Virtual Beef

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Timing Spring Turn-out

Christine O'Reilly, Forage and Grazing Specialist, OMAFRA, Lindsay

Spring is in the air, and cattle and farmers alike are eager to start the grazing season. Timing that delightful move is critical, as spring grazing management sets up both yield potential of the pasture and the amount of gain achievable for calves and yearlings.

How early is too early?

Livestock should go out on pasture when grasses have fully developed three to four new leaves. Turning out earlier than this is very stressful on the plants. Perennial forages rely on carbohydrates stored in their root systems to fuel regrowth when they break dormancy (*Figure 1*). The plants do not refill those carbohydrate stores until they have enough leaf area to produce more sugar than they need to grow. By waiting until grasses have three to four fully developed new leaves, those plants are given a chance to put energy back into the roots. The plants will draw on those reserves again to recover from grazing. If cattle go out to pasture too early, the plants have not been able to refill their root reserves and there is no energy to draw on when grazing takes their leaves away. This early spring stress will reduce pasture yields for the rest of the grazing season. If livestock are turned out too early year after year, weeds that begin their growth later in spring than grasses may be able to out-compete the forage plants.

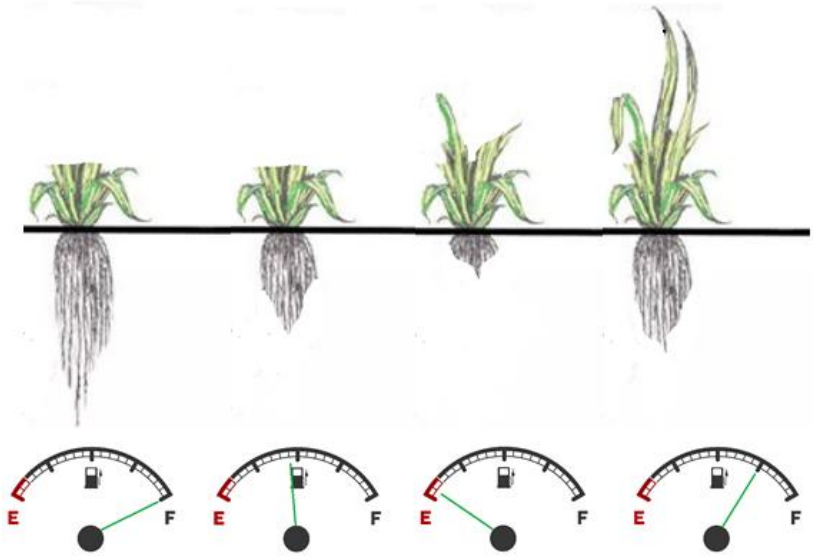

Figure 1 – Root carbohydrate reserves change during grass regrowth

How late is too late?

Waiting too long can have negative effects on livestock production. Spring grass growth is very rapid, and it is easy for pasture maturity to get ahead of animal consumption. Once plants enter their reproductive stages, feed quality and palatability decline quickly. This reduces gains in young stock and milk production in cows with calves at foot. For the first grazing rotation, cattle should be moved quickly through paddocks to nip the tops off everything, which will delay the onset of reproductive growth stages. The second rotation through the paddocks will be slower and make more use of the grass that is there. Many producers manage forage quality by taking a first cut of hay (or haylage) off part of their pasture ground and bringing those acres back into the grazing rotation in the late spring or summer once the plants have recovered and grass growth has slowed.

One way to check whether grasses are too mature is to grab a handful and slide your hand along the leaves. If the grasses are coarse, sharp, or cut your hand they are very mature and are no longer palatable to cattle. Another quick test: would it feel nice to walk barefoot through that paddock (avoiding cow pies of course)? Young stock are even fussier eaters than mature cows. Their mouths and muzzles are more sensitive, and they do not like being poked in the face by their food. To keep intakes and gains up, graze plants frequently enough to keep them in a vegetative state. Maintaining grass quality also reduces the need for energy and protein supplements, which saves money.

What about wet pastures?

Spring grazing often involves managing wet conditions. Pugging (also called poaching) is hoof damage that creates divots in a pasture and exposes grass roots and bare soil. This kind of damage can reduce pasture yields, and the uneven surface may make haying operations difficult. Not grazing during these wet conditions is an option, but with rapid spring grass growth delayed grazing makes managing grass quality even more difficult. Research in Ireland has shown that cattle with unrestricted access to pasture spent only 37% of their time grazing (Kennedy et al., 2012). Livestock do the least amount of pugging damage to a field when they are grazing. Other activities, such as visiting the water trough or mineral source, lying down, or socializing cause more damage.

