Feeding options for market lambs.

Finding inexpensive ways to feed lambs is a top priority for producers. The opportunity to save $5 to $10 per lamb marketed is significant if it can be found. In 2013 there was a resolution passed at the OSMA Annual General Meeting requesting that a trial be completed testing whether high moisture corn cob meal would be a suitable feed replacement for corn. A few years before that, we completed a trial and learned that corn silage could only be fed profitably to dry matter levels of 25% to lambs, and even then, it was no more profitable than feeding a 100% concentrate diet. While corn is not very costly right now, it has been in the past and likely will be in the future so producers were interested in finding ways to get more tonnes of feed per acre, or probably more accurately, more kilograms of lamb produced per acre; and thus be more cost effective.

Traditionally some farmers have also believed it necessary to include some oats, barley or both together as mixed grain in a concentrate ration for finishing lambs. The concern was that corn, by itself, was too "hot" for lambs. To investigate these questions, a lamb feeding trial was conducted to determine the feed consumption, lamb growth, carcass characteristics and meat quality of lambs fed concentrate diets based on whole corn and mixed grain, whole corn grain or corn cob meal. In each case the protein supplement was distiller's dried grains with solubles (DDGS) and a vitamin/mineral premix. Lasalocid and ammonium chloride was included as well.

A producer that is going to feed corn cob meal is likely going to have it custom harvested and either stored in an upright silo, bunk silo or sealed bag. As approximately 3 ½ tonnes was needed for the entire trial, it was not economical to have it custom harvested. Instead a New Idea corn picker was used and then the cobs were run through a mobile mix mill. The corn cob meal was bagged and air was drawn out with a shop vacuum cleaner and sealed. The trial began around 3 weeks after bags were sealed. The whole corn and mixed grain and the whole corn diets were premixed and bagged. However, the corn cob meal diet had the protein, vitamin and mineral supplement premixed and bagged and was mixed each morning at feeding time with the corn cob meal at rate of 68.6% corn cob meal and 31.4% supplement. The corn cob meal was 67.6% dry matter (DM), 6.7% crude protein (on DM basis) and 81.8% TDN (on DM basis). Table 1 lists the ingredient composition and nutrient content of the complete diets as offered to lambs.

Table 1. Dietary treatments and ration analysis

		Corn/Oats/Barley	Corn	Corn Cob Meal
Ingredient composition[1]				
	Corn	25.50%	60.55%	
	Corn cob meal			60.55%
	Oats	21.25%		
	Barley	21.25%		
	DDGS[2]	30.00%	37.45%	37.45%
	Premix	1.00%	1.00%	1.00%
	Limestone	1.00%	1.00%	1.00%

	Total	100.00%	100.00%	100.00%
	$/tonne	$355.00	$314.00	$184.00
Nutrient composition[3,4]				
	Dry matter	88.0%[a]	88.4%[a]	74.4%[b]
	Crude protein	17.2%[a]	16.8%[a]	15.2%[a]
	Total digestible nutrients	85.7%[a]	88.9%[a]	81.8%[a]
	Calcium	0.91%[a]	0.68%[a]	0.66%[a]
	Phosphorus	0.52%[a]	0.51%[a]	0.49%[a]
	Neutral detergent fibre	23.9%[a]	16.6%[a]	24.4%[a]
	Acid detergent fibre	11.2%[a]	10.0%[a]	11.6%[a]
	Calcium to phosphorus ratio	1.76[a]	1.31[b]	1.35[ab]

[1]Ammonium chloride (0.5%) and Bovatec (0.18 kg/tonne) were included in ration.
[2]DDGS = distiller's dried grains with solubles
[3]Averages with different superscripts are statistically different ([a] vs. [b])
[4]Composition of nutrients is listed on a dry matter basis.

