BEEF CATTLE WINTERING SITE MANAGEMENT (WSM) BENEFICIAL MANAGEMENT PRACTICES (BMPs): AN ECONOMIC ASSESSMENT OF BENEFITS AND COSTS

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Abstract

Water quality is a public health concern. Federal and provincial governments are promoting beef cattle wintering site management (WSM) practices to improve water quality. On-farm costs and benefits of these practices have not been measured. PRA Inc was contracted to assess the farm economics of changing from traditional confinement dry lot winter feeding of beef cattle to more environmentally friendly WSM feeding practices (BMPs). Using a case study approach, PRA Inc. assessed the on-farm start-up costs of confinement winter feeding versus in-field grazing practices. The unpublished PRA report indicated WSM in-field grazing offered significant saving in capital investment as well as operating cost for beef cattle farms. This paper summarizes the findings of the PRA report as well as related research that measured potential economic as well as environmental benefits of adopting WSM feeding systems on beef cattle farms in Western Canada. The main WSM BMPs examined were swath grazing (SG), bale grazing (BG), bale processing (BP), stockpiled feeds (SPF) and traditional confinement or dry lot (DL) feeding. Adopting WSM in-field grazing/feeding systems offers a win-win outcome for farm cash-flow as well as the environment.

Keywords: WSM BMPs, confinement feeding or DL, SG, BG, BP, SPF, input costs

Sub Theme: Environment

Introduction

Water quality is becoming a major public health concern in Canada. Commercial agriculture is perceived as one of the main sources of water contamination. Approximately 14 million head of beef cattle are wintered annually in Western Canada, the primary beef feeding region in Canada. These cattle are traditionally wintered in confined paddocks or dry lots located near to readily available water, shelter and feed supply. The over-winter build-up of faeces and urine creates excess nutrients, pathogens, pesticides, hormones, antibiotics and trace elements such as copper and arsenic, in a manure pack. This manure pack has the potential of contaminating neighbouring surface and ground water. In addition, farmers typically spread manure on cultivated land during the fall and winter. Spring run-off and rain events transport contaminants which degrade water quality in the connected water bodies posing a potential health hazard for humans and animals. Greenhouse gases from manure packs and land application also affect air quality.

Through its National Farm Stewardship Program, Agriculture and Agri-Food Canada (AAFC) promoted a variety of beneficial management practices (BMPS) to improve water quality and environmental stewardship. Undoubtedly, BMPs can provide significant environmental benefits, but potential on-farm benefits and costs to producers have not been measured. The absence of such critical information is viewed as a major impediment to implementing BMPs in Canadian agriculture.

Scope of Study and Research Methods

In light of the foregoing, AAFC hired a consulting firm, PRA Inc., in 2007 to identify and assess the on-farm economic benefits and costs of switching from the traditional beef cattle confined or dry lot (DL) winter feeding practice to more sustainable WSM BMPs. The three Prairie Provinces., Alberta,

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Saskatchewan and Manitoba, comprised the study area. Given the short time frame for reporting results, a case study approach was used in the assessments. This report is based on the unpublished PRA case study supplemented with other research data and information.

Sources of Data and Information

Information and data for the PRA study were collected from interviews with industry experts and case studies involving producers in the three provinces. An initial literature review provided the context for the case study and relative technical information regarding the benefits and costs of implementing WSM BMPs on farms. Industry experts, three from each province, were engaged to critique the literature review, offer insights about ranching in the respective provinces critique the survey instrument and review the draft research reports. AAFC professional staff developed terms of reference for the study, provided names of potential case farms, reviewed the questionnaire and draft reports, and managed the overall project.

Selection criteria for the case farms included the following:

- Beef cow-calf herd consists ≥50 cow-calf pairs,
- Farm was operating WSM in-field feeding or grazing practices for >2 years;
- Farm has good production and farm financial records, and was willing to share data and information.

Three farms were selected in each province. Each study participant completed a detailed questionnaire prior to a farm visit by the consultant. Participants received an honorarium of $250. Nine case studies of potential farm benefits and costs of adopting in-field grazing WSM BMP were completed. This paper is based mainly on the PRA nine case studies of WSM in-field grazing systems and supplemented with relevant research studies.