Researchers studied restricting the amount of time that cattle spent on pastures to try to reduce pugging damage. They found that cows can eat their daily forage dry matter intake during two 3-hour periods each day, and spend 98% of their time on pasture grazing under this type of management (Kennedy et al., 2012). This has led to the development of a management technique called on/off grazing, where cattle are let out to graze for three hours in the morning, then brought into a barn or dry lot until they are turned out to graze for another three hours in the afternoon or evening. For each grazing interval they are only given access to the amount of grass the herd can eat in that time, so it is a modified form of strip or block grazing. The Irish study showed that when cows were not restricted in the time they could graze, pugging damage resulted in 20% less grass yield compared to the on/off grazing management.

Another way to minimize pasture damage is to use several gates. If the herd enters the paddock through one gate and leaves through a different gate the traffic through each gate area is cut in half. This decreases the amount of pugging and soil compaction around gates. Leaving behind more residual grass can also help protect the field from pugging damage. In tame pastures, leaving 10 – 15 cm (4-6 in.) might be appropriate under wet conditions.

Waiting to let cattle out to pasture until the grasses have three to four full leaves reduces stress on the plants and contributes to higher pasture yields all season. Managing fast spring growth to keep grasses in a vegetative state will maximize gains on pasture. Wet ground in spring is a challenge, but careful management can prevent field damage and maximize forage quality for the rest of the season. Getting the timing of turn-out right sets up the pasture for success.

References

- Kennedy, E., O'Donovan, M., Delaby, L., and Boland, T. 2012. Strategies to increase the length of the grazing season for spring and autumn calving cows. Teagasc Technology Updates. Available: https://www.teagasc.ie/media/website/publications/2011/Extending-the-Grazing-Season_5798.pdf

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Preparing your Bull for the Breeding Season

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The breeding season for bulls is short but intense. Consequently, when the breeding season begins your bull must be ready to go and have the appearance of a well-muscled athlete. The bull needs all that physical fitness as he will spend a significant amount of time following cows rather than feeding over the course of the breeding season. To deliver success with calves on the ground, your bull must be in good nutritional and physical shape when the breeding season rolls around.

Preparing your bull for the current year's breeding season begins at the end of the previous year's breeding season. This article discusses key considerations to get maximum performance out of your bull.

Bull Nutrition

Bulls should be body condition scored between 30 and 60 days prior to turnout (the earlier the better!). An ideal pre-breeding target body condition score (BCS) is between 3 and 3.5. A bull with a BCS of 2 or less should be deemed unsatisfactory for use as the animal is unlikely to be able to perform adequately over the intensive breeding season. Equally, bulls classed as obese should not be used as semen quality is likely to be affected due to fat deposition in the scrotum. Fat interferes with thermo-regulation – an important component of quality sperm production. Bulls that are marginally under the ideal BCS 60 days out from breeding will benefit from being put on a higher plane of nutrition. Attempting to get thin bulls to an ideal BCS will often lead to bulls getting fat rather than fit. Fat bulls have poorer semen quality and from a libido perspective are often lazy.

Yearling bulls need a diet containing 13.5 – 14% crude protein with no more than 60% grain. The inclusion of forage in the diet should increase as the young bull matures. Mature bulls will be adequately supplied with a 12% crude protein diet. Often this protein requirement can be met by offering moderate to good quality forage. Mineral supplementation is critical, as an adequate supply of minerals (particularly vitamins A & E and zinc) are important to build the bull's physical fitness and to prime the reproductive system for the breeding season ahead.

Over the course of the breeding season bulls can lose between 220 and 330 lbs in weight, even on very good pasture. Once the breeding season is complete, your bull needs to be placed on good pasture, have access to good quality forage over the winter, and have continued access to minerals and water so that he can regain his strength and fitness.

Foot Trimming

Foot trimming should be carried out at least 30 days and ideally 60 days out from the start of the breeding season. This will give time for the hoof to recover from the effects of trimming and, if there are any hoof issues detected, to give time for those issues to be treated.

Vaccinations

The time leading up to breeding season is also a good time to revisit and execute your annual vaccination protocol. Bulls should be vaccinated with the same vaccines used on the cows. In Ontario, vaccination against BVD and IBR should be considered standard practice. Vaccination against leptospirosis and camplyobacteriosis (Vibrosis) may be more herd-specific and producers should consult with their veterinarian for direction. Vaccinations should be given at least 60 days prior to the start of the breeding season as, with all vaccines, there is a risk of fever. Sperm produced during a fever are abnormal and infertility can last up to 2 months after such an event.

