  

Virtual Beef

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Ministry of Agriculture, Food
& Rural Affairs

Ontario

Canadian Program for the Export of Beef to the European Union: Understanding the benefits of enrollment to Ontario Cow-Calf Producers

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For cow-calf producers, farm profitability is dependent upon the financial return generated by calves at the time of sale. To maximize the value of calves at the time of sale, cow-calf producers should aim to produce calves that appeal to the broadest set of buyers. As an example, OMAFRA market research in 2018 demonstrated that calves marketed through special calf sales received a premium of between $0.20-$0.35/lb when compared with regular sales. There are a wide range of programs available that cow-calf producers can participate in that help add value to calves. The Canadian Program for Certifying Freedom from Growth Enhancing Products (GEPs) for the Export of Beef to the European Union (EU) is one of the programs that has the potential to generate significant added value for cow-calf producers.

Participation in the EU beef export program also means that those cattle are generally eligible for participation in many provincial “free-from” or “natural” beef programs* and the Canadian Beta Agonist-Free Beef Certification Program, which is required for beef exports to China. Having cattle eligible to participate in as many programs as possible broadens the number of buyers available to purchase cattle, which in turn leads to better prices through increased demand. Participation in such programs may incur some additional costs but this is usually more than off-set by the increased financial return at the time of sale.

The Canada-European Union Comprehensive Economic and Trade Agreement (CETA) came into force on September 21st, 2017. CETA gives Canada duty-free access to the EU for 64,950 tonnes of Canadian beef made up of 35,000 tonnes of fresh/chilled beef, 15,000 tonnes of frozen beef and 14,950 tonnes “Hilton”** quota shared with the U.S. Canada also continues to have access to the existing shared, duty-free 45,000 tonne quota for high quality grain-fed beef which is available to Australia, the US, Canada, New Zealand, Uruguay and Argentina. It is not allocated, but offered on a first-come, first-served basis. Considering that 50,000 tonnes is available for Canada alone, plus the shared quota, there is significant opportunity to grow export sales into the EU.

The EU is one of the largest and highest priced beef markets in the world, with a population of 515 million people and per-capita beef consumption in 2020 estimated to be 20.75 kgs. Per capita beef consumption in Canada is estimated to be 24.4 kgs for 2020. The EU Agricultural Outlook for Markets and Income 2019 – 2030 predicts tariff rate quota imports (of which CETA is a part) will increase from under 400,000 tonnes currently to over 400,000 tonnes by 2030. This expected increase in beef import requirements by the EU presents Canadian beef producers with an exciting opportunity to significantly increase exports to a high value market.

EU consumers have conflicting expectations towards food which extend beyond food affordability to issues such as health, origin, convenience, environment, climate change and animal welfare. The National Beef Strategy mission for Canadian beef to be “recognized for superior quality, safety, value, innovation and produced using sustainable production practices which protect animal welfare and the environment” is in alignment with European consumer food demands and EU public policy. This fact presents an enormous opportunity for Ontario beef producers to use their competitive advantage to resonate with European consumers and capitalize on the requirements of consumers in this high-priced beef market.

In order to supply beef into the EU, farms and feedlots must be registered under the Canadian Program for Certifying Freedom from Growth Enhancing Products (GEPs) for the Export of Beef to the European Union and cattle must remain enrolled in the program from birth through to slaughter. This means that cow-calf producers (the herd of origin), feedlots and slaughter facilities must be registered under the program to maintain the chain of enrollment. Cattle that transfer between farms can only transfer from the registered farm of origin to a registered feedlot and be slaughtered at a federal slaughter facility registered on the EU program. In order to build Ontario’s EU export potential, it is critical that a greater number of cow-calf producers and feedlots register in the program to produce enough volume of beef to make it economically viable for a registered slaughter facility to export beef to the EU. The demand for Canadian beef exists in the EU – it's now about developing the supply chain.

