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New & Improved Recipe for Extra Forage After Winter Wheat

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Hard Lesson on Forages in 2012

In 2012 much of Ontario experienced dry, challenging conditions that caused shortages of hay and haylage. At that time many producers turned to 'emergency' forages, including cereals and cereal-pea mixtures to supplement low inventories. As a result, a group of OMAFRA and University of Guelph collaborators led by Dr. Bill Deen and Ken Janovicek and began to research the **best** option and protocol for forage-after-wheat if another forage shortage were to arise. The work was funded by Beef Farmers of Ontario and the Ontario Forage Council via the Farm Innovation Program, Agricultural Adaptation Council. Indeed, the conditions of the summer of 2012 and its disappointing forage yields may be happening again now in many parts of the Province and this new research provides some simple, straightforward recommendations to maximize high quality forage yields. Yield data was collected over several research stations and farm sites throughout southern Ontario, while the nutritional quality data was generated from formal research station sites.

Forage-After-Wheat Recipe, In Short:

- 80 kg per ha of oats seeded ASAP after wheat harvest
- 50 kg of N per ha
- Pray for rain
- Plan to harvest as silage by the end of October
- Quality by maturity stage is not greatly affected by early November, but likely will only make 'boot'

This recipe is based on the yield and quality data as extra seed (more than 80 kg/ha) and other variety choices (barley alone, added peas, triticale) do not have any yield or quality advantage over oats alone as shown in Tables 1 and 2. Table 2 is 2014 data only, with triticale inclusion in the University station plots that year. Both of these tables show that all the forages harvested were of very high quality in terms of total digestible nutrient (TDN). Only in cases of very high land quality and assurance of good growing conditions, does N beyond 50 kg appear to help (results not reported here). All forages tested also seem very stable in terms of quality over stage of maturity, although producers ought to plan to harvest it around boot stage or soon after. In other words, this 'recipe' is the best prospect for good yields, low risk, and feed quality success in cost-effective forage-after-wheat.

Table 1. Cereal crop variety and seeding rate effects on average yield and TDN content harvested at boot stage with 50 kg-N/ha at the Elora and Woodstock research station trials that evaluated fall harvested cereals in 2013 and 2014 (*Adapted from Deen et al., unpublished 2016*).

Crop	Dry Yield (0% Moisture) - tonne/ha -	Total Digestible Nutrients (TDN) Energy Content %	Energy Yield Harvested - tonne/ha -
Barley	1.2 [b]	76.6 [a]	0.88 [b]
Oats (120 kg/ha)	2.4 [a]	74.4 [a]	1.80 [a]
Oats (80 kg/ha)	2.3 [a]	74.3 [a]	1.75 [a]
Oats + Peas	2.2 [a]	74.8 [a]	1.64 [a]
se[++]	*0.22*	*8.9*	*160.3*

Note: *Results for dry yields, energy content and energy yields with differing superscripts and different fill colour are statistically different.*

What's Winter Wheat Got To Do With It?

Because of the early harvest period and resulting gap in the typical Ontario cropping cycle, going onto winter wheat ground with forages right after harvest is a very easy option. In truth, cover crops should be going on this ground anyway for soil health and erosion control reasons, and if agronomic need can meet a forage shortage it's the elusive 'win-win'. The protocols and results for forage-after-wheat can easily be adapted to other situations, but forage is truly a 'no-brainer' after winter wheat.

Table 2. Cereal crop varieties in 2014 only, a year where plots included triticale. Effects on average yield and TDN content harvested at boot stage with 50 kg-N/ha at the Elora station evaluating fall harvested cereals. (*Adapted from Deen et al., unpublished 2016*).

Crop	Dry Yield (0% Moisture) - tonne/ha -	Total Digestible Nutrients (TDN) Energy Content %	Energy Yield Harvested - tonne/ha -
Barley	1.3 [d]	76.7 [a]	0.99 [d]
Oats (120 kg/ha)	2.8 [a,b]	72.6 [a]	2.05 [a,b]
Oats (80 kg/ha)	2.9 [a]	73.5 [a]	2.15 [a]
Oats + Peas	2.5 [b]	73.5 [a]	1.86 [b]
Triticale	2.0 [c]	75.2 [a]	1.41 [c]
se[++]	*0.12*	*15.9*	*97.5*

***Note:** Results for dry yields, energy content and energy yields with differing superscripts and different fill colour are statistically different.*

Why not Pasture?