Parasite and Fly Control

Parasite and fly control should be carried out to ensure bulls can maintain peak physical performance. In Ontario, dewormer is typically given in the fall. There is little in the literature about the risk of infertility from using wormers on bulls, but if a dewormer is needed during the breeding season, consult with a veterinarian to make sure the products used is appropriate. Fly control is important as flies can be a nuisance and a distraction for bulls. Producers should read product labels carefully to ensure the product to be used is safe for use on breeding bulls and follow the instructions carefully.

Eye Lesions

Eye lesions in mature bulls occur more frequently than is often realised. Eyes should be examined for vision compromising conditions such as cataracts, corneal opacity or carcinoma. The mouth should be examined for signs of injury or lesions that may impact the ability of the animal to feed properly. Feet and legs should be examined for signs of lameness or for any conformational defect that could lead to lameness in the future.

Managing Infertility

Research by the University of Georgia has shown that a sub fertile bull when used on a 35-cow herd produces 4,560 lbs less of weaned calf than a fertile bull. Total infertility in bulls is rare and is defined as the inability to impregnate. However, many bulls are or may become "sub-fertile" for a variety of reasons. We define fertile bulls as mature bulls capable of impregnating 60% and 90% of a 50-cow herd within 3 and 9 weeks of the breeding season, respectively, by natural

service. A sub-fertile bull is a bull that can achieve pregnancies by natural service, but not at the rate achieved by fertile bulls when the opportunity exists.

Carrying out breeding soundness examinations is an important exercise to identify potentially sub-fertile bulls and to avoid the substantial economic losses these bulls can cause. A bovine soundness examination should be carried out by a qualified veterinarian or technician. It is not a cheap examination but considering the substantial economic cost of a sub-fertile bull, it's well worth the annual investment.

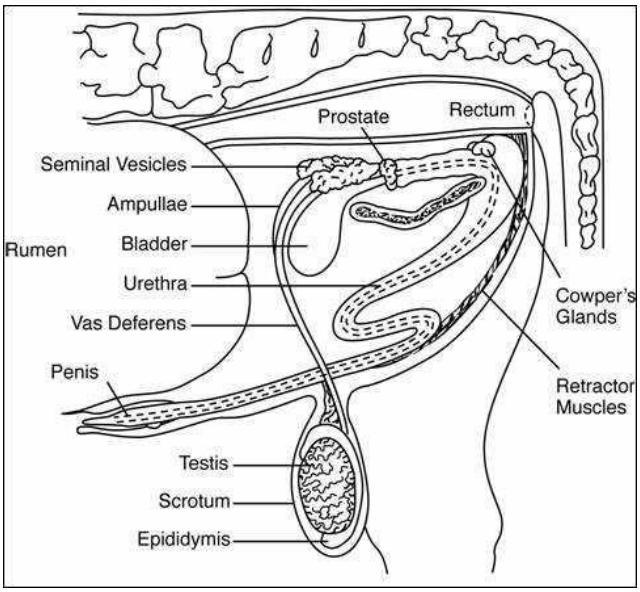

Figure 1 - Diagram of the reproductive tract of the bull
Image adopted from: Hamilton, T., 2006

To carry out a breeding soundness exam, the veterinarian requires access to the scrotum and sheath. Therefore, the bull must be properly restrained. A rump bar should be used to avoid getting kicked when measuring and palpating the testicles. Bulls should stand on non-slip flooring material (rubber flooring is ideal) to avoid the bull losing its footing during examination. Bulls must have the ability to move backwards and forwards during examination. In many cases, a simple halter is the better solution to using a head gate.

A visual assessment of the scrotum shape should be made prior to any physical examination. A normal scrotum has a pendulous shape with a well-defined neck, an ideal shape for thermoregulation. Straight sided and wedge-shaped scrotums are associated with small testicles and excess fat in the scrotum.

Careful physical examination of the scrotum is important to detect problems not visibly apparent. The scrotal skin should be smooth, elastic and the testicles should move freely within the scrotum. Thickening of the scrotal skin can be indicative of trauma and, if inflamed, will cause heating of the testicles and a tendency for them to be held higher in the body. Photosensitivity in some bulls can cause oedema and swelling of the scrotum.

Scrotal circumference (SC) is a critical component of a breeding soundness examination. Scrotal circumference is highly correlated with paired testes weight, daily sperm production and sperm quality. Bulls with above average SC reach puberty earlier and this trait is highly heritable in female offspring.

