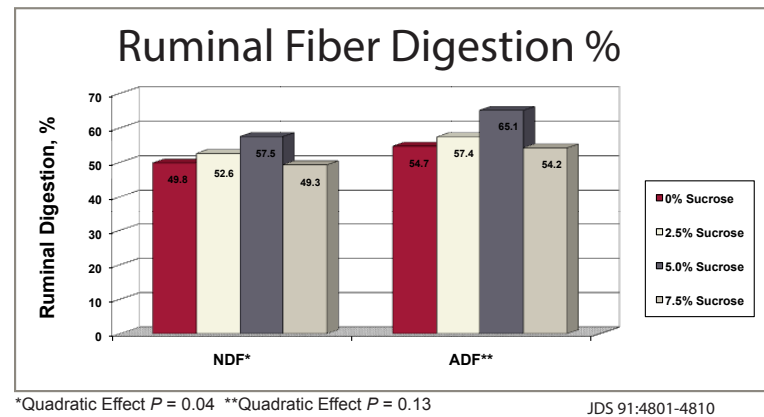
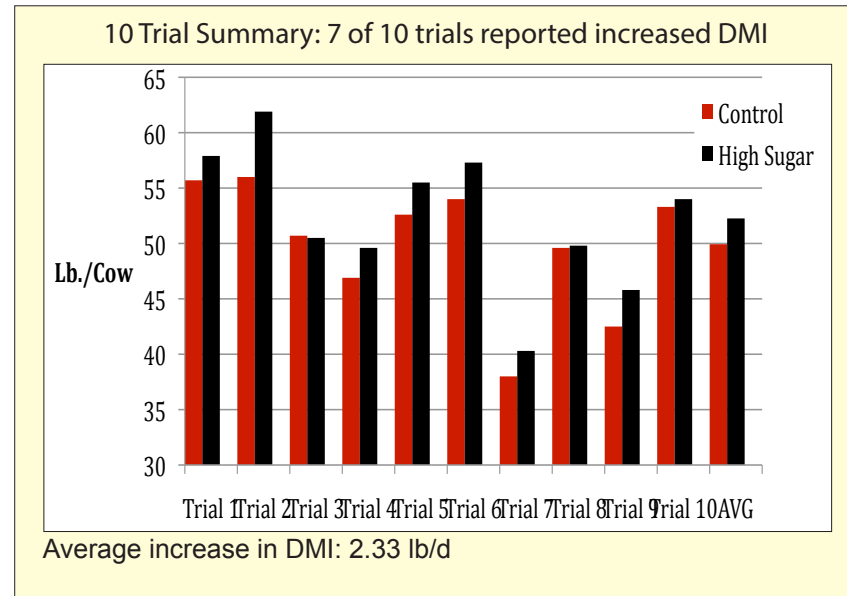


At that low level of forage, rumen fill was not limiting intake of the cows. The diets fed in trial 10 did contain 20% distiller's grain. This trial reported that replacing corn grain with molasses at 5% of diet DM did increase milk fat % on high starch diets.



Based on the 10 trial summary, starch and sugar do not have the same impact in the rumen. Replacing some of the starch in the diet with sugar changed DMI, milk fat yield and milk production. This would imply that sugar is having an impact on the rumen environment that is different from starch. Sucrose had a positive impact on NDF and ADF digestion up to 5% of diet DM with total dietary sugar equal to 7.1% (see graph). In this trial, the diet contained 60% forage and sucrose accounted for 70% of the total sugar in the diet. Of the sugars in molasses, 75% is sucrose and 11% is glucose.

**So what is the risk to try QLF liquid supplements in a dairy diet?** When you account for the value of 3.5% FCM, only 1 of 10 trials reported a net income of less than 15 cents per cow (trial 2). In trial 2, cows fed liquid molasses consumed 61.9 pounds of dry matter and produced 103 pounds of 3.5% FCM with a milk efficiency of 1.66. So the take home message is that right now the risk is very low to try QLF liquid supplements in the diet. In 9 of 10 trials when starch from corn was replaced by sugars from molasses or liquid supplements, marginal milk production was increased, IOFC was increased and ROI exceeded 2.2:1. Tracking the pounds of fat and pounds of 3.5% FCM produced is the best way to measure response to liquid supplements. Dairy diets should contain a minimum of 45% forage to optimize animal response to sugars and QLF liquid supplements. All liquid supplements such as whey, corn distiller's syrup and molasses will reduce ration sorting but not all liquid supplements contain high amounts of sucrose and glucose. Just because a liquid is brown and in a tank doesn't mean that it contains molasses. You should always verify with your liquid feed supplier how much molasses or sucrose is in a liquid feed.



