if enough manure can be supplied in one year to fulfill the nitrogen requirements for a number of years without significant losses. The public is still unaware as to how little odour is produced in a properly configured manure injection operation and this information is equally as important to dissimilate as the agronomic information.

The swine manure treatments included a low disturbance disk at rates of 3000 gpa, 6000 gpa, 9000 gpa, and a high disturbance sweep at 3000 gpa, 6000 gpa, 9000 gpa. The urea treatments were applied at 50 lbs/ac, 100 lbs/ac, 150 lbs/ac of actual N. Urea was applied with a Flexi-Coil 5000 with the stealth opener on 9 inch rows. Two checks were also used, a high disturbance and a no disturbance check. No fertilizer was applied to the checks. These treatments were applied in the fall of 1998. Kyle durum was seeded on May 3rd 1999 and again on May 9th, 2000 at 80 lbs/ac with an Ezee-On air drill with stealth openers on 10 inch spacing. No additional fertilizer or manure was applied to the plots in either year, in order that we could determine the amount of nutrient carried over to the second year of production. The three main study parameters were yield, protein, and 1000 seed weights. In year 3, peas, chickpeas, and barley were seeded on the swine manure treatments. These three crops are commonly found near hog barns; peas and barley as a high protein feed source. We will determine the rotational benefits of these crops on land previously injected with swine manure.

Major Findings

Year 1 (1999)

Protein was increased by using higher levels of hog manure as was the case with the urea. In all cases, the protein levels in the low, medium, and high rates of swine manure met or exceeded the protein levels in the low, medium, and high rates of urea, respectively. In regard's to 1000 seed

weights, only small differences could be found between the treatments. The most dramatic results showed up in yields, where in all cases the hog manure treatments out yielded the urea based fertilizer. Higher levels of hog manure or different types of disturbances did not necessarily translate into a higher yielding crop.

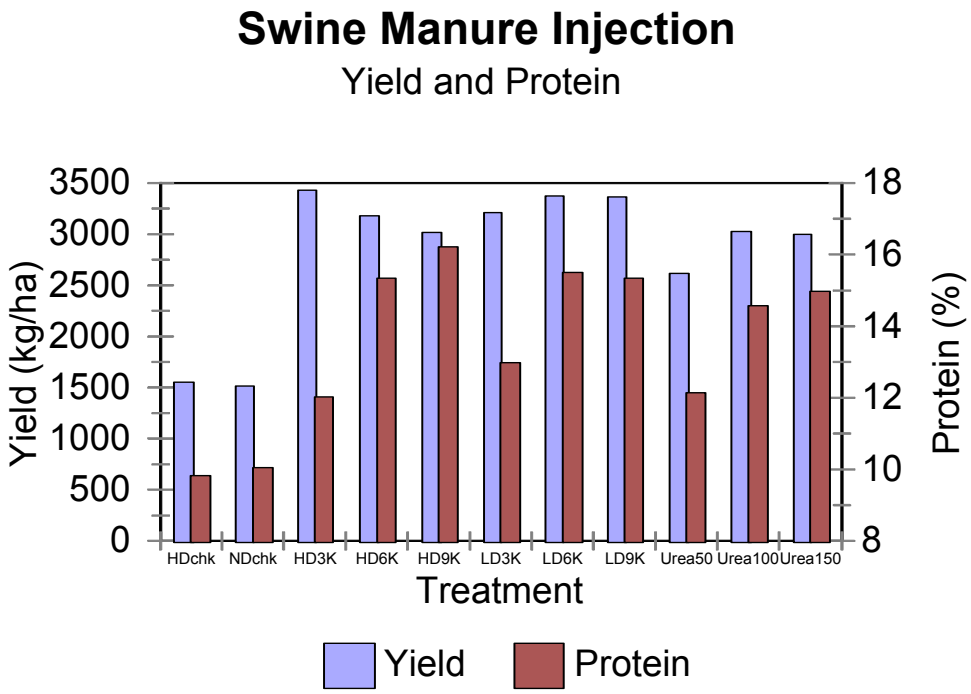


Figure 3. Yield and Protien on Swine Manure 1999

Year 2 (2000) Carryover Year

When fertilizer and manure were applied at low rates in 1998 (50 lbs/ac and 3000 gpa rates), it appears that the 1999 crop exhausted most of the nutrient. There is small yield and protein differences between the low rate treatments and the checks. However, varying amounts of nutrient carryover is apparent when higher rates of fertilizer and manure were applied (100 and 150 lbs/ac, and 6000 and 9000 gpa rates). All the 9000 gpa and 6000 gpa manure treatments out yielded the high rate of urea. Also at the two high rate of manure, where nutrient carryover is