Seasonal variation in scrotal circumference is commonly observed but these changes should not exceed 1 – 2 cm. An SC decline of 2 – 4 cm between the date of examination and the start of the breeding season can indicate a problem with testicular degeneration and may not be simply a result of loss in bodyweight. Recovery, if it occurs, can take months.

Table 1 - Minimum recommended scrotal circumference in various breeds for breeding soundness

Age (Months)	Minimum Scrotal Circumference (cm)			
	Simmental	Angus Charolais Maine Anjou	Hereford Shorthorn	Limousin Blonde d'Aquitaine
12–24	33	32	31	30
15–20	35	34	33	32
21–30	36	35	34	33
>30	37	36	35	34

Adopted from (Hamilton, T., 2006)

Palpation of the sheath is important to detect the presence of any abnormal swelling. A penile rupture/haematoma is a painful swelling of the sheath close to the scrotum. This is caused by sudden movements of the cow during intromission or when young bulls mount each other. If untreated, these bulls find mating difficult and painful.

Sperm collection, examination and analyses is an important component of a breeding soundness exam. Semen should be analysed for motility, sperm count, and identification of the significance of abnormal sperm. The threshold for the % normal sperm in a sample is 70%. The presence of foreign cells in the semen is often noted as this may indicate the presence of inflammation elsewhere in the reproductive system.

Other Considerations

Understanding the social behaviour of bulls is critically important for their successful management and to reduce the risk of fighting injuries. Seniority and social ranking are determined by age and are established in the holding paddock prior to the breeding season. It is not a good practice to mix bulls of different ages together in the breeding paddock as the older bulls will inhibit the breeding activity of the younger animal, particularly when there are a low number of cows in estrus. Research has shown that breeding rates are higher when bulls of similar age are mixed together compared to mixing bulls of different ages.

In Summary

Proper management and breeding assessment of bulls prior to the breeding season is critical for the economic wellbeing of any cow calf operation.

Carrying out these simple checks well in advance of the breeding season will provide enough time for a replacement to be found, if that is necessary.

References

- Chenoweth, P. 2002. Bull Breeding Soundness Exams and Beyond. Proceedings: The Applied Reproductive Strategies in Beef Cattle Workshop, September 5-6 2002, Manhattan, Kansas.
- Hamilton, T. 2004. Beef Bull Fertility. OMAFRA Factsheet 410/20
- Handley, J. 1997. Selecting Beef Bulls. OMAFRA
- Jones, L. 2019. Economics of beef bulls: Selection and Fertility. Progressive Cattlemen, Vol. 9, Issue 4.
- Palmer, C. 2016. Management and Breeding Soundness of Mature Bulls. Veterinary Clinics: Food Animal Practise, 32:479-492
- Penny, C. 2010. Examination of Bulls for Breeding Soundness, Published by Zoetis UK Ltd.
- Potter, B. 2016. Bull Selection in Ontario. OMAFRA

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Yeast Doesn't Just Make Your Bread Rise… but Also Your Profitability!

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Background

Maintaining gut health is an important part of ensuring feedlot health, good animal performance, and efficient feed conversion. Metabolic disorders like ruminal acidosis and associated secondary disorders like liver abscesses and laminitis not only decrease feedlot performance, but also can impact carcass value and net economic returns. Research suggests that the period of highest risk of ruminal acidosis for feedlot cattle occurs in the second half of finishing period. In-feed antibiotics have historically been a method to improve these outcomes. However, new Canadian legislation effective December 1st, 2018 has resulted in changes to the access of antimicrobials used for controlling disease in animal production and improving feed efficiency, many of which are now under veterinary prescription. In addition, consumer preference for antibiotic-free products will continue to push research in the sector of alternative 'natural' feed additives. Direct-fed microbials like *Saccharomyces cerevisiae* (yeast) have been extensively studied as a natural feed additive and have shown promise as an antibiotic alternative to reduce risks of animal health disorders, such as ruminal acidosis in dairy cattle. The effectiveness of direct-fed microbials at an increased dose rate to reduce digestive upsets and improve animal health is not well established for beef feedlot cattle.

The Experiment

This experiment aimed to assess the effectiveness of yeast fed at double dose in the late finishing phase on cattle performance and to assess rumen pH, gut health, and carcass characteristics. The yeast in this study is a live active dry *Saccharomyces cerevisiae* product developed for use in cattle, pig, horse, sheep, and goat feed (Vistacell, AB Vista, Marlborough, UK). The original recommended dose of this product for feedlot cattle is 1.5 grams per head per day which was established based on research in dairy cattle. For this study, 3 grams per head per day of the product was added to the fed ration providing a high dose with a minimum of 60 billion colony forming units (CFU). Fifty-four steers were split up into 3 pens depending on weight and were randomly assigned to control (CON) groups, which were fed the finishing diet (60% high moisture corn, 20% dried distillers' grains with solubles, and 17% alfalfa haylage), or the yeast (YST) group, which had the same diet with the yeast added.