The results presented in Tables 1 and 2 and the resulting recommendations are focused on stored forages, as that data is much more easily collected (mechanical harvest of plots, etc). Again, these principles can be applied to grazing systems too. Grazing is likely an even more economical option, so long as there are fences! At the risk of extrapolating (without the benefit of grazing data) the use of oats-only and seeded at 80 kg/ha seems logical for pasture too. However, this oat option has not been properly compared in Ontario to other options such as brassicas (turnips, forage rape, etc) which are used after wheat for grazing here and in Michigan.

Bottom Line

Based on good data collected over several years and locations in Southern Ontario (including on-farm plots not reported here), oats alone seeded at 80 kg/ha and fertilized at 50 kg N/ha is the simplest and best option for using cereal species for extra high-quality forage after wheat. Brassica species and extra nitrogen might have some additional potential on some ground, but the cereal planting recommendation resulting from this study is based on sites that were heavily repeated over several years and multiple locations under rigorous protocol. Yes it's that easy!

Figure 1: Cereal crops and especially oats can provide high quality forages and good yields if planted immediately after winter wheat and harvested in mid-Fall.

Figure 2: A study funded by Beef Farmers of Ontario and the Ontario Forage Council led by Dr. Bill Deen at the University of Guelph found seeding 80 kg oats and 50 kg N per hectare is the best prospect for Fall forage.

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A closer look at monensin inclusion levels in feedlot diets

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The use of monensin is a commonly used in feedlot diets in Canada to stabilize dry matter intake and improve feed conversion. In the past, label claims included inclusion rates up to 33 ppm; however, more recently the Canadian Food Inspection Agency increased the maximum inclusion level for feedlot cattle to 48 ppm. The ionophore monensin works to alter the rumen microbial population changing the predominant short-chain fatty acids (SCFA) that are produced by the rumen microbial populations. The resulting shift in SCFA profile increases propionate at the expense of acetate, resulting in greater nutrient capture from the feedstuff. While numerous studies have established the impacts of monensin at traditional inclusion rates of 22 or 33 ppm, very few studies have investigated beef cattle responses at higher monensin doses.

Recent work from the University of Saskatchewan, published in the Journal of Animal Science, took a closer look at the impact of monensin inclusion levels on total tract digestibility, rumen SCFA concentration, and SCFA absorption from the rumen. In a Latin Square experiment, four Hereford crossbred ruminally cannulated heifers were fed a high grain finishing diet (76% barley grain, 12% barley silage) and offered either 0, 22, 33, or 48 ppm of monensin.

Feed intake, performance and digestibility
Throughout the experiment, heifer bodyweights remained similar between the different monensin inclusion levels. Individual feed intakes measured at the end of each feeding period revealed that intakes decreased with increasing monensin concentration (Table 1) including decreased dry matter intake at the 48 ppm inclusion level. There were also numerical decreases in the day-to-day variation in feed intake with those fed 48 ppm monensin having the least variation in intake during the measurement period. This suggests that perhaps using monensin at the higher dose rate may be useful to producers at times when intakes may be highly variable, as variable feed intake can increase risk for ruminal acidosis and poor feed efficiency.

Nutrient digestibility is an important consideration in maximizing efficient feedlot production and reducing nutrient loss. In this study, overall total tract digestibility was not impacted by monensin concentration. However, ethanol soluble carbohydrate (simple sugars) digestibility, increased linearly with increasing monensin inclusion level. Although the reason why minor changes to ethanol soluble carbohydrate digestibility occur is not clear, overall increased monensin inclusion did not negatively impact total tract digestibility.