evident, the low disturbance injection yields were significantly higher than the high disturbance injection treatments. This may indicate an advantage to injecting the manure in more concentrated narrow bands (Table 1). Keep in mind that, in both years, the crop was seeded using the same opener, any nutrient loss from the seeding operation should be identical. Protein reacted slightly different. As with yield, the low disturbance injection treatments had significantly higher protein than the high disturbance treatment at each manure rate, but unlike yield, the high rate of urea had significantly higher protein than the medium rate (6000 gpa) manure treatment. So with protein, the pattern was low disturbance followed by high disturbance manure treatments followed by urea at each respective rate (Table 2).

Table 1. Yield

Treatment	Yield (bus/ac)
Low Disturbance 9000 gpa	33.3 a
High Disturbance 9000 gpa	29.7 b
Low Disturbance 6000 gpa	26.5 c
High Disturbance 6000 gpa	23.1 d
Urea 150 lbs/ac	20.5 e
Urea 100 lbs/ac	15.1 f

Table 2. Protein

Treatment	Protein (%)
Low Disturbance 9000 gpa	14.8 a
High Disturbance 9000 gpa	14.5 b
Urea 150 lbs/ac	12.9 c
Low Disturbance 6000 gpa	12.8 c
High Disturbance 6000 gpa	11.9 d
Urea 100 lbs/ac	11.1 e

Year 3 (pulse year 2001)
Peas, chickpeas, and barley were seeded in the spring of 2001. No fertilizer was applied to any of the treatments; however, the pulses were inoculated. Yield and protein will be taken in the fall of 2001.

Conclusion

It appears there is a great nutrient potential for swine manure when injected directly into the soil. Overall, the best yields and protein were observed when manure was injected using the low disturbance type opener. The crop grown in the manure injected plots were observed to have wider, greener leaves with less disease than plants grown on the check. This enables the plant to achieve greater yield potential. As well as the agronomic advantages to injecting manure, there

Figure 4. Swine Manure Injection Carryover on Pulses

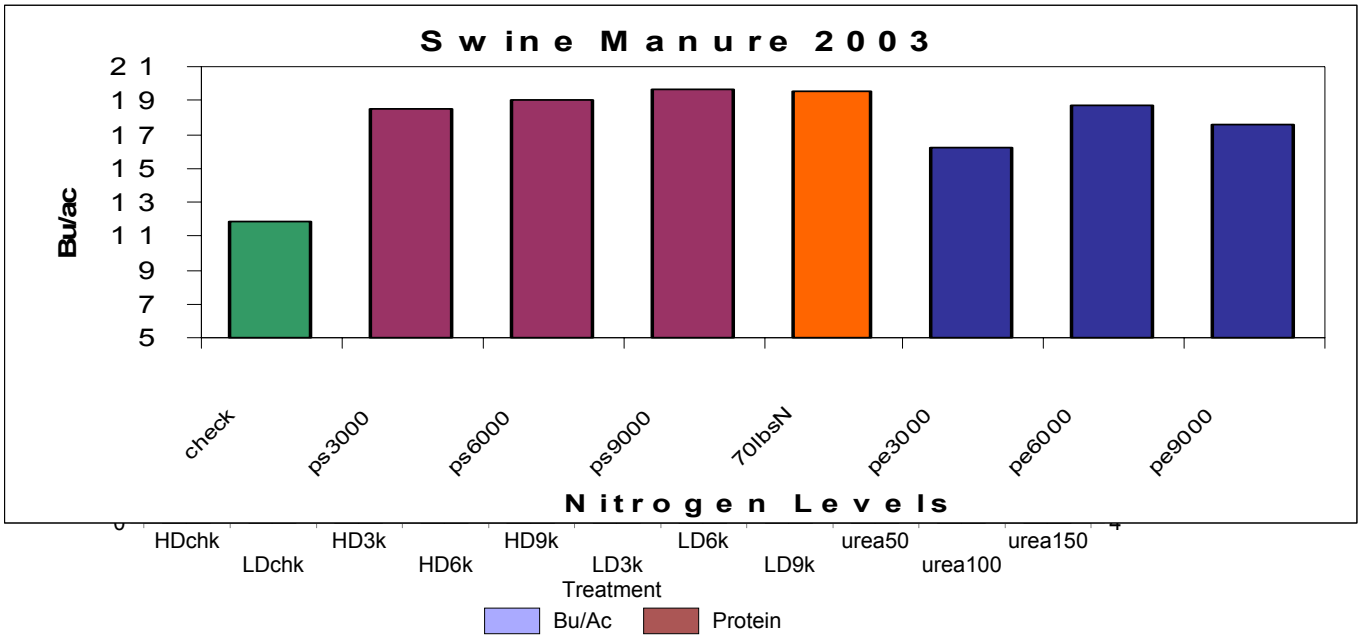
are environmental benefits, specifically concerning odor management. If not injected, the strong, foul smell of swine manure can affect the lives of neighbors for miles. However, as shown at our field day, one can comfortably stand next to the implement while the injection process is taking place. This has significant implications on issue of manure management and disposal.