Winter Site Management (WSM) BMPs

WSM is defined as any system of in-field grazing/feeding strategies combined with infra-structure changes to manage environmental risks, optimize feeding, lower conventional operating costs and improve herd health. A Significant amount of planning and trialling is required to successfully implement sustainable WSM BMPs. Implementation involves four basic ingredients, namely, farm management plan, feeding strategies, infrastructure plan and resource management plan. These four pillars are usually embedded in an environmental farm plan (ARECA, 2006).

When implementing WSM BMPs, management must ensure that there is sufficient feed to sustain feeding throughout the winter feeding period and exercise due diligence to reduce waste, ensure clean-up and maintain a consistent diet during the feeding period. It is essential to have relatively easy access from home base to manage the herd, facilitate cattle movement, achieve expected grazing efficiencies and minimize environmental losses. Portable supplies of potable water must be provided together with temporary fencing and shelters from adverse weather conditions. More vigilance is necessary to protect against theft, wildlife damage and predation.

The primary goal for implementing WSM BMPs is protection of ground and surface water, natural habitat and riparian area. Given the prolonged cost-price squeeze in the Canadian beef cattle industry, year round grazing, defined as ≥300 grazing days (ARECA, 2006), is being strongly advocated to reduce operating cost. However, year-round grazing does not necessarily constitute sustainable WSM unless it is implemented with appropriate measures to minimize environmental risk. Therefore winter feeding strategies should not only extend grazing days but also modify traditional cropping, feeding and grazing practices to protect the environment.

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WSM BMPs such as in-field grazing/feeding reverse the practice of confining and bringing feed to the cattle. Instead, grazing/feed is strategically located in the field and every 3 to 5 days cattle are moved from feeding site to feeding site to avoid over-grazing and over-manuring the field. Cattle can graze for up to 6 months using swaths or windrows, bales, corn stover, crop residues such as straw and chaff, and stock-piled forage. Cattle movement in WSM is coordinated with access to potable water and shelter. This deliberate movement of cattle is very similar to controlled and rotational grazing on spring and summer pastures.

While WSM requires significantly more planning and management oversight than confinement or DL feeding, WSM in-field feeding systems offer many potential environmental and economic benefits. Jungnitsch, Lardner and Schoenau (2005) examined the effect of in-field winter feeding on soil nutrients, forage growth, animal performance and farm economics at the Temuende Research Farm in east central Saskatchewan. The researchers noted that only 9% to 10% of the nitrogen (N) fed to cattle is retained in the animal. Further, of the huge amount of N excreted, only 9% to 19% remained in the raw manure removed at pen cleaning. Most of the N is lost through volatilization. Therefore, in addition to environmental benefits, there are obvious economic benefits in capturing some or all of the expelled nutrients.

Jungnitsch et al. examined the effects of bale processing (BP), bale grazing (BG), dry lot raw manure (DLM) and dry lot composted manure (DLC) on soil and residue nutrients. Soil inorganic N and K were significantly higher on winter feeding pastures than on DLM and DLC treated pastures. Soil inorganic N was 3-4 times greater on winter feeding fields than on DLM treated fields. Dry matter yield (DMY) and forage quality on BP and BG winter pasture were significantly greater later in the year than on DLM and DLC treated pastures. For example, DMY from BG exceeded DLM applied by 60% and protein content was more than double (245%). Fields subjected to BP were superior to BG fields, but both exceeded manure-applied fields. Although cattle weight gain and condition on BP and BG pastures and DLM pastures were not significantly different, economics favoured in-field or pasture feeding. Taking DMY into account, BG feeding reduced production cost by 22.5% compared to traditional DL feeding. Similarly, BP lowered production cost by 26.8%. Winter feeding on pasture thus offered significantly more benefits recycling N and K, increasing forage growth and lowering machinery/equipment costs.

Lardner. (2005), evaluated feed waste with WSM BMPs and the effects of manure deposition on subsequent forage growth at the Termuende Research Farm. During study period 2003-2005, DMY increased for all treatments relative to the control. In the first year, DMY was 2.3 to 3.0 times greater with BP and BG compared to 1.7 and 1.5 times for DLM and DLC. By the second year, DMY was 3.2 to 4.6 times the control. In contrast, there was no significant difference between the DLM and DLC and the control, suggesting a carryover effect from the nutrients directly deposited on pasture by the cows. Pasture growth tended to be concentrated around the feeding sites during the first year of in-field grazing, but by the second year , grass growth appeared more uniformly distributed in the fields.