Measurements

Every 28 days, each steer was weighed, blood sampled, and ultra-sounded for backfat and rib fat thickness. Additional body weights and blood samples were collected three to five days before slaughter. Feed intake and feeding behaviour were recorded for each animal using individual RFID tags that corresponded to the assigned Insentec feeder (Insentec B.V., Marknesse, The Netherlands) that recorded each feeding event. Rumen pH was measured using ruminal data loggers, which were set up to record pH every five minutes for three weeks.

Figure 1 - Reticulo-ruminal pH probe.

Hot carcass weight, grade fat, ribeye area, liver and kidney weights, and liver abscess scores were measured and recorded at the time of slaughter. Afterwards, the entire digestive tract was dissected and rumen samples collected. The rumen was separated, emptied, and lightly rinsed with water and dissected as seen in Figure 1. Once dissected, a specimen of the rumen wall was obtained from the caudoventral sac for histology analysis. The rumen wall was then photographed, and health scored on a scale of 1 to 5 as seen in *Figure 2*. This scoring system focused on the visual appearance of the rumen papillae, specifically regarding coloration. Healthy papillae are free from pink or light grey to white discoloration and are uniform in colour and physical appearance.

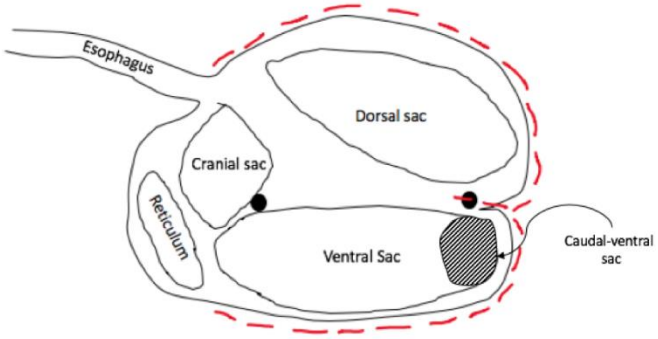

Figure 2 - Rumen dissection technique and papillae sampling location. Red dotted line is place of incision for dissection.

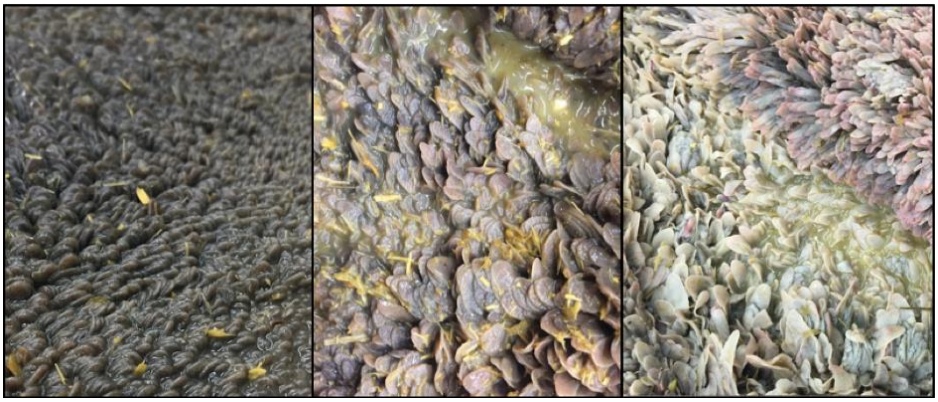

Figure 3 - Rumen health scores 1 (left), 3 (middle), and 5 (right).

Six to ten papillae removed from the rumen wall were fixed and stained for viewing on a microscope. The outer skin of the rumen papillae is made up of strata layers, responsible for absorbing nutrients while keeping unsafe molecules out of the system. Measurements of each strata layer; corneum, granulosum, spinosum, and basale (seen in *Figure 3*) were completed for each animal. Sloughing of the outer most layer, the corneum, was scored on a scale of 1 to 5.

