Develop New Strategies to Efficiently Utilize Oat Grains in High Production Dairy Cows to Maximum Economic Return and Benefit to Prairie Oat Growers:

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Background and Motivations:
Development of domestic and international market for oat producers and oat related industries is a key to maintain and increase business, maximize profit and provide economic return and benefit to prairie oat producers. To develop competitive market in dairy industry, we need to investigate which oat grain variety or what types of oat grain (milling-type or feed-type) has highest Feed Milk Value (FMV) and highest absorbed nutrient supply and determine how much FMV in oat grain can be further/highly improved/increased by optimal feed processing applications, what is suitable and optimal processing conditions for oat grain, and how much corn, barley or other cereal grains can be replaced by oat grain in high production dairy diets..

Objectives:
(1) To use a systematic approach to find best variety or best type of oat grain with highest FMV and high nutrient supply for high production lactation dairy cows, (2) To further improve digestive behaviors and FMV in dairy cows through optimal feed processing technology, and (3) To develop new and alternative feeding strategies to efficiently utilize oat grains in high production lactation dairy cows to find a maximum replacement level to common barley or corn with feed-type or milling-type of oat grain in order to maximum economic return and benefit to prairie oat growers and support market development of oat grain nationally and internationally.

Planned Research Projects:
This prairie oat research program consists of the following projects which are close related to each other.
Project 1: Systematically compare prairie oat grain varieties/types with common barley in Feed Milk Value (FMV) for dairy cattle in western Canada in order to find the good variety or type of oat grain with highest FMV value for dairy cows;
Project 2: Improve/increase FMV of the feed type and/or milling type of oat grain through feed processing applications in comparison with barley for lactating dairy cows. The suitable processing will be determined for Prairie oat grain grown under western Canadian cool climate condition. Feed processing methods/technology will be tested and applied at Canadian Feed Research Centre (CFRC: Feed Processing Centre);

Project 3: Develop new feeding strategies of the milling type or feed-type oat grain to find maximum or optimal replacement level of barley grain with of oat grain in high production lactation dairy cow to maximize benefit and economic return to prairie oat growers and dairy milk producers;
Project 4: Develop new feeding strategy for both raw and heated feed type and/or milling type of oat grain based on the performance of the best ratio found in above Projects in high production lactation dairy cows to benefit of prairie oat growers and dairy milk producers.

Current Research Findings Project 1:
It was found that:
1. The feed type of oat grain, Nasser, had a higher ($P<0.05$) fat content (6.66%) than the milling type of oat grain, Arborg (4.16%) and Ruffian (4.88%) and much higher than feed barley grain- Austenson (1.90%).
2. The feed type of oat grain, Nasser, had similar crude protein content compared with feed barley grain- Austenson (13.82 vs. 13.54%, $P>0.05$), and had a lower ($P<0.05$) protein content compared with the milling type of oat grain, Arborg (15.78%).
3. As to ADICP and NDICP, there were no difference ($P>0.05$) between feed type and milling type of oat grain and between oat and barley grain.
4. Oat grain, both milling type and feed type had higher ($P<0.05$) Neutral Detergent Fiber (NDF) content than barley grain.
5. As to total digestible nutrients (TDN) content, the feed type of oat grain, Nasser, had an equal TDN content compared with feed barley grain- Austenson (88.88 vs. 87.71%, $P>0.05$), and Nasser had a higher ($P<0.05$) TDN than the milling type of oat grain, Arborg (82.92%) and Ruffian (83.95%).
6. As to net energy for lactation (NEL3x), the feed type of oat grain, Nasser, had similar NEL3x content compared with feed barley grain- Austenson (2.08 vs. 2.01 Mcal/kg, $P>0.05$), and Nasser had a higher ($P<0.05$) NEL3x than the milling type of oat grain, Arborg (1.91 Mcal/kg)and Ruffian (1.93 Mcal/kg)
7. In terms of protein and carbohydrate fractions, oat grain, both milling type and feed type had lower ($P<0.05$) slowly degradable protein fraction (PB2) than the feed barley grain, Austenson (5.90, 5.36, 4.70% CP vs. 14.83 %CP). But feed type had higher ($P<0.05$) slowly degradable carbohydrate fraction (CB3) than the feed barley grain, Austenson (23.33 % CP vs. 16.84 %CP).
8. As to rumen degradation kinetics in dairy cows, oat grains both milling type and feed type had lower ($P<0.05$) rumen undegraded protein than the feed barley grain, Austenson (29.29, 20.97, 27.99 g/kg DM vs. 38.24 g/kg DM). Rumen undegraded starch was also lower ($P<0.05$) in oat grain compared with feed barley grain.
9. There was no difference in intestinal digestion of protein between the feed type oat grain, Nasser and feed barley grain, Austenson. However, total track digestion including rumen and intestine of feed type of oat grain was much higher ($P<0.05$) than the feed barley grain, Austenson.
10. The feed type oat grain, Nasser had lower ($P<0.05$) intestinal digestion of starch than feed feed barley grain, Austenson. But total track digestion of starch including rumen and intestine of feed type of oat grain was no significant difference ($P>0.05$) than the feed barley grain, Austenson.

11. In terms of total metabolizable protein (MP), oat grain, both milling type and feed type had lower ($P<0.05$) MP than the feed barley grain, Austenson (98.38, 95.03, 95.57 vs. 129.63 g/kg DM), but much lower ($P<0.05$) degraded protein balance (DPB) than the feed barley grain, Austenson (59.73, 61.13, 54.05 vs. 111.44 g/kg DM).
12. Feed Milk value was lower ($P<0.05$) in oat grains, but Feed type and milling type, than the feed barley grain, Austenson (2.00, 1.93, 1.90 vs. 2.63 g/kg DM).

Summary and Take Home Message:
1. Feed type of oat grain had significantly higher fat content than barley grain.
2. Oat grains was lower in metabolizable protein and feed milk value compared with barley grain.
3. Feed type of oat grain had similar total digestible nutrients (TDN) content to barley grain
4. Feed type of oat grain had equal content of the net energy for lactation (NEL3x) in dairy cows to barley grain.