The program is composed of 10 mandatory elements. However, there are many of elements of the program cow-calf producers already comply with. The program can be summarized into 4 basic pillars: (a) enrollment in the program, (b) animal identification and traceability, (c) prohibition on the administration of growth enhancing products (GEPs) for the animals' entire life and (d) maintenance of records.

Enrollment:
For most producers, enrollment in the program is straight forward. To enroll in the program, the first contact is a CFIA approved veterinarian who will complete the enrollment form. As part of the enrollment process, the veterinarian will carry out a GEP assessment on the farm and, where successful, will issue a certificate of compliance. This certificate of compliance is required when cattle are transferred to a registered feedlot or to a slaughter facility. An annual review by a CFIA approved veterinarian is required to maintain enrollment. A premises ID is also required for enrollment.

Cow-calf producers need to be registered in the program prior to moving animals off-farm and feedlots or slaughter facilities must be registered in the program prior to receiving enrolled animals.

Animal Identification & Traceability:
All animals under the program must be identified with a Canadian Cattle Identification Agency (CCIA) approved tag prior to leaving to farm of origin. If a farm also has cattle not enrolled in the EU export program, EU eligible cattle must be identified with an additional visual identifier which is easily discernable during a walk-through inspection. Tagging must be completed prior to any processing activity that could lead to the administration of growth enhancing products.

A transfer certificate listing the EU eligible animals must be provided when the animals are transferred to a registered feedlot or slaughter facility. The valid certificate of compliance must accompany the transfer certificate.

If cattle are transferred through an EU program registered auction market, EU program cattle cannot be comingled with non-EU program cattle. Each lot of program cattle to be sold must be sourced from one birth farm. Once sold, program eligible cattle can be comingled with other EU eligible cattle from another registered herd.

Management of Growth Enhancing Products (GEPs)
The single most important element of the program is that program animals must never be administered any growth enhancing products for the duration of the animals' entire life.

Products which cannot be fed to program cattle include drugs with estrogenic or androgenic actions such as trenbolone and zeranol (both components of hormone implants), drugs with gestagenic action (i.e. drugs that suppress normal cycling in heifers such as melengestrol acetate, well known as MGA premix), drugs containing natural substances such as estradiol, testosterone and progesterone (all components of hormone implants) and drugs defined as beta-antagonists such as ractopamine and zilpaterol.

On mixed farms where GEPs are purchased and fed to non-EU eligible animals, producers must record the date of purchase, use and disposal of these products. Cow calf producers should be aware that progesterone is a component of estrus control/synchronization products that are often used on cow-calf producer farms to manage the breeding season for beef cows and heifers. It is critical that these products are never used on program animals. Where such products are used on registered farms, it's important to record the purchase, use and disposal of these products.

Record keeping:
Record keeping is central pillar of the program. Producers are required to maintain an annual animal inventory showing all eligible animals on the farm. A self-developed inventory is also acceptable provided it contains all the information required in Annex 5 of the program.

Copies of enrollment forms, GEP assessment reports, certificates of compliance, transfer certificates, tag replacement reports, and GEP administration reports must be also maintained.

Where GEPs are used, a manual of procedures must be developed which shows the GEPs to be used, timing of use, procedures for use and disposal.

Where mixed feed or supplements are fed to eligible animals, producers must maintain a record of feed ingredients used and the source of the ingredients. This is necessary to demonstrate to the approving CFIA veterinarian that the feed for EU eligible animals is free of all GEPs. Where the mixed feeds or supplements to be fed to program cattle originate from a commercial feed mill, the producer must obtain a letter of guarantee from the feed mill that the feed supplied is free of all GEPs.

On mixed farms where feed or supplements are also fed to non-EU eligible animals, producers must develop a written plan which demonstrates how the GEP- containing feeds will be segregated from GEP-free feeds and how EU eligible animals will be managed to prevent access to the feed with GEP's.

Although the development of plans and manuals of procedures may sound onerous, a simple written plan of items that the producer will carry out is all that is required.