## INCREASE THE VALUE OF YOUR MILK BY FINE-TUNING THE CARBOHYDRATES IN YOUR COWS' DIETS

Being a successful dairy producer in the U.S. requires optimizing your marginal milk production. What is marginal milk production? It is the additional milk that you produce per cow by fine-tuning your ration. Here is an example, a group of cows produces 80 pounds of milk on 52 pounds of dry matter intake and then the ration is fine-tuned and now this group of cows is making 84 pounds of milk on 54 pounds of dry matter intake. Did feed costs go up? Yes, because the cows ate 2 pounds more dry matter. Did profit go up? Yes, because milk is worth more than feed. Feed costs are currently between 14 and 15 cents per pound of dry matter and milk is worth \$19 a hundredweight. So feed costs went up 30 cents a cow per day and the value of the 4 pounds of marginal milk is 76 cents. So the net profit per cow in this group was increased (76 - 30) 46 cents per cow per day. Here is another way to look at the situation. For every pound of additional dry matter intake that the cow eats in early lactation, she is going to produce 2 pounds of milk. So even if milk price drops to \$15.00 a hundredweight, 2 pounds of additional milk is worth 30 cents and it will cost you 15 cents for the pound of dry matter to make that milk. The net result is that you are still making an additional 15 cents per cow/day. It always makes sense to invest in feeding fresh cows and cows in the first 200 days in milk because you get 1.7 to 2 pounds of milk per pound of dry matter intake and milk is worth more than feed. How can I be so certain that if you increase dry matter intake in early lactation that you will get more milk? Well, the biology of the cow is set up so that in early lactation, the energy and protein she consumes is directed toward milk and not toward deposition of body fat. The biology is designed so that the cow produces the most milk at a time when the calf needs the most milk. We remove the calf from the cow and feed it separately but that doesn't change the biology. The cow is wired to produce the most milk during the first 6 months of lactation. It is just the opposite in late lactation (200+ DIM), the energy and protein consumed is directed toward the building up of body condition and not milk. During late lactation (200+ DIM), you are going to get 1 to 1.3 pounds of milk for each pound of dry matter intake. The hard part is not predicting the response to additional dry matter intake but rather determining the bottleneck to dry matter intake in early lactation and removing it. If you want cows to milk, you need to get them to eat well during early lactation.



Cows have a maintenance requirement which is the amount of nutrients needed to stay alive. You should think of this maintenance as a tax that you have to pay and you pay this tax each day on every cow no matter how much milk she produces. If a cow produces 65 pounds per day or 85 pounds per day, you are going to pay the maintenance tax. One way to estimate what this maintenance tax is costing you is to estimate the cost of your dry cow diet. I know this isn't perfect because your dry cow is being fed to meet her maintenance requirement plus the requirement for pregnancy but it will give you an estimate of what it costs to keep a pregnant dry cow alive. You make more money when the maintenance tax becomes a smaller percentage of the total daily income generated by a cow. One strategy to consider is trying to optimize daily income per free stall. For example, let's



say that you have 1,000 free stalls on your farm and some of the cows in those free stalls are making money and some are just breaking even, you need to focus on increasing the marginal milk production of the cows making money and think about replacing a break-even cow with a fresh heifer. The goal is increasing the average income per free stall per day.

What does all this have to do with fine-tuning the carbohydrates in the cow's diet? Well, you can increase the marginal milk production of your cows and your profit by adjusting starch and sugar in the diet. Why is this so? It comes back to biology once again. Cows have to synthesize lactose (milk sugar) to make milk and lactose has to be synthesized from glucose. If you have a reduced amount of glucose reaching the mammary gland then cows make less milk. Cows make glucose from propionate and from amino acids. Nutritionists call these amino acids, glucogenic (glucose making) amino acids. Propionate comes from the ruminal fermentation of carbohydrate. That is why I say that cows make milk on carbohydrates because if you optimize carbohydrate digestion, you will optimize milk production. You can feed a diet that produces too much propionate and this diet will depress fiber digestion and dry matter intake. You can also feed a diet that produces too little propionate and this diet will result in lower than expected milk production. The goal is to find the "Sweet Spot" where propionate production is just right to drive milk production and not depress feed intake. You pay nutritionists and consultants to find that "Sweet Spot" for your herd and keep it there.