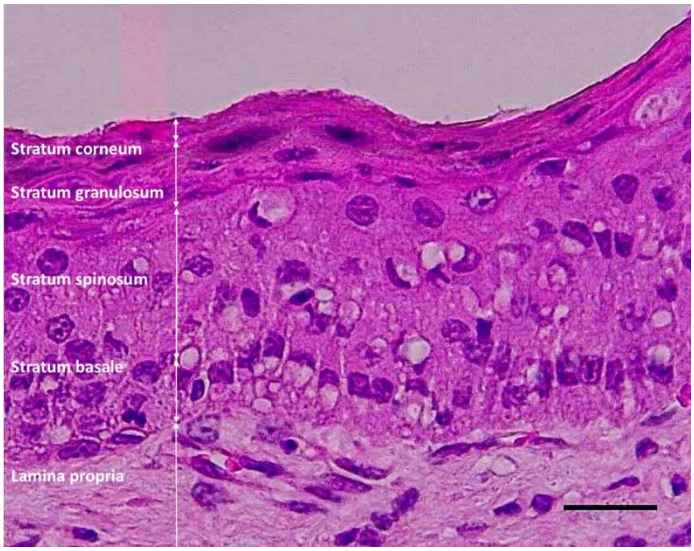

Figure 4 - Rumen papillae strata layers.
Image taken at 40X magnification, black line represents 25 µm.

Results

Performance results seen in *Figure 4* show a 31% decrease in dry matter intake (DMI) for yeast-fed steers, while average daily gain (ADG) and ultrasound measurements were the same between treatment groups. This translated into improved feed conversion ratios (FCR) for the yeast-fed steers in comparison to the control steers. Additionally, the individual variation in DMI was less in yeast-fed steers than control steers. This suggests that yeast can reduce daily variation in feed intake, which may help reduce the risk of subacute ruminal acidosis in feedlot cattle.

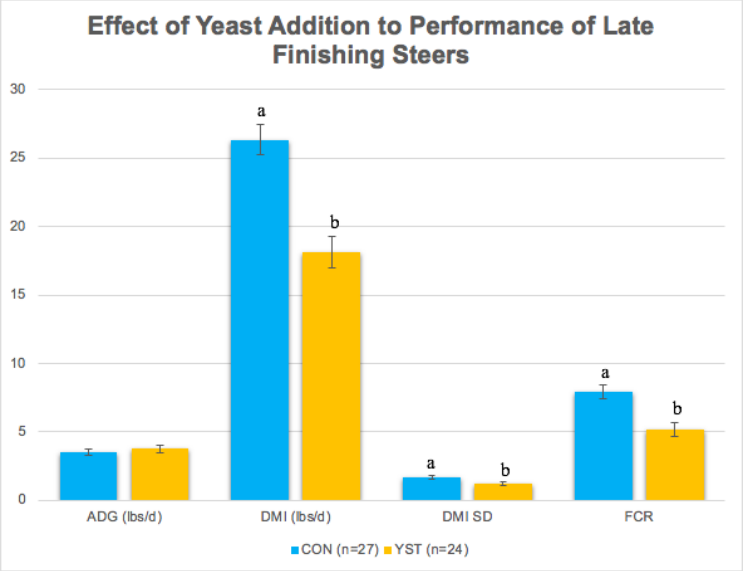

Figure 5 - Performance of control and yeast treated steers.
Different letters indicate significant differences between groups.

There were significantly fewer visits to the feeder per day and smaller meal sizes for the yeast-fed steers when compared to the control steers (seen in *Table 1*). All other feeding behaviour parameters remained the same between treatment groups. No differences were found between the control and yeast-treated steers for rumen pH measurements, carcass traits or rumen papillae strata thickness.

Table 1 – Feeding behaviour measurements of control and yeast treated steers.

	Dietary Treatment	
Item	**CON (n=27)**	**YST (n=24)**
Time at feeder, min/d	73	61
Visits to feeder, visits/d	37.4[a]	27.3[b]
Time per visit, min/visit	2.20	2.48
Visit size, g DM/visit	330	304
Number of meals, meals/d	10.0	8.8
Time per meal, min/meal	6.3	5.7
Meal size[z], g DM/meal	1227[a]	946[b]
Eating rate, g DM/min	221	179

[z]Meal is defined as any eating period with breaks no longer than 7 minutes
Different letters indicate significant differences between groups

Figure 6 - Steer 128E using Insentec feeder.

Conclusions & Implications

The results of this experiment suggest that added yeast (60B CFU) to the diet in the later finishing period significantly decreased DMI and improved feed efficiency, while having no impact on carcass traits or average daily gain. Although added yeast reduced feed intake variability, there were no statistically significant improvements in rumen pH or rumen health scores. The ability of added yeast to improve feed efficiency while maintaining gains has excellent potential to reduce feed costs to producers without loss in productivity. Given the cost-effectiveness of yeast and the observed improvement in animal efficiency, the addition of yeast to feedlot diets three months before slaughter has the potential to improve feedlot operators' bottom line.