Comprehensive information on program requirements can be found on the CFIA webpage titled: Annex R: The Canadian Program for Certifying Freedom from Growth Enhancing Products (GEPs) for the Export of Beef to the European Union (EU).

Training videos for beef producers are available on the Canadian Cattlemen's Association website at https://www.cattle.ca/market-access/market-access-requirements/eu/

***Note:** Some "free-from" and "natural" beef programs require that producers also not use antibiotics, which is not a requirement under the EU program.
**** Hilton Quota** refers to tariff rate quota for the import of high-quality beef into the EU, which was agreed during the Tokyo Round at the Tokyo Hilton Hotel of as part of GATT negotiations in 1979.

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Effects of Feeding Finishing Cattle Essential Oils And/Or Organic Acid: Growth Performance, Meat Quality, and Sensory

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Introduction

An alternative approach to feeding cattle with antibiotics is to replace antibiotics with other feed ingredients that have antimicrobial properties. Essential oils and organic acids are two feed ingredients that have antimicrobial properties and warrant investigation.

Essential oils are plant-based compounds that can mirror the mode of action of antibiotics. Organic acids can suppress fungal activity and maintain an acidic environment in the rumen to prevent diseases. Previous research studies have evaluated the effects of essential oils on beef cattle growth performance and carcass characteristics, yet organic acids have not been studied before. In both cases meat quality and sensory have not been determined. Therefore, the objective of this study is to understand the effects of feeding essential oils and/or an organic acid to finishing cattle on growth performance, carcass characteristics, meat quality, and sensory of the *longissimus thoracis* (ribeye) muscle.

What We Did

Sixty-eight crossbred steers (BW = 1188 ± 79 lb) were fed at the University of Guelph Elora Beef Research Centre. Steers were grouped by weight and randomly assigned to 5 different treatments:

1) a negative control where no additives were included (**CON**)
2) a positive control with supplementation of monensin/tylosin (**M/T**), where monensin was supplemented at 33 mg/kg (Rumensin; Elanco Animal Health, Greenfield, IN, USA), and tylosin was supplemented at 11 mg/kg (Tylan; Elanco Animal Health) on a dry matter basis
3) a proprietary blend of essential oils (**EO**) supplemented at 1 g/steer/day (Victus Liv, DSM Nutritional Products, Parsippany, NJ, USA)
4) benzoic acid (**BA**) provided at 0.5% dietary inclusion on a DM basis (VevoVitall; DSM Nutritional Products)
5) a combination of a proprietary blend of essential oils and benzoic acid (**COMBO**). Steers were fed the assigned diets for 98 days leading up to slaughter

Growth performance data (weights, feed intake, and conversion rates) were measured/calculated at the beginning and the end of the finishing study. Grading data (carcass weight, ribeye muscle area, backfat thickness, marbling, and liver abscesses) were collected following slaughter. Meat quality evaluation included pH, instrumental color (Minolta handheld spectrophotometer), proximate composition, instrumental tenderness (Warner-Bratzler shear force), and cooking loss. Trained sensory panels were used to assess tenderness, chewiness, juiciness, and flavor of ribeye steaks.

Figure 1. Left to right: Minolta handheld spectrophotometer, pH meter, and Soxhlet extraction apparatus used for determination of extractable intramuscular fat

What We Found

Dietary treatment did not affect finishing weight, average daily gain, or feed intake (Table 1). A tendency for gain to feed ratio was observed; specifically, monensin/tylosin steers tended to have greater feed efficiency compared with **CON** (no additives), essential oils, and **COMBO** (blend of essential oils and benzoic acid) steers (Table 1). Dietary treatment did not affect carcass characteristics and most meat quality attributes (Table 2 and Table 3). Dietary treatment did affect lipid content in ribeye steaks, and the following trained sensory attributes: tenderness, chewiness, juiciness, and beef flavor (Table 3 and Table 4). Specifically, ribeye steaks from **CON** steers had less lipid content while ribeye steaks from **CON** and **COMBO** steers were tougher, chewier, and less juicy compared with other treatments (Table 3 and Table 4). Overall, results from this study suggest that growth performance was similar for steers supplemented with essential oils and(or) benzoic acid versus **CON** steers, and beef quality from alternative treatments was generally not compromised.