Peas and barley are commonly grown near hog barns for feed, and chickpeas are growing in popularity in the southwest. It is likely these crops will be grown in a rotation on land injected with the manure from adjacent barns. This test will determine the response of these crops to the swine manure treatments set out in the fall of 1998.

Application Timing of Swine Manure (2003)

Swine manure was injected into the soil in 2003 at three rates 3000, 6000, 9000 gallons/acre before seeding and after emergence. Two checks were also included – no fertilizer and 70 lbs/ac of actual nitrogen. Application prior to seeding improved yields as compared to the post emergent application. Swine manure also increased protein when compared to the fertilized check.

Figure 5. Swine Manure Injected before and after Emergence

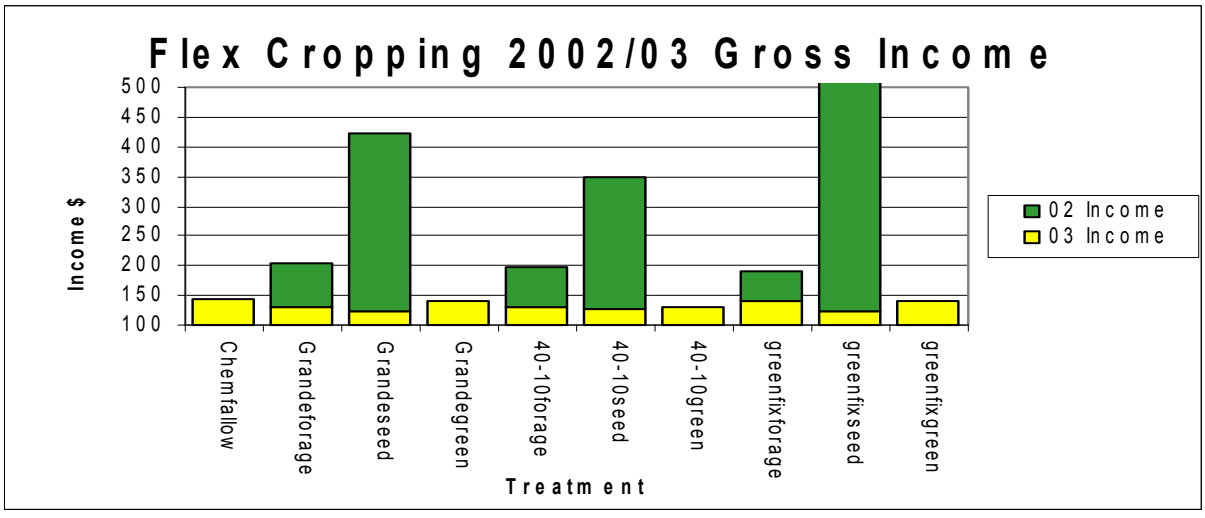


Flexible Cropping Systems

Nine crops were seeded in 2002, Grande pea, 40-10 silage pea, AC Greefix, Fababean, Forage oats, Forage Triticale, Forage barley, millet, and corn. All the crops were harvested for forage and seed. The pulses were also greenmanured using glyphosate on July 10th. The plots were then recropped to durum in 2003. We looked at gross income for the crops in a two year period. The following commodity prices were used.

- Durum 2003 - $4.37 bu source - Nov Pro
- 2002 Prices
- Lentils .18 cents/lb, Peas $5.98bu. Greenfeed $70 tonne source – Sask Ag Stats book.
- Oats $3.08 bu, Barley $3.26, Triticale $4.06 source - Wheatland Commodities
- Greenfix 30 cents/lb, Fababean $5.50 bu source - Local producers