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Effective Fibre – Does it Have a Role in Feedlot Rations?

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Today's feedlot rations often contain a high inclusion of grains and grain byproducts with some level of roughage inclusion. While the objective of feeding finishing cattle a ration with a high amount of grains is to increase the energy density of the diet and improve ADG, rations must also be balanced to limit issues associated with digestive disorders while maintaining production. Promoting gut health can help reduce incidence of conditions that are related to digestive upsets, including acidosis, rumenitis, liver abscesses, and founder. This article explores what makes effective fibre so "effective" in promoting gut health and why effective fibre has a place in feedlot rations.

What is physically effective fibre and how does it contribute to rumen health?

It is well established that fibre inclusion in a ruminant ration is important to rumen health. The "bulk" of it is necessary to stimulate rumination, increasing saliva production to help buffer low rumen pH. Volatile Fatty Acids (VFA's) are produced through ruminal fermentation and represent a significant energy source for cattle. Rapidly digested carbohydrates, grains, tend to lead to an increase in VFA production, which reduces ruminal pH. When the rate of VFA production is out of balance with VFA absorption, the pH of the rumen can drop too low for an extended amount of time, resulting in acidotic

conditions. Acidosis is associated with reduced rumen motility, impaired fibre digestion, decreased nutrient absorption, inflammation and damage to the rumen wall. Acidosis is also associated with liver abscesses and founder (laminitis) in cattle, which have direct costs for producers (vet bills, decreased feed efficiency) and indirect costs (lower carcass grades and increased carcass trim). The National Beef Quality Audit (2016/17) reported that 19.3% of livers assessed from fed cattle scored A+, noting an increase from 9.9% in 2010/11 and 2% in 1999.

Inadequate inclusion of fibre in the diet is a risk factor for acidosis and related conditions in feedlot cattle. Fibre stimulates rumination and saliva production, which buffers the pH of the rumen. Neutral detergent fibre (NDF) is often used as an indication of how much fibre is in a ruminant ration. And can be tested by laboratory analysis. But the chemical fibre fraction (%NDF) is only part of the picture. It is not simply the amount of fibre in the ration that matters; it is also the physical form of fibre that influences rumen health and function. Some byproduct feed ingredients (e.g. DDGS, corn gluten feed, etc.) are high in dietary NDF, but don't have the same "scratch factor" to stimulate rumen motility and salivation as long-stemmed hay. Similarly, ground roughage sources with a smaller mean particle size do not have the same capacity to stimulate chewing behaviour as forages with a longer mean particle size.

How is physically effective fibre measured?

Physically effective NDF (peNDF) is measured to predict the potential of the feed to stimulate chewing and saliva production and relates to the particle size of feed. Physically effective NDF is a function of NDF and physical effectiveness factor (pef) of a feed, where **peNDF = pef x % NDF (DM basis)**. A Penn State Particle Separator (PSPS) can be used to measure the physical effectiveness factor, or particle length, of total mixed rations and forages. Unlike other established laboratory methods for assessing physically effective fibre, the PSPS is a fast and practical tool that can be used to estimate physically effective fibre in the ration on-farm. The newest version of the PSPS has 3 sieves (19 mm, 8 mm, and 4 mm openings with a bottom pan). The physically effective component of a ration is calculated as the amount of material retained on the three sieves, expressed as a percentage of the whole sample. To estimate physically effective NDF (peNDF), the proportion of feed on the top three sieves is multiplied by the NDF content of the feedstuff or ration. Caution must be taken when accounting for the 4 mm (bottom) screen, since this screen is meant to capture particles that are high in fibre, but other feed ingredients and byproducts can also be trapped on this sieve. When a large amount of grain and supplement is trapped on this bottom sieve, which is often the case with finishing rations, the bottom screen should be discounted when calculating peNDF.

Figure 1 – Penn State Shaker Box used to measure particle size distribution in ruminant rations

Are there other factors that impact rumen health?

It must be noted that in addition to forage particle length, there are other factors that impact ruminal pH and the risk of acidosis in feedlot cattle (*Table 1*). Feeding management, animal behaviour and physiology, and ration characteristics all play a role in influencing rumen health and optimizing performance. While this article focuses on physically effective fibre and the role it plays in maintaining rumen health, it is important to pay attention to other management factors on-farm that also influence rumen health.