Table 1: Body weight, feed intake, rumen pH and short-chain fatty acid (SCFA) concentration in heifers fed a high grain diet differing in monensin concentration

	Dietary Treatments					P-value	
	0 ppm	**22 ppm**	**33 ppm**	**48 ppm**	**SEM**	**Linear**	**Quadratic**
Body weight, kg	358	347	347	357	10.2	0.82	0.25
Dry matter intake, kg/d	10	10	9.3	9.1	0.35	0.012	0.37
Standard deviation in dry matter intake, kg/d	0.93	0.62	0.48	0.47	0.213	0.13	0.6
Total tract digestibility, %	79.4	77.3	76.3	78.8	1.62	0.60	0.17
Mean rumen pH	5.83	6.03	5.75	5.88	0.125	0.97	0.66
Total rumen SCFA concentration, m*M*	132.7	128.4	133	132.2	3.88	0.93	0.51
Acetate, %	49.9	49.4	49.2	48.5	1.79	0.59	0.91
Propionate, %	31.2	31.9	33.5	35.9	3.41	0.35	0.73
Butyrate, %	14.7	13.3	13.7	12.7	1.75	0.54	0.95

Rumen pH, Short Chain Fatty Acid (SCFA) concentrations and absorption

Low rumen pH can be an indication of ruminal acidosis and result in poor feed conversion and poor performance over the finishing period. Mean rumen pH was similar amongst all monensin inclusion levels, indicating that monensin did impact rumen pH. Rumen SCFA concentrations (acetate, butyrate, and propionate) also did not differ with monensin inclusion levels. However, ratios of acetate to propionate did improve linearly with increasing monensin inclusion levels (Figure 1). This indicates that the new higher monensin inclusion levels are consistent with known impacts on rumen fermentation and may offer further improved feed utilization, however this needs to be verified in additional experimentation.

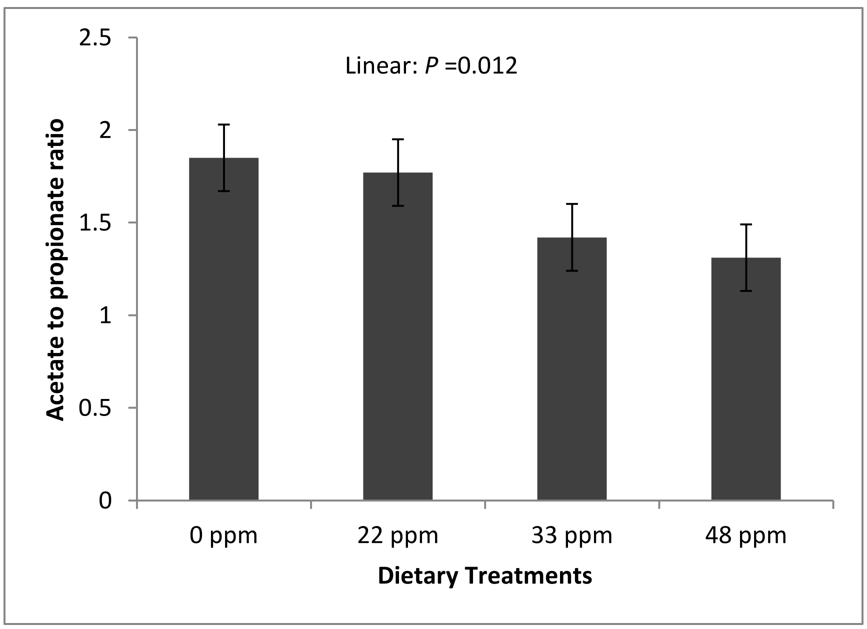

Figure 1: Rumen acetate to propionate ratio from heifers fed differing concentrations of monensin

One aspect that was not known is how monensin impacts the absorption of SCFAs in the rumen. This is important as SCFA are the primary soure of energy for beef cattle. Short-chain fatty acid absorption can be measured in ruminally cannulated cattle using the washed-rumen technique. For this technique, the rumen is emptied and washed free of digesta and the esophageal and omasum openings are temporarily plugged. Then a warm solution with a known SCFA concentrations is placed into the rumen, continually mixed, and the solution is sampled over time to determine disappearance of SCFAs from the solution, which equates to SCFA absorption across the rumen (Figure 2). The absorption rate of SCFAs (acetate, butyrate, propionate) was not different among all monensin inclusion levels (Figure 3), indicating that absorption of SCFAs was not significantly impacted by monensin concentration.