Table 1. Effects of replacing monensin and tylosin in beef finishing diets with alternative feed ingredients on steer growth performance.

Item	Dietary Treatment					SEM	*P*-value
	CON	M/T	EO	BA	COMBO		
Steers, number	14	14	13	13	14		
Starting weight, lb	1178	1199	1183	1182	1201	46	0.62
Final weight, lb	1606	1669	1600	1604	1621	49	0.21
Total weight gain, lb	428	470	417	422	420	16	0.15
Average daily gain, lb/day	4.39	4.78	4.30	4.30	4.25	0.15	0.15
Dry matter intake, lb/day	27.54	26.94	27.31	26.08	27.45	1.06	0.80
Gain to feed ratio (G:F)	0.161	0.178	0.158	0.167	0.156	0.007	0.07

[a,b]Least square means lacking a common superscript letter within a row are different ($P < 0.05$).

Table 2. Effects of replacing monensin and tylosin in beef finishing diets with alternative feed ingredients on steer carcass characteristics.

Item	Dietary Treatment					SEM	*P*-value
	CON	M/T	EO	BA	COMBO		
Steers, number	14	14	13	13	14		
Hot carcass weight, lb	943	980	934	937	959	32	0.18
Ribeye muscle area, in^2	14.8	15.4	14.4	15.1	15.3	0.4	0.27
Backfat thickness, in	0.76	0.72	0.76	0.81	0.72	0.06	0.78
Marbling score[1]	Sm^{58}	Mt^{24}	Mt^{40}	Mt^{46}	Mt^{07}	25	0.12
Liver Scores[2]	0.70	0.00	0.50	0.00	0.20		
No liver abscesses	10	13	11	13	13		
1-2 small abscesses	1	0	0	0	0		
2-4 large abscesses or multiple small abscesses	0	0	0	0	0		
Liver adhered to gastrointestinal tract	3	0	2	0	1		

[a,b]Least square means lacking a common superscript letter within a row are different ($P < 0.05$).

[1] Marbling score: Sm^{00} = $Small^{00}$; Mt^{00} = $Modest^{00}$.

[2] Liver scores were reported as observational data.

Table 3. Effects of replacing monensin and tylosin in beef finishing diets with alternative feed ingredients on meat quality evaluation of *longissimus thoracis* (ribeye).

	Dietary Treatment						
Item	CON	M/T	EO	BA	COMBO	SEM	*P*-value
Steers, number	13	13	11	12	14		
pH	5.52	5.49	5.49	5.49	5.48	0.01	0.22
Minolta L* (lightness)	37.66	39.21	39.01	39.01	39.02	0.66	0.36
Minolta a* (redness)	21.33	21.33	21.45	21.83	21.67	0.58	0.91
Minolta b* (yellowness)	8.17	8.70	8.60	9.00	8.92	0.39	0.30
Moisture content, %	71.86[a]	70.48[b]	70.15[b]	70.84[ab]	70.35[b]	0.44	0.04
Lipid content, %	4.24[b]	6.20[a]	6.41[a]	5.94[a]	6.07[a]	0.58	0.05
7 d aged, WBSF[1], kg	4.16	3.63	3.33	3.54	3.73	0.31	0.37
7 d aged, cooking loss, %	19.05	19.38	18.17	19.15	19.57	0.82	0.58
14 d aged, WBSF[1], kg	3.36	3.04	2.77	3.25	3.04	0.18	0.18
14 d aged, cooking loss, %	21.32	19.63	21.18	21.44	19.32	0.91	0.25

[a,b]Least square means lacking a common superscript letter within a row are different ($P < 0.05$).

[1] WBSF = Warner-Bratzler shear force.

Table 4. Effects of replacing monensin and tylosin in beef finishing diets with alternative feed ingredients on sensory evaluation[1] of *longissimus thoracis* (ribeye).