Table 1 – Factors that impact ruminal pH and risk of acidosis in feeder cattle

Factor	Increasing pH	Decreasing pH
Forage proportion and particle size	Higher inclusion rate, longer particles	Lower proportions, shorter particles
Grain processing	Whole or coarse	Fine ground, steam flaked, high moisture
Grain type	Corn	Wheat, barley
Additives	Ionophores, buffers	
Management	Consistent delivery time and amount	Inconsistent delivery time and amount
Diet transition and adaptation	Gradual transitions, longer adaptation periods	Abrupt transitions, short adaptation periods
Frequency of daily feeding	Greater than 1 time per day	One time per day or less
Length of feeding period	Shorter feeding period	Longer feeding period
Feed sorting	Selection for long particles	Selection for smaller particles/grains

Source: NRC Beef Cattle, 2016

Past, present, and future study on effective fibre in feedlot rations

The role of effective fibre in maintaining rumen health and influencing milk composition has been well-established in the dairy industry. The role of fibre inclusion in feedlot rations is not a novel concept for the feedlot sector, but often its importance is overlooked and inclusion under-evaluated in feedlot rations, especially when antimicrobial tools are used to mitigate the negative effects of poor rumen health. While optimal levels of effective fibre under various conditions and ruminal pH prediction models for feedlot cattle continue to be studied, researchers have used modelling to recommend peNDF ranges for feedlot cattle. These ranges are summarized in *Table 2.*

Table 2 – Referenced peNDF (%) values for feedlot cattle rations

% peNDF	Impact on rumen health and animal performance	Source
7-10%	Level at which mean ruminal pH is maintained above 5.7, preventing reductions in intake	Fox and Tedeschi, 2002
12-18%	Reduced risk of development of liver abscesses at higher end of range	Mertens, 2002
20%	Level at which cell wall digestibility is maximized	Fox and Tedeschi, 2002
22%	Optimum peNDF level to minimize liver abscesses	Mertens, 2002

Although predictive modelling offers a general idea of target ranges for physically effective fibre in feedlot rations, the models do not account for all other factors that influence rumen pH (*Table 1*), fermentability of feed, or absorption of VFAs from the rumen. There is opportunity for more applied research on effective fibre in finishing rations to better understand optimal levels of physically effective fibre, the impact of various ingredient types on fibre requirements, the effect of grain processing on fibre requirements, and other aspects of effective fibre on rumen health. Ongoing research out of the University of Saskatchewan, University of Guelph, and Agriculture and Agri-Food Canada will shed more light on the role of effective fibre in feedlot rations and optimal inclusion rates for feedlot health and performance.

Key Messages

Maintaining rumen pH to reduce bouts of acidosis is important to overall cattle health. Evaluating and monitoring physically effective NDF in feedlot rations is one important aspect of reducing risk of acidosis. In a feedlot context, poor rumen health is not only a gut function and efficiency issue, but it is also associated with other health issues, such as ruminitis, liver abscesses and founder. The Penn State Particle Separator is an on-farm tool available to feed industry professionals, and with a modified approach, it can be used to monitor the inclusion of physically effective fibre in finishing cattle rations. Talk to your nutritionist or feed consultant about physically effective fibre in your ration, particularly around measuring effective fibre, forage types and inclusion rates, and other feeding management strategies to help reduce the risk of ruminal acidosis.

References

- Beef Cattle Research Council. Acidosis. Retrieved March 29, 2019, from http://www.beefresearch.ca/research-topic.cfm/acidosis-63
- Beef Cattle Research Council. Beef Quality Audit. Retreived March 29, 2019, from http://www.beefresearch.ca/research-topic.cfm/beef-quality-audits-40
- Gaylean, M.L. and M.E. Hubbert. 2014. Traditional and alternative sources of fiber – Roughage values, effectiveness, and levels in starting and finishing diets. The Professional Animal Scientist, 30:571-584.
- Fox, D.G. and O. Tedeschi. 2002. Application of Physically Effective Fiber in Diets for Feedlot Cattle. Proceedings of the Plains Nutrition Council Spring Conference, April 25-26: 67-81
- Jones, C. and J. Heinrichs. 2016. Penn State Particle Separator. Available at: https://extension.psu.edu/penn-state-particle-separator.
- Mertens, D.R. 1997. Creating a system for meeting the fiber requirements of dairy cows. Journal of Dairy Science, 80:1463-1481
- Mertens, D. R. 2002. Measuring fiber and its effectiveness in ruminant diets. Proceedings of the Plains Nutrition Council Spring Conference, April 25-26: 40-66
- National Research Council 2016. Nutrient requirements of beef cattle. 8th revised edition. The National Academics Press, Washington DC, USA.

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