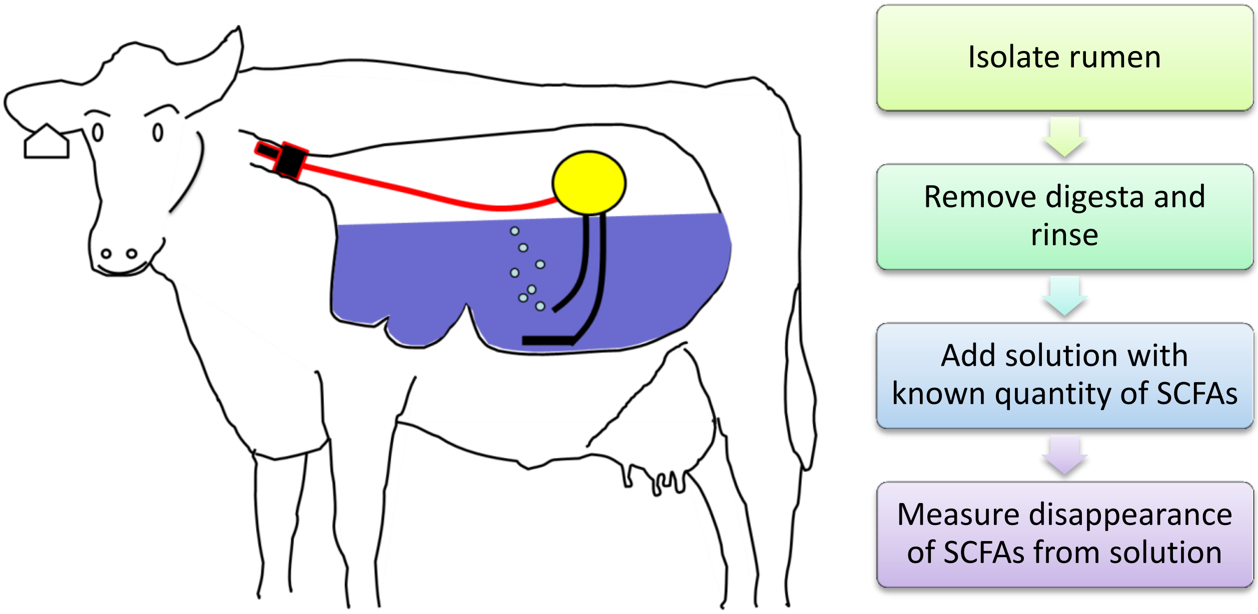

Figure 2: The temporary isolated washed rumen technique for measuring absorption of short-chain fatty acids (SCFAs) from the rumen.

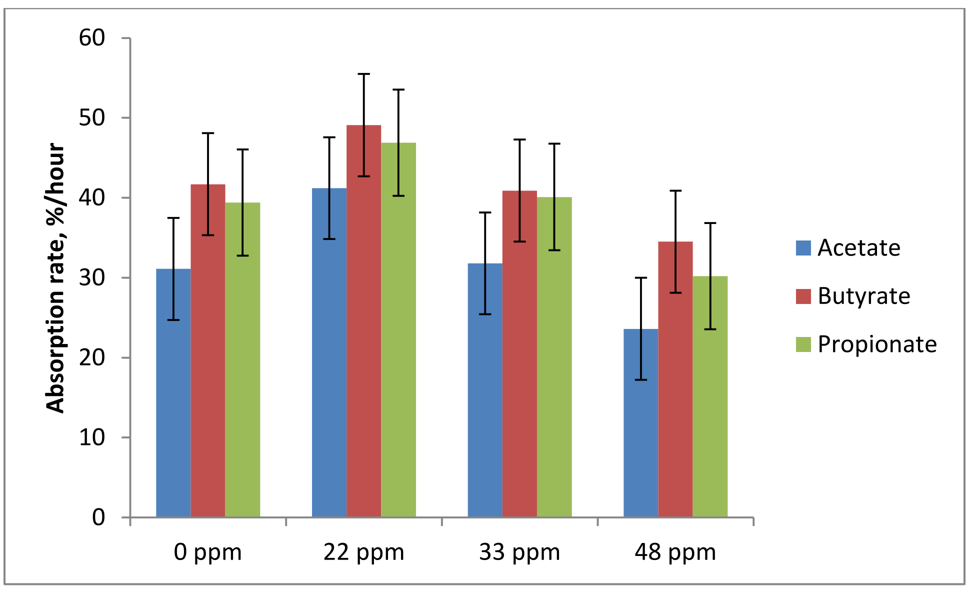

Figure 3: Rumen absorbance as determined using the washed rumen technique from heifers fed differing concentrations of monensin

Should you consider using increasing to 48 ppm monensin?