Normally I report nutrient content on an as fed basis if all the diets are of similar dry matter. In this case, because one treatment is much wetter, they were reported on a dry matter basis. If you are used to seeing, for example, protein levels lower it may because you are expecting them on an as fed basis. Given a normal grain diet our crude protein levels on an as fed basis would have been around 15%. When harvesting the corn cobs, the picker snapped the cobs off the plant but the husks almost always stayed with the plant and thus were not included in the feed. This would be a difference from the more modern picking systems where the husk would remain in the feed. It probably dropped yield by around 10% and would likely have affected nutrient content and digestibility a bit too. Another issues is that pricing corn cob meal is very difficult as it is not a normally traded commodity. The corn cob meal was priced based on corn prices and correcting for dry matter and estimated yield per acre differences. calculations came to corn cob meal costing around 66% of corn grain. If you think this price is incorrect, you can calculate costs per unit of lamb gain realistic to your situation by calculating how you value the above rations per kilogram or pound of feed and multiplying that value by the feed to gain ratio (as fed basis) below (Table 2). That will give a decent estimate of cost of feed per unit of gain.

Table 2. Lamb growth performance, feed use and cost.[1]

	Corn/Oats/Barley	Corn	Corn Cob Meal
Average daily feed intake (as fed basis), kg (lb)	1.48 (3.27)[a]	1.34 (2.95)[b]	1.7 (3.75)[c]
Average daily feed intake (dry matter basis) , kg (lb)	1.31 (2.88)[a]	1.18 (2.61)[b]	1.27 (2.79)[a]
Average daily gain, kg (lb)	0.31 (0.68)[a]	0.29 (0.64)[a]	0.30 (0.66)[a]
Days to market[2]	65	69	67
Feed to gain ratio (as fed basis)	4.89[a]	4.33[a]	5.80[b]
Feed to gain ratio (dry matter basis)	4.30[a]	3.83[a]	4.31[a]

Feed cost ($/unit gain) , kg (lb)	1.74 (0.79)[a]	1.36 (0.62)[b]	1.07 (0.48)[b]

[1] Averages with different superscripts ([a] vs. [b] vs. [c]) are statistically different.
[2] Calculated based on average daily gain and a gain of 20 kg.

Whole corn compared to corn with mixed grain

It is very clear from Table 2 that feeding whole corn resulted in lower feed costs per unit of gain than feeding corn with mixed grain (oats and barley). It is important to note no negative effects resulting from feeding only corn as the grain portion of the diet were observed. The only carcass difference seen was that the dressing percentage was slightly higher for the whole corn diet (48.3%) compared to the corn and mixed grain diet (46.1%). It should be noted that the dressing percentage was calculated by dividing the dressed weight at slaughter (cold carcass) by the live weight before lambs were shipped to slaughter. This means the dressing percentage would include shrink losses from shipping. Ultimately, at an increase in feed cost of around $7.50 per lamb to market, it is difficult to justify feeding oats and barley to market lambs.

Confusion can sometimes result around the term “hot” when discussing different grains. Generally, the term refers to how available a grain is to microbes in the rumen. If too much is available too quickly, the ration is called “hot” as it will cause upsets in the rumen microbial population usually due to acidosis. There are two factors that are critical in discussing how “hot” a ration is: 1. How much fibre that is effective at stimulating rumination is present (often quantified by effective neutral detergent fibre (eNDF)), and 2) what form the grain is in (whole vs. flaked vs. ground). Obviously, the more ground it is, the more quickly it will be broken down by microbes. Certainly, the amount of eNDF in mixed grain (8.2%) is higher than in corn (5.4%). But as this difference is relatively small (for example wheat straw is around 80% eNDF), the difference would only be relevant in very borderline cases. The actual heat that is produced by digesting a feed (related to the “heat increment” in feed energy description) is something entirely different. In that case, the feeds with more fibre create more heat upon digestion.

Corn cob meal

Corn cob meal was definitely less expensive to feed than the corn and mixed grain diet. Based on 20 kg of gain, the savings would be around $13.40 per lamb going to market. Comparing the difference between whole corn and the corn cob meal must be done more carefully. Given the statistical analysis done, the difference was not, but was close to being, significant. Sometimes when this happens the phrase “tended to be different” is used. In this case it is appropriate to indicate that the corn cob meal diet tended to be less expensive than the whole corn diet. The savings, as calculated from values in Table 2, would be $5.86 per lamb going to market based on 20 kg of live weight gain. More care must be put into storage and feeding corn cob meal as it is an ensiled feed, and thus more susceptible to spoilage. We had no clinical cases of listeriosis in our trial.