	Dietary Treatment						
Item	CON	M/T	EO	BA	COMBO	SEM	*P*-value
Steaks, number	13	13	11	12	14		
Tenderness	8.72[b]	10.36[a]	10.42[a]	10.50[a]	9.42[b]	0.72	<0.0001
Chewiness	6.24[a]	4.56[b]	4.36[b]	4.45[b]	5.52[a]	0.73	<0.001
Juiciness	8.12[c]	8.90[ab]	9.68[a]	9.44[a]	8.58[bc]	0.79	0.0005
Beef flavor intensity	9.20[bc]	9.27[abc]	9.79[ab]	9.90[a]	8.92[c]	0.52	0.01

[a,b,c]Least square means lacking a common superscript letter within a row are different ($P < 0.05$).

[1] Traits were measured on a 15-cm line scale which included the following: tenderness: 0 = extremely tough to 15 = extremely tender; chewiness: 0 = not chewy to 15 = extremely chewy; juiciness: 0 = very little juiciness to 15 = very high juiciness; beef flavor intensity: 0 = very weak beef flavor detected to 15 = very intense beef flavor.

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Beef Quality: The Actual Research Challenge for Consumer Satisfaction

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Canadian beef producers have a tremendous opportunity to meet the increasing global demand for high quality animal protein products. However, high feed costs and inconsistent quality remain significant challenges. Research has been underway towards addressing these challenges through the use of DNA panels to allow animals to be selected and specifically managed according to DNA profile to increase the production efficiency and product quality.

Beef quality audits in Canada continue to identify beef tenderness as a top quality concern consumers have with beef. If beef was more consistently tender, consumers would be willing to pay more for beef and purchase it more often (Shackelford et al., 2001). Although feed efficiency and beef quality represent tremendous challenges and opportunities for the industry showing a moderate to high heritability (between 0.12-0.53), the ability of the industry to address these through improved genetics has been almost impossible until very recently with the development of genomics technologies. Traditional approaches to genetic improvement for these traits are not successful as the traits are too expensive and difficult to measure. Current research going on in our group at University of Guelph and University of Alberta in collaboration with AgSights (ON) and Delta Genomics (AB) is designed to improve the genomic tools available to increase selection efficiency and address new traits of importance for consumers and with benefit to beef producers.

The Canadian beef industry is highly segmented and contains multiple stakeholders (seedstock, cow-calf, feedlot, processor, retailer and consumer). The division between groups along the supply chain enables individual stakeholders to make logical decisions regarding their own business practices. However, in light of the entire chain, these decisions can at times be detrimental to the end product and to consumer satisfaction. With little or no market signal back along the supply chain, needed changes are not necessarily made for the end product, which can impact desire for the end product and competition with other protein choices. Poor information flow along the beef supply chain can lead to inefficiencies, as demonstrated in the decline in high yielding carcasses in the past decade (down from 66% to 41%, Canadian Beef Grading Agency data).

Genomic approaches offer an opportunity to accelerate genetic improvement, but genomics requires accurate phenotypes (and genotypes) from genomically-linked individual animals. Selection efficiency with EPDs (expected progeny differences) will be higher with the knowledge gained from functional genomics studies using the new –OMICS technologies such as transcriptomics (Cánovas, 2016; Van Eenennaam, 2016). Despite a growing molecular and physiological understanding of complex traits, little is known about the target genes determining the traits and their precise function, and a significant unexplained source of variation of phenotypes remains in beef cattle. Within this context, a more complete understanding of the key regulator genes and regulatory pathways involved in economically important traits such as tenderness in beef cattle will provide knowledge to help improve genetic selection and production management. Therefore, studying the transcriptome using high throughput –OMICS data (RNA-Sequencing) from muscle and fat biopsies of the most divergent animals with extreme Warner-Bratzler shear force (**WBSF**) values (HIGH and LOW tenderness groups) will complement these tools and further advance identification of key regulator genes and functional SNP within a systems biology approach (Canovas et al., 2014; Fonseca et al., 2018). Additionally, fatty acid composition of beef has also been rated as an important factor for a more nutritious and healthier food; therefore, identification of genetic markers that are associated with meat tenderness and fatty acid composition in beef cattle along with a precise understanding of the biology underlying the traits will provide a more effective improvement in meat quality and marker-assisted diet management.