Hay waste between the systems was negligible. Straw, included in the in-field rations to reduce feeding cost, was used by cattle as bedding thereby causing significant loss as feed. This feed residue or waste was not a total loss as it could contribute to soil organic matter and act as litter to trap nutrients and moisture. In short, Lardner concluded that direct deposition of manure nutrients by animals on pasture, compared to mechanical application, was more efficient in nutrient cycling and pasture productivity.

Research at the AAFC Lacombe Research Station, Alberta, indicated that switching from conventional DL feeding to SG reduced labour cost by 38 per cent and overall cash cost by 45.5%. Unpublished 2008 research data from Alberta's AgriProfit$ Business Analysis and Research Program indicate significant profit opportunities associated with converting a portion of DL winter feeding to SW or

BG. A net gain of $0.66/Animal Unit Day (AUD) or $66/AU was estimated for a 100-day feeding period. Even renting land to grow forage for SG or BG can yield potential savings $8.36/ha. ($20.66/ac) compared to DL feeding. Indeed, renting land for SG or BG and reducing feeding in DLs could save $0.77/AUD or $77/AU over the 100-day feeding period. While these estimates are sensitive to market conditions, individual farm productivity and farm cash flow, potential savings of this magnitude cannot be overlooked.

Over a 200-day winter feeding period, cost saving ranged from 23% for BG, to 42% and 48% for stockpiled grazing (SPG) and SG, respectively. The saving from straw and chaff grazing was 59%. The corresponding savings in $/cow were $80, $146, $168 and $208, respectively (ARECA, 2007). In practice, most farms employ a mix of practices to take advantage of their unique farming situation. For example, farmers may combine straw and chaff grazing with BG to take advantage of available crop residues.

The most profitable cow-calf farms in Western Canada tend to be low cost per unit; low cost per unit operations generally had a longer grazing season; and the most profitable cow calf farms had less overhead or yardage (ARECA. 2007). Yardage may be defined as the non-feed costs, i.e., overhead and the additional expenses associated with feeding the cattle during the feeding period. Assuming feed is priced at market, it is the extended grazing period and control of yardage that distinguish profitable from unprofitable operations. Yardage for confined or DL feeding, adjusted for animal size, was estimated at $0.87-$0.94/AUD compared to $0.32/AUD for SG and $0.40/AUD for BG. Therefore extending grazing days can significantly reduce feeding costs.

Economics of WSM Case Study Results

Consensus estimates of winter feeding costs for the most common WSM BMPs in the PRA case study farms are shown in Table 1. Operating cost for SG was 58.6% below that of BG, while BP cost was more than double (230.4%) that of SG. Feeding by BP required 65% more capital investment than converting to SG or BG.

Table 1

CONSENSUS FROM CASE STUDY ESTIMATES OF WINTER FEEDING COSTS FOR 150-HEAD COW-CALF FARM, 2008			
Inputs Costs	$ Per Head		
	Swath Grazing (SG)	Bale Grazing (BG)	Bale Processing (BP)
Feed	87.50	152.00	180.00
Labour			
Planning	1.41	0.61	2.90
Feed Mgt	0	0.50	24.84
Fence Mgt	2.48	2.70	2.48
Shelter Mgt	2.17	2.17	2.17
Total Labour	6.06	5.98	17.17
Fuel	0	0	8.00
Total Operating ($)	99.62	157.98	229.56
Fixed Capital			
Equipment	0	0	13,000
Fence (Permanent & Portable)	2,000	2,000.00	2,000
Shelter	8,000	8,000	8,000
Watering System	10,000	10,000	10,000
Fixed Capital Investment ($)	20,000	20,000	33,000

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Source: PRA Inc, Table 4, p. 21.