While bunks must be managed to maintain unspoiled feed, I did notice a few interesting positive management issues with the corn cob meal. The diets with the whole grain had the common problem where lambs did not appear to prefer the DDGS and would consume most of the grains before consuming the DDGS. As the corn cob meal was ground (using 3/4 inch screen), the DDGS could be

mixed in and not sorted. This led to more uniform feed refusals each morning when refusals were removed and weighed. A number of us, who were feeding regularly, noticed that when the corn cob meal was dumped in the bunks the lambs were not very eager to consume it until the DDGS/premix was added to it and mixed in. It's difficult to know exactly what was going on, in terms of palatability, but we did anecdotally observe some positive effect of the DDGS/premix on corn cob meal consumption.

In terms of carcass quality, the lambs that consumed the corn cob meal had smaller loin weights than those that consumed the whole corn diet (94% of the size). The lambs fed the corn cob meal also had around 1.5 mm more backfat than lambs fed the whole corn diet. Smaller loins or more backfat for the corn cob meal diet were not expected given the energy levels in the corn cob meal diet were numerically lowest and the protein to energy ratios were similar across all dietary treatments. It may be related to energy availability being higher due to the corn cob meal being ground and ensiled.

Implications

So what should you feed? If you can pencil corn cob meal to the same price done in this trial and could manage the bunks/spoilage, then consider feeding corn cob meal. In many cases corn cob meal will not allow for as much automation as whole corn grain so a proper assessment should include labour costs. Probably the only producers who can take advantage of corn cob meal would be those large enough to keep the surface fresh. It is generally accepted in a bunk silo or horizontal bag that 6 inches of feed should be removed per day. In an unsealed upright silo, at least 4 inches should be removed daily to minimize impact of spoilage. Small producers should compare all available feeds to the cost of corn, DDGS and premix. Unless mixed grain prices drop such that they are only 20% greater than corn, they should be left out of the diet for market lambs – they cannot be used profitably.

Thank you to the Agricultural Adaptation Council and the Ontario Sheep Marketing Agency for their financial support and the loan of lambs from Shepherd's Choice (Norwood, ON). Acknowledgement is also given to the hard work and dedication of the Agriculture Diploma students who participated in this project. And finally, a thank you to the farm crew (Mark Monden and George Woudenberg) for their dedication to making things work.

AAC agricultural adaptation council

Ontario

This project was funded in part through *Growing Forward 2 (GF2)*, a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of *GF2* in Ontario.

Addendum (not be included in article)

As an addendum to the article for Ontario Sheep News, I'd like to include a full report of the data analyzed including carcass and meat quality measures for the research committee's review. I was thinking that it might be appropriate for me to write an article some time relating to what I have seen as an "average" lamb with respect to meat quality and carcass. Producers might find it interesting to know some of that information.

Feed

	A			B			C		
	corn/oats/barley			corn			corn cob meal		
	LSMeans	StdErr	diff	LSMeans	StdErr	diff	LSMeans	StdErr	diff
Dry matter	88.04	0.23	a	88.40	0.23	a	74.43	0.23	b
Crude protein	17.25	0.65	a	16.85	0.65	a	15.24	0.65	a
Total digestible nutrients	85.71	2.06	a	88.92	2.06	a	81.81	2.06	a
Calcium	0.91	0.08	a	0.68	0.08	a	0.66	0.08	a
Phophorus	0.52	0.02	a	0.51	0.02	a	0.49	0.02	a
NDF	23.86	3.52	a	16.62	3.52	a	24.37	3.52	a
ADF	11.17	1.49	a	10.04	1.49	a	11.62	1.49	a
Ca:P	1.76	0.11	a	1.31	0.11	b	1.35	0.11	ab