How can you increase your marginal milk? How can you increase the value of your milk? You must sell more pounds of fat and protein to increase milk income. All federal milk marketing orders in the Midwest and West except for Arizona pay on the pounds of fat and protein sold. The Arizona milk marketing order pays on the pounds of fat sold. You increase the pounds of fat and protein produced by optimizing carbohydrate digestion in the rumen. You also need to make sure you have enough lysine and methionine in the diet and are feeding enough fat to support milk fat synthesis. There have been a number of experiments designed to try and determine the optimum ratio of starch to sugar in the diet. One of the hypotheses tested in these experiments was: Is sugar and starch the same when fermented in the rumen. After all what is starch? Starch is a long chain of glucose (sugar) linked together. If the hypothesis is true that starch and sugar are equal when fermented in the rumen, then there should be the same animal performance on all diets. The control diets which contained no supplemental sugar or molasses should produce the same amount of milk and milk components as the diets with higher sugar and lower starch content. If animal performance is different on the high starch diets versus the low starch and high sugar diets, then the hypothesis is not true and sugar and starch have different impacts in the rumen. Within each experiment, the amount of forage in the diet was the same across diets. In all these experiments, the amount of starch in the diet was decreased as the amount of sugar was increased.

A simple substitution of starch with sugars from molasses containing liquid supplements, molasses or sucrose boosted income over feed cost (IOFC). In 10 university research trials from 2004 through 2009, the replacement of starch with sugars from molasses, liquid supplements or sucrose increased milk fat yield, 3.5% FCM yield, milk protein yield and energy-corrected-milk (ECM) yield. Using current milk component prices (Dec. 2011) for milk fat of \$1.74/lb and milk protein of \$3.34/lb, the average increase in milk value was \$0.667 per hundredweight. Of this increase in milk value, 47% (\$0.313) came from milk fat and 53% (\$0.354) came from milk protein. There wasn't a single trial where milk fat yield was not increased. The average increase in milk fat yield for the 10 trial summary was 0.18 pounds. The average increase of 3.5% FCM from the 10 trials was 4.44 pounds. Milk protein yield was increased an average of 0.106 pounds with an average increase in energy-corrected-milk (ECM) yield of 4.01 pounds. ECM and 3.5% FCM are superior measures of milk income compared to raw milk because they account for the pounds of fat (FCM and ECM) and pounds of protein (ECM) produced.

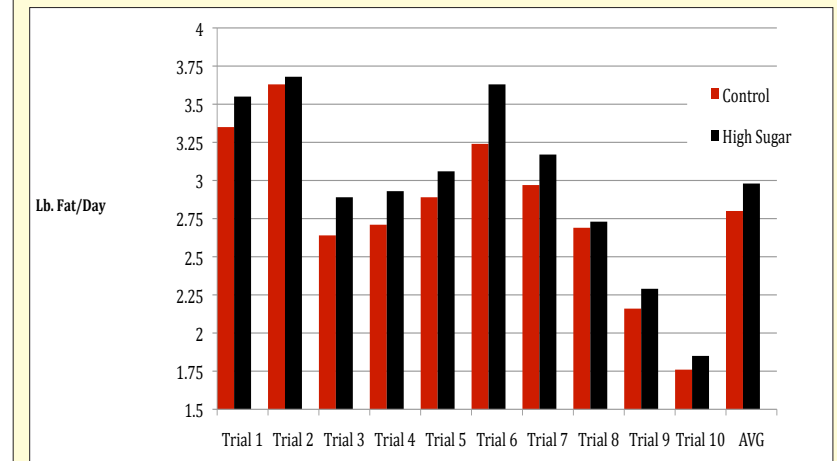
From these 10 trials, the best response occurred when the diet contained between 5% and 7% total sugar with the majority of the total sugar coming from sucrose and glucose. It is not just the total sugar that is important but the type of sugar that is used to replace starch. The majority of sugar in molasses, QLF TMR 20 and QLF Dairy Suger 38 comes from sucrose and glucose.