Genome-wide association studies (**GWAS**) can provide great insight into the genetic architecture of complex traits, potential causal variants and candidate genes in beef cattle (Suravajhala, et al., 2016). Numerous GWAS studies have been performed in *Bos taurus*, *Bos indicus* and crossbred beef cattle on meat quality and carcass traits (Magalhães et al., 2016). Several of these studies have focused on WBSF as a relevant trait and identified genetic markers mostly on chromosome 10 within the genomic sequence of *CAPN3* gene in Brahman cattle (Barendse, et al., 2008) and on chromosomes 7 (spanning *CAST* gene) and 29 (spanning *CAPN1* gene) for Angus, Charolais, Hereford, Limousin and Simmental breeds (Hulsman et al., 2014).

In the same context, preliminary results from our project identified nine markers (SNPs) significantly associated with tenderness (WBSF) in a crossbreed (Angus x Simmental) population located at the Elora Beef Research Center (Elora, ON). Six of these markers were located on chromosome 29, and two were on chromosome 2 ($P<0.05$). In addition, looking at the genes containing significant SNPs, we also identified 105 genes in close proximity (<500 Kb) of significant SNPs because they could be segregating with (in linkage disequilibrium) the causal variant. Among the 105 genes proximal to the WBSF SNPs, metabolic process made up most of the functional classification, which included *CAPN1* gene. Three SNPs were located in the *CAPN1* gene on chromosome 29. The *CAPN1* gene is well known for affecting meat tenderness. The *CAPN1* gene is involved in post-mortem proteolysis of muscle fibres and has been shown to be associated with meat tenderness in *Bos taurus*, *Bos indicus*, and their crossbreeds (Pinto et al., 2011). The effect of CAPN1 haplotypes (the group of genetic variants inherited together within the CAPN1 region) has been shown to be significant for tender alleles at both CAPN1 and CAST which together would have 4.11 kg lower WBSF than animals homozygous for tough alleles (a lower WBSF score represents more tender meat. In addition, two SNPs located in the glycogen phosphorylase (*PYGM*) and the Neurexin2 (*NRXN2*) genes were significantly associated with WBSF. Functional analysis showed that the *PYGM* gene is involved in the generation of precursor metabolites and energy during glycolysis (Nogales-gadea et al., 2012) and is responsible for the breakdown of cellular glycogen into glucose, which is the sugar used for cellular energy. The *NRXN2* gene is associated with biological processes related with angiogenesis, blood coagulation and heart, nervous system and skeletal system development.

Other studies investigating gene expression through RNA-Sequencing provided new possibilities of identifying novel functional variants and future changes in the product levels and structure of the genes of the *Longissimus thoracis* (ribeye) muscle in different breeds. Transcriptomic analysis could detect key regulator genes involved in the biological processes associated with the tenderness of the meat such as organization and synthesis of collagen fibrils, cell growth, development and muscle contraction. Currently, Cánovas Lab at U of G is collaborating with UNESP in Brazil (Albuquerque Lab) where they are performing similar research in Nellore cattle, a *Bos indicus* beef breed. Preliminary results have revealed differentially expressed genes associated with residual feed intake, tenderness, marbling, and other carcass and quality meat traits in the *Longissimus thoracis* muscle from animals with different environment conditions, ages and management systems including castrated and uncastrated animals. The purpose of our study is to increase the number of genotyped animals (pure and cross-bred) with phenotype records for WBSF in Canadian beef cattle. The results of this study, including transcriptomic analysis, will be validated across beef breeds and independent populations to increase the efficiency of genetic selection for tenderness and other meat quality related traits in beef cattle.