Growth/Performance

	A			B			C			P=
	corn/oats/barley			corn			corn cob meal			
	LSMeans	StdErr	diff	LSMeans	StdErr	diff	LSMeans	StdErr	diff	
adfi (af)	1.48	0.10	a	1.34	0.10	b	1.70	0.10	c	0.0001
adfi (dm)	1.31	0.08	a	1.18	0.08	b	1.27	0.08	a	0.0004
start weight	32.9	0.5	a	32.0	0.5	a	31.9	0.5	a	0.2545
end weight	51.8	0.8	a	50.2	0.8	a	51.1	0.8	a	0.3635
adg	0.310	0.013	a	0.288	0.013	a	0.298	0.013	a	0.5135
days to market	63	2	a	66	2	a	66	2	a	0.3599
feed to gain ratio (dm)	4.30	0.17	a	3.83	0.23	a	4.31	0.13	a	0.3087
feed to gain ratio (af)	4.89	0.19	a	4.33	0.27	a	5.80	0.16	b	0.0322
feed cost ($/kg gain)	1.736	0.063	a	1.359	0.089	b	1.066	0.052	b	0.0088

Meat quality and carcass characteristics

	A			B			C			P=
	corn/oats/barley			corn			corn cob meal			
	LSMeans	StdErr	diff	LSMeans	StdErr	diff	LSMeans	StdErr	diff	
live weight	51.7	0.2634	a	51.4833	0.2634	a	51.5	0.2643	a	0.8121
dressing percentage	0.4608	0.008561	a	0.4833	0.008597	b	0.4642	0.008539	a	0.0004
loin primal	0.9733	0.02111	ab	1.0283	0.02111	a	0.9633	0.02111	b	0.0792
loin lean	0.09667	0.005774	a	0.1067	0.005774	a	0.1133	0.005774	a	0.1377
loin fat	0.1983	0.009184	a	0.2017	0.009184	a	0.2167	0.009184	a	0.3354
loin bone	0.17	0.01119	a	0.17	0.01119	a	0.14	0.01119	a	0.1073
loin trimmed	0.8067	0.01844	a	0.8517	0.01844	a	0.8017	0.01844	a	0.1239
loin tender	0.165	0.005174	a	0.175	0.005174	a	0.16	0.005174	a	0.1296
loin	0.3483	0.009574	ab	0.3683	0.009574	a	0.3283	0.009574	b	0.0211
GR	14.3333	0.5741	a	14.0833	0.5741	a	14.5833	0.5741	a	0.8282
loin width	31.2961	0.8433	a	33.0976	0.8481	a	31.3564	0.8403	a	0.215
loin length	58.25	1.3499	a	60.1667	1.3499	a	58.1667	1.3499	a	0.5028
fat 1/4	3.75	0.3439	a	3.1667	0.3439	a	4.0833	0.3439	a	0.1784
fat 3/4	3.772	0.4791	ab	3.2587	0.4837	b	4.7163	0.4763	a	0.0488
marbling	3.6194	0.5141	a	3.8	0.5152	a	3.3722	0.5135	a	0.1531
loin eye area	1443.48	28.3739	a	1477.63	28.3739	a	1433.35	28.3739	a	0.5195
pH	5.7427	0.03175	a	5.716	0.03206	a	5.6947	0.03156	a	0.3695
colour L	35.1416	0.6363	a	36.2326	0.6425	a	35.6641	0.6326	a	0.3814
colour a	14.8375	0.3462	a	14.8875	0.3462	a	14.405	0.3462	a	0.5618
colour b	0.5492	0.3756	a	0.3691	0.379	a	0.1342	0.3735	a	0.5314
shear force 2d	6.537	1.0497	a	8.2188	1.058	a	8.1721	1.0446	a	0.1339
shear force 8d	4.74	0.8518	a	6.325	0.8601	a	5.8388	0.8467	a	0.2276
cook loss 2d	18.93	0.543	a	19.5325	0.543	a	18.6092	0.543	a	0.4826
cook loss 8d	20.3191	1.9123	a	18.4018	1.9301	a	18.9708	1.9016	a	0.7084