As there were limited negative impacts on the animal in increasing to the new 48 ppm inclusion, the decision to increase to 48 ppm monensin in the ration may come down to an economiclly based one and will these new inclusion levels have a positive return of investment in commercial feedlots. As this study was a small number of animals, it was not possible to evaluate overal growth performance and feed efficiency measurements at the higher inclusion rate. However, If monensin costs are aproximatly 6 cents per day at 33ppm, an increase to 48 ppm is roughly 8.75 cents per day. If feed cost of gain is assumed at $1.6 kg gain/d, an approximate 2% improvement in feed conversion is needed to break even. In addition, with observed decreases in feed intake and a potential for reduced variation in feed intake, including monensin at 48 ppm may help to normalize feed intake, which may positively impact rumen health.

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Surveillance and Biosecurity – Active engagement with *Salmonella* Dublin Bovine Network Surveillance Project 2016

Ann Godkin, Cattle Veterinarian, OMAFRA, Elora

To date, in 2015 and 2016, there have been almost 40 isolations of *Salmonella* Dublin from Ontario herds at the Animal Health Laboratory (AHL) in Guelph. Until 2012 the infection had never been identified in Ontario cattle. The positive samples have come from calf mortalities in about 10 veal and two dairy operations. This doesn't sound like a lot but judging by what has happened in New York State and Quebec over the last 10 years, this could be the beginning of a larger invasion.

Outbreaks of disease with *S.* Dublin can be very severe. Typically calves between the ages of 2 weeks and 4 months are most affected. In some reports 40 to 50% of exposed calves die. In most Ontario situations the most visible sign has been pneumonia. Diarrhea is far less prominent than one would expect. In young calves the *S.* Dublin bacteria enter the blood stream and circulate to a variety of organs such as the lungs, liver, spleen, joints and stomach lining. A very poor response to antibiotic treatment and an increase in calf deaths is what prompts herd owners and their vets to submit samples to the lab.

A concerning aspect of the current *S.* Dublin isolates is the multi-drug resistance (MDR) of the current strain. So far the Ontario isolates, like the ones in New York and in Quebec, are resistant to most antibiotics available for calf treatment. Few calves that become sick during a *S.* Dublin outbreak are successfully treated.

Cattle movement is how *S.* Dublin enters a dairy, beef or veal operation. Typically the infection moves from farm to farm via carriers, infected yearling or mature cattle that show no signs, or in young calves that are already infected but not yet showing signs. As over 70% of Ontario dairy producers reported introducing cattle into their herds over a recent five year period we suspect that more herds are infected than those who have had disease detected in laboratory submissions so far.

S. Dublin can infect people as well as cattle. And in people as in cattle, *S.* Dublin infection is both invasive and multi-drug resistant. On farms where *S.* Dublin could be present everyone working with cattle should take basic biosecurity precautions to avoid infection. Biosecurity practices should be reviewed. Frequent hand cleaning or gloves, protective clothing that stays in the barn, sanitation of feeding and handling equipment and so on will help to protect people and calves. Young, immunocompromised and older people are more vulnerable to infection. People access to the calf area should be restricted, especially if calves have been sick.

As part of the provincial disease surveillance strategy, a bovine health network group has been formed to communicate with industry, government, researchers and laboratory services regarding important cattle disease issues. The group has recently initiated a project to investigate calf health and, in particular, *S.* Dublin. The project has two parts. In Part One a dairy producer can sign up to have a bulk tank milk sample tested for antibody to *S.* Dublin to check for carrier cows. Testing bulk tank milk is a first step to evaluate how prevalent *S.* Dublin is within Ontario's dairy herd population.

In Part Two, project funding offsets the charges for veterinarians to do, or submit, calves from dairy, veal or cow-calf farms for post-mortem examination. PM's can be done by the herd vet at the farm, with samples submitted to the lab, or the entire calf can be submitted to the Animal Health Laboratories in Guelph or Kemptville.

If you are interested in participating in the calf PM part of the project, contact your herd veterinarian to find out how to enroll in this surveillance project. Project details are also available from Ann Godkin (ann.godkin@ontario.ca or 519 846 3409).

This project is funded by the OMAFRA-University of Guelph Strategic Partnership, under the Disease Surveillance Plan, which is a joint federal-provincial Growing Forward 2 project.

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