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Corn Test Weight – Does It Affect Performance of Cattle?

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The 2019 growing season presented challenges in many parts of the province. Delayed planting and variation in maturity at harvest resulted in variability in the grade of the corn crop in Ontario. When corn fails to reach physiological maturity (black layer) before a frost, there are potential consequences to test weight. This has left many livestock producers asking "what is the impact of low test weight corn on the performance of my livestock?". We can look to research that has been done on finishing cattle to help answer this question.

Corn quality is assessed using standard measurements. If you take corn to the local elevator, your corn will be graded, and you will be paid accordingly. Test weight is one factor that is considered as part of the grading scheme and thus light test weight corn is often discounted according to elevator discount schedules. Minimum test weights are specified for each grade in the Official Grain Grading Guide by the Canadian Grade Commission. Test weight is a measure of grain density; it is measured by weighing a known volume of grain and in Canada it is assessed before removing cracked corn and foreign material. Samples are graded sample weight if the test weight is lower than the minimum test weight established for corn. In Canada test weight is expressed as kilograms per hectolitre (kg/hL) or grams per 0.5 litre (g/0.5 L), but test weight is also commonly referred to as bushel weight, expressed as pounds per bushel (lb/bu).

Is corn test weight a good predictor of feeding value of corn for cattle? Several studies have looked at the impact of light test weight corn on cattle performance, most of which found little to no performance differences in cattle fed moderately low-test weight corn (59.3 kg/hL or 46.18 lb/bu) versus normal test weight corn. In a published study by Weichenthal et al. (1999), light-test weight corn (59.2-61.5 kg/hL or 46 to 48 lb/bu) and normal corn (72 kg/hl or 56 lb/bu) were fed to cattle consuming growing and finishing diets in a beef feedlot. The growing diet consisted of 32.9% corn silage, 22.3% alfalfa haylage, 37% dry rolled corn, and 7.8% protein supplement on a dry matter basis, and the finishing diet included 9.2% corn silage, 86.2% dry rolled corn, and 4.6% protein supplement on a dry matter basis. Average daily gain, feed efficiency, and carcass measurements were similar between treatment groups in both growing and finishing cattle. Birkelo et al. (1994) used metabolism facilities to study energy partitioning and net energy estimates of finishing diets that consisted of 77.7% light test weight (52.6 kg/hL or 40.8 lb/bu) or normal test weight (69.3 kg/hL or 53.8 lb/bu) whole corn. They found that low test weight corn was slightly greater in net energy for maintenance and gain due to reduced fecal losses associated with low test weight corn and concluded that low test weight corn is not inherently lower in net energy content than normal test weight corn. A study out of North Dakota State University found slightly different results. The study looked at the impact of feeding high (68.5 kg/hL or 53.7 lb/bu), medium (60.1 kg/hL or 46.9 lb/bu), and low test weight corn (50.4 kg/hL or 39.1 kb/bu) to finishing steers, and while they found that test weight did not impact performance in terms of ADG, they did observe a response of increasing dry matter intake and feed:gain (F:G) with decreasing test weight, suggesting that it may take more light test weight corn to achieve the same gains. The authors concluded that cattle feeders buying low test-weight corn must assess the benefits of taking advantage of discounts on low test corn versus the potential for reduced F:G.

Collectively this research tells us that it is important to analyze and consider all nutrients and use current net energy equations when formulating rations and determining feeding rates. Although starch content tends to be lower in low test weight corn, low test weight corn often has higher protein, fibre, and mineral concentrations and rate of starch digestion may differ between low-test weight corn and normal test-weight corn. These research outcomes also serve as a good reminder that it is important to add ingredients to the ration by weight rather than by volume.

In short, corn with moderately low-test weight does not appear to impact performance of cattle. However, with every new crop commodity or ingredient introduced to your ration, it is important to understand the quality and nutritional attributes of your feed inputs and monitor the condition and performance of your cattle. Work with your feed advisor to balance your rations and identify and mitigate risks associated with quality issues.

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