

Supplementing transition cow rations with Prequel21 and StrataG to improve breeding  
efficiency in Jersey Cattle during Summer months

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## ABSTRACT

The objective of this study was to determine if supplementing transition rations with the Omega system produced by Virtus Nutrition could improve breeding efficiency in jersey cattle, with a focus on the summer months of the California central valley. Beginning in March of 2011 the rations for the close up pen, all animals 21 days and under pre-fresh, was supplemented with Prequel21 at a rate to supply each animal with .25 pounds daily. When those animals that were supplemented during the pre-fresh period began calving, the ration for the fresh pen was supplemented with the rumen bypass fatty acid StrataG at .34 pounds daily. Data on conception rates was collected from the previous three years to be compared to the results of the study, the rates were broken down by year, lactation, month and summer to see where improvements would possibly be recorded. The supplementation was kept in the ration until November 2011 when the new data from the study was collected and compared. Conception rates during the summer did increase above the average from the previous three years (2008, 2009, 2010), but very little difference is seen between 2010 and 2011. Additionally, average milk at week 4 and week 8 were monitored so see if any difference was realized. Week 4 milk averages saw as much as 12% increase from March to August 2011, peaking as high as 59.1 pounds. Week 8 milk also rose as much as 12% getting to 64 pounds. The similarity in 2010 and 2011 with regard to conception rate is likely due to the previous transition supplementation being implemented during the summer of the 2010-year. The study was helpful for the dairy by aiding the overall efficiency of the

herd, however, alternate studies might be more desirable. To get a better idea if the supplementation was actually doing what it claims to do, a side-by-side study would be a better fit. This would ensure that there are as few variables affecting results as possible. With a side by side both groups would have the same weather and same time period so the only thing different between them would be the supplementation in one groups ration.

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# INTRODUCTION

The transition period of today's dairy cow serves as the culmination of a pregnancy as well as the building blocks of a new lactation. The importance of aiding the animal through this time via nutrition is well known, but what supplementation will do the best is not. It is important to supply the cow with ample energy to recover from calving and begin her new lactation strong and avoid diseases associated with negative energy balance. There is however a possibility of supplementing not only for increased energy, but also for increased performance such as breeding efficiency.

Wickstrom Jersey Farms, Inc. runs its feeding operation on the ideology of no cost spared. All animals in the operation are fed the best possible rations to give the best opportunity for success. This project was a good fit for the dairy considering the experience during the early lactation of the herd. A transition specific ration was already implemented, with supplementation designed to supply the necessary energy. However, the rations did not include ingredients to improve breeding and other production performance that the Omega products claim to do by encouraging gluconeogenesis, reducing fat accumulation in the liver and improving the animals overall health. With this project came the opportunity to improve what is thought to be one of the most important periods of the animals on a large dairy herd's life cycle. The objective of this study was to determine if supplementing transition rations with the Omega system produced by Virtus Nutrition could improve breeding

efficiency in Jersey cattle and help reduce the incidence of poor conception rates over summer.

## REVIEW OF LITERATURE

The health benefits humans receive from consuming omega-3 fatty acids are well known; reduced cardiovascular disease, hypertension and arthritis specifically. So it is common for milk and milk product producers to boost the levels of these fatty acids (FA) in their rations to improve the amount in their milk. But what if feeding certain forms of these FA could have other benefits for your herd. Higher milk production and more efficient breeding are just two possibilities of feeding FA during the animal's transition period. The transition period is usually defined as the last 3 wk. prepartum until 3 wk. postpartum (Silvestre et al., 2011) and is marked by reduction in DMI, negative energy balance once the new lactation is started as well as a decrease in immunity which leads to uterine diseases. Metabolically speaking, during late pregnancy the cow undergoes many changes to support fetal growth and to prepare for the onset of milk production (Smith et al., 2009). The combination of omega-3 and omega-6 FA targets this difficult time, attempting to supply key nutrients to fill the void the animals change in nutrient partitioning may cause. Animals fed n-3 fatty acids during the transition period have been shown to have higher energy balances than those fed traditional diets (Zachut et al., 2010)