PRA developed a base case reference 150-head confined DL farm and compared **start-up** and operating costs with a 150-head WSM farms. Estimates for the base case reference farm were compiled from the case studies and Manitoba guidelines for estimating production costs (MAF&RI, 2007). Buildings and equipment were valued at new costs; buildings were depreciated over 20 years and equipment over 10 years. All feed, replacement bulls and heifers were purchased at market, manure hauling was contracted. Estimated capital investment is given Table 2. Confinement DL feeding required construction of pen, shelter and barn for calves valued at cost and amortized over 20 years at 4%.

Capital investment required to implement a SG or BG feeding system was 15.5% lower than the capital investment required for a comparable DL feeding system. Due to the bale shredder, upfront capital requirement for a BP system was 10.6% below DL feeding.

Table 2

CAPITAL INVESTMENT IN FEEDING SYSTEMS FOR 150-HEAD COW-CALF FARM ($)				
Capital Assets	Confinement Feeding (DL)	Swath Grazing (SG)	Bale Grazing (BG)	Bale Processing (BP)
Wind-break Fence	4,000	8,000	8,000	8,000
Feedlot Fence	4,000			
Calf Shelters	8,000			
Handling Facilities	5,500			
Calving Barn (30’x32’)	9,600			
Waterers	5,000			
Pasture Watering System	4,000	10,000	10,000	10,000
Pasture Water Source	3,000	3,000	3,000	3,,000
Gates	840			
Round Bale Feeders	1,500			
Well & Pressure System	6,000	6,000	6,000	6,000
Hydro (6 poles)	2,400	2,400	2,400	2,400
Storage Bins	3,500			
Total Building	57,340	29,400	29,400	29,400
Tractor & Loader	30,000	30,000	30,000	30,000
Bale Shedder	13,000			13,000
Stock Trailer	12,000	12,000	12,000	12,000
Truck (50%)	20,000	20,000	20,000	20,000
Misc. Mach. & Equip.	5,000	5,000	5,000	5,000
Total Mach. & Equip.	80,000	67,000	67,000	80,000
Bldgs, Mach. & Equip.	137,340	96,400	96,400	109,400
Breeding Herd	127,500	127,500	127,500	127,500
FIXED CAPITAL	264,840	223,901	223,901	236,902
INVESTMENT/COW	1,765.60	1,492.67	1,492.67	1,579.33

Source: Unpublished PRA. (2008). Table 6, p. 30.

Several operating input costs remained unchanged across confined feeding and WSM feeding systems (Table 3). However, WSM avoids several costs including expensive feed grain, relying instead on salvage crops, aftermath or stubble, chaff, hay and straw. Use of bedding is avoided, as well as manure removal, storage and disposal. Expenditures on chemicals, fuel and fertilizers are reduced in WSM. Fuel costs are lower for SW and BG because cattle are moved to new feeding sites and movement is over relatively very short distances. Notably, manure removal, storage, hauling and spreading are avoided. Fuel cost for BP is higher due to bale shredding.

By far the most significant advantage with WSM feeding over DL feeding was the saving in labour time ranging from 50% to 75% according to case farm consensus. The consultant report set labour cost at 50% below DL feeding. In short, WSM feeding can reduce production cost by 15% to 20% and significantly free up operator labour for alternative employment opportunities or more leisure time with family.