Figure 6. Pulse/Durum Gross Income



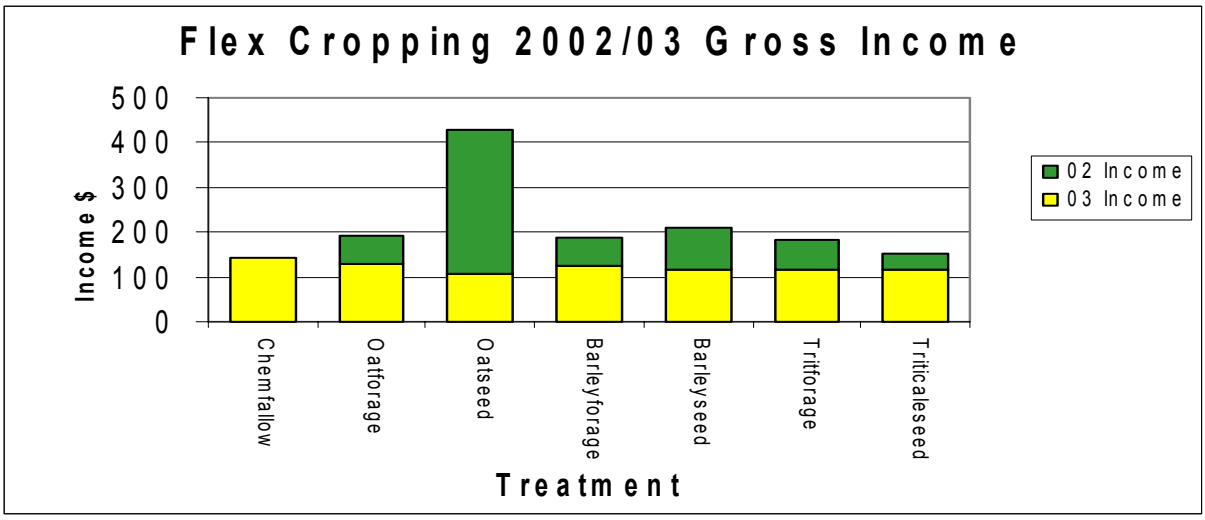


Figure 7. Cereal/Durum Gross Income

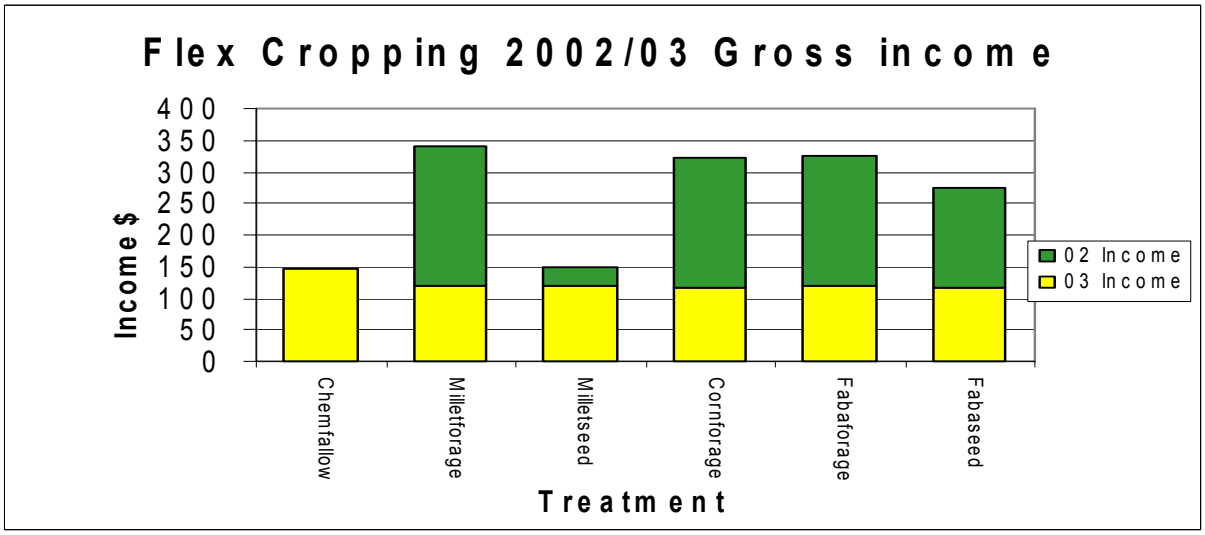


Figure 8. Other Crops/Durum Gross Income

Results and Conclusions

In general best gross income was achieved by growing the 2002 crop to maturity and harvesting it for seed. Due to the wet fall of 2002 and the dry summer of 2003 very little recrop differences on the durum were noticed. Very good forage yields were achieved by the C4 crops this may not always be the case as 2002 was a very good year for warm season crops. In the two year period their was no advantage to using chemfallow or greenmanure.