### ***Fatty Acids Overview***

Omega 3 fatty acids are simply components of the fats in the different foods that we consume; there are 3 different types of these fatty acids. Alpha Linoleic Acid (ALA) is the most common group found in our diets, most likely because it is an essential fatty acid (one not made naturally by our bodies but essential for life). ALA is derived from plant and plant oils (Bellows et al., 2010). Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA) are the other two groups, known as long chain marine fatty acids. Fatty acids, specifically n-3 omega polyunsaturated fatty acids (PUFA) are long chain PUFA found in plants and marine forms (Gogus and Smith, 2009). Unlike saturated fatty acids PUFAs are associated with various health benefits as well as performance benefits in dairy cattle. N-3 fatty acids as well as n-6 fatty acids have been shown to aid in the transition period of the dairy cow and assist her return to a new lactation. Dairy cows with high production on average have a longer period from parturition to first ovulation (Garnsworthy et al., 2008). This is caused from the high level of energy partitioning towards her new lactation as opposed to reproduction. Feeding omega fatty acids has proven to improve ovarian function as well as follicle size (Sevenson, 2008).

### ***Estrous/Management***

When trying to improve a herd's reproduction numbers, there are managerial methods that should be in place prior to supplementing a ration to improve breeding. Management should have goal benchmarks laid out as well as basic protocols to help achieve them, one of these is the voluntary waiting period (VWP), also known as days first service (DFS).

VWP is a measure of how many days postpartum until the animal will be inseminated in an attempt to conceive another pregnancy. The more days postpartum the animal is, the higher her conception rate will be (Miller et al., 2007), so it is important not to breed back too soon, 60 days is the industry standard for VWP. While breeding an animal before her VWP to reduce the calving interval is tempting, it is important to keep in mind that if the animal is bred back too soon in her lactation, she might have to be dried off when milk production is still relatively high (Miller et al., 2007).

Organizing a successful breeding program can also require an estrous synchronization protocol, usually referred to as Ovsynch. Ovsynch was developed in response to challenges with detection and poor fertility, it allowed for control over follicular and corpus luteum development allowing for a timed A.I. (TAI)(Gordon, et al., 2010). A common plan for these timed ovulations often starts with a dose of GnRH, followed by PGF 7d later, and another GnRH after another 48h TAI is administered 20-24h after the latter GnRH injection (Miller et al., 2007). It has been found that herds operating with a well managed Ovsynch program can reduce the VWP to 50 days resulting in fewer average days open and greatly improved pregnancy rates at first A.I. service when compared to animals bred after observed estrous (Miller et al., 2007).

Another factor that is often overlooked when transitioning cows into a new lactation is feed bunk competition. Competition at the feed bunk causes a reduction in dry matter intake (DMI). This depression in feed intake during the time close to calving has poor effects on the already diminishing energy balance within the cow. A

study at the University of British Columbia in Vancouver compared the DMI of transition cows in a competitive pen against a non-competitive pen, n=72 and n=36 respectively. The animals in the non-competitive pen ingested an average of 75 g/visit greater than the animals in the competitive pen (Proudfoot et al., 2009). From this we can concur that keeping stocking density well below 100% in transition pens is important to reduce competition and keep DMI as high as possible with close-up animals to give as much opportunity as possible to keeping energy levels up.

### ***Feed Supplementation***

With proper managerial tools functioning, effort can be put into feeding protocols to further improve the breeding efficiency of a modern dairy herd. The effects of supplemental fats in rations on milk yield and composition as well as intake and digestion have been common practice in the dairy business for some time now, (Petit and Benchaar, 2007) but as a means to improve breeding is still a new idea to the industry. The key to aiding the cow through the very difficult transition period is as simple as keeping her as healthy as possible by supplying her with adequate energy. Prepartum feeding of fat in the ration has been shown to decrease liver lipid and triglyceride concentrations (Petit and Benchaar, 2007) thus resulting in a greater capacity for oxidation of FA as well as incorporate FA into cellular triglycerides. This all indicates a potential to moderate hepatic lipidoses (Petit and Benchaar, 2007). Compared to other long chain FA, supplementing with a linoleic acid proved to be the most beneficial because of its reduction in triacylglycerol concentrations and resulted in one of the highest rates of gluconeogenesis. So from

this it can be concluded that if a source of linoleic acid is supplemented before calving, it can decrease lipid accumulation in the liver as well as incidence of fatty liver. As a result this has proven to improve the desired overall health of the cow during her transition, as well as feed intake and milk production in the lactation following freshening. With the improvement to overall health, this is a good way to ease the animal into her new lactation