Table 3

ESTIMATED COSTS FOR 150-HEAD CATTLE CONFINEMENT AND WSM FEEDING FARMS, 2008						
Farm Inputs	Confined Feeding (DL)		Swath/Bale Grazing (SG/BG)		Bale Processing (BP)	
Operating Costs	Total	$/Cow	Total	$/Cow	Total	$/Cow
Grain	1,275	8.50		0.00	0	0.00
Hay	26,025	173.50	26,025	173.50	26,025	173.50
Salt & Minerals	2,363	15.75	2,363	15.75	2,363	15.75
Total Feed	**29,663**	**197.75**	**28,388**	189.25	**28,388**	**189.25**
Straw	3,000	20.00	0	0.00	0	0.00
Vet Medicine & Supplies	2,984	19.89	2,466	16.44	2,466	16.44
Breeding	5,168	34.45	4,704	31.36	4,704	31.36
Repairs, Maintenance & Fuel	4,200	28.00	1,899	12.66	4,200	28.00
Utilities	1,500	10.00	1,500	10.00	1,500	10.00
Marketing & Transportation	3,498	23.32	3,498	23.32	3,498	23.32
Death Loss	1,594	10.63	1,594	10.63	1,594	10.63
Manure Removal	2,501	16.67	0	0.00	0	0.00
Insurance	1,037	6.91	914	6.09	953	6.35
Herd Replacement	9,900	66.00	9,900	66.00	9,900	66.00
Miscellaneous	1,001	6.67	1,001	6.67	1,001	6.67
Other Operating Costs	**36,383**	**242.55**	**27,476**	**183.17**	**29,816**	**198.77**
Operating Interest (3.25%)	2,146	14.31	1,815	12.10	1,914	12.76
Total Operating Costs	**68,192**	**454.61**	**57,679**	**384.53**	**60,118**	**400.79**
Depreciation		0.00		0.00		0.00
Buildings	2,517	16.78	821	5.47	821	5.47
Machinery & Equipment	6,401	42.67	5,359	35.73	6,401	42.67
Depreciation	**8,918**	**59.45**	**6,180**	**41.20**	**7,222**	**48.15**
Investment Costs		0.00		0.00		0.00
Buildings	1,007	6.71	328	2.19	328	2.19
Machinery & Equipment	1,920	12.80	1,920	12.80	1,920	12.80
Livestock	5,100	34.00	5,100	34.00	5,100	34.00
Pasture Land & Fencing	11,301	75.34	11,624	77.49	11,624	77.49
Total Fixed Costs	**28,246**	**188.31**	**25,152**	**167.68**	**26,194**	**174.63**
Fixed & Operating Costs	96,438	642.92	82,831	552.21	86,312	575.41
Labour ($11/Hr)	14,850	99.00	7,425	49.50	7,425	49.50
Total Production Cost	**111,288**	**741.92**	**90,256**	**601.71**	**93,737**	**624.91**

Source: Adapted from unpublished PRA Inc. 2008. Figure 3.

Summary and Conclusion

Conventional cattle feeding in Western Canada during winter involves confining or herding cattle into dry lots (DLs) and feeding them over the winter. The accumulated over-winter manure is cleaned out and spread on cultivated land in the fall. These practices have significant negative impacts on surface and ground water quality. Consequently winter site management, (WSM), BMPs such as infield grazing/feeding are being promoted as alternatives to DL feeding. Infield feeding systems include swath grazing (SG), bale grazing (BG), bale processing (BP), stockpiled grazing, and corn stover, chaff and residue grazing. By extending the grazing season, implementing careful feed management, and avoiding overgrazing and over-manuring fields, in-field grazing BMPs can improve cash flow and minimize water contamination.

The PRA case study indicates that operating costs can be conservatively reduced by 15%-20% if farmers change from DL feeding during the winter months to WSM in-field grazing/feeding practices. Scientific research undertaken in Western Canada confirm significant savings in feed, manure handling and labour costs when cattle are fed or grazed in the field as opposed to feeding in DLs. For example, labour costs fell by 38% and cash cost by 45.5% when DL feeding was compared with SG (McCartney, 2004). Cost saving comes mainly from eliminating expensive feed grain from the rations, and substituting less expensive home-grown feeds and crop residues. Once feed is strategically located in the field, moving the cattle to a new feeding site every 3 to 5 days takes less than an hour. There are no manure cleaning, handling and transportation costs. Except in the case of BP, machinery operating and maintenance costs are reduced. Indeed, the overall saving in operator labour time provides a unique opportunity for more leisure time or off-farm employment.

Scientific research also shows WSM feeding systems improve pasture productivity. Direct deposition of faeces and urine in the field by cattle was more efficient in recycling N and K than mechanical application of raw and compost manure. Because cattle are moved every few days to a new feeding site, in-field feeding systems minimize potential contamination of surface and ground water created by DL feeding and the mechanical application of manure in the fields.

WSM feeding systems require a change in thinking about feeding cattle and significantly more attention to detailed planning. However, despite these increased management requirements, adoption of WSM feeding systems on Western Canadian farms can be win-win outcome for economics and the environment. Each farm situation is different, but initial experimentation or trialling can, in the short term, achieve a sustainable beef cattle feeding system.

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