Trial Year	Trial	Forage % of Diet	Starch Source	Sugar Source	Increase in 3.5% FCM Yield, lb/d	Increase in DMI, lb/cow	Milk Efficiency (3.5% FCM/lb DMI)
2004	1	60	HMSC	Dried Molasses	4.11	2.2	1.87
2004	2	52	HMSC	Liquid Molasses	2.63	5.9	0.45
2008	3	50	Ground Corn	Liquid Supplement with Fat	5.18	0.1	51.8
2008	4	50	Ground Corn	Liquid Supplement with Fat	6.81	2.7	2.52
2008	5	45	Ground Corn	QLF TMR 20	4.53	2.9	1.56
2008	6	60	Corn Starch	Sucrose	9.27	3.3	2.81
2009	7	50	Cracked Corn	Sucrose	4.59	2.3	2.0
2009	8	44	Ground Corn	QLF Dairy SUGR 38	1.47	0.2	7.35
2009	9	44	Ground Corn	QLF Dairy SUGR 38	4.57	3.3	1.38
2009	10	37	Ground Corn	Liquid Molasses	1.20	0.7	1.71
Average					4.44	2.33	1.91

The average increase in DMI from the 10 trials was 2.33 pounds. Feed costs are 14 cents per pound of DM. So the additional dry matter has a value of 32.6 cents per cow/day. The value per hundredweight of 3.5% FCM for Nov. 2011 was \$18.77 for the Pacific Northwest, and \$19.31 for Arizona. Using an average price of \$19.04 per hundredweight for 3.5% FCM, the IOFC would be calculated as  $(4.44 \times 0.1904) - (2.33 \times 0.14) = \$0.519$  per cow/day. You are investing 32.6 cents for the additional DMI and generating 84.5 cents of additional milk income. Another way to look at the 10 trial summary is to calculate milk efficiency. For every extra pound of DMI, cows produced 1.91 pounds of 3.5% FCM. At current feed and milk prices, the breakeven for milk efficiency is 0.73 pounds of milk per pound of dry matter intake.

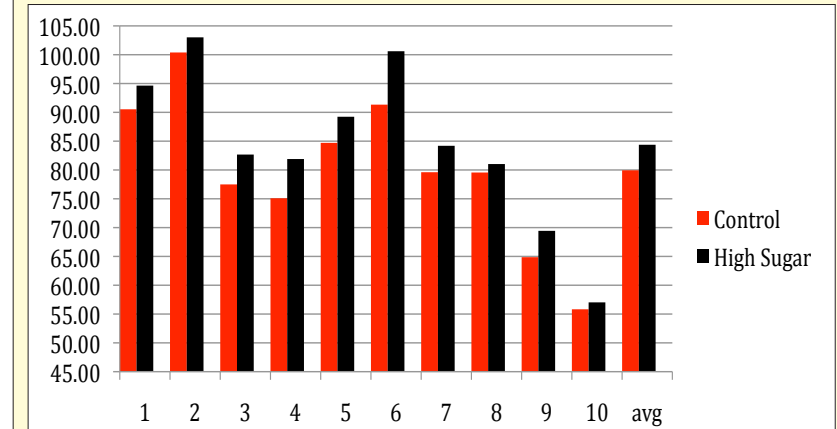
When you separate the 10 trials by stage of lactation, trial 7 was conducted with fresh cows in the first 4 weeks of lactation, trials 1,2,5 and 6 were conducted in early lactation, trials 3, 4, 8 and 9 were conducted in mid-lactation and trial 10 was conducted in late lactation (200+ DIM). The reason for the high dry matter in trial 10 is that the diet contained only 37% forage.

10 Trial Summary: 10 of 10 trials reported increased milk fat yield



Average Increase in Milk Fat Yield = 0.18 pounds  
Value of increased milk fat = \$1.959 X 0.18 = 35.3 cents per Cwt.

10 Trial Summary: 8 of 10 trials had increased FCM yield of greater than 2



Average Increase in 3.5% FCM = 4.44 pounds  
Trials feeding less than 45% forage (8 and 10) reported the smallest increases in 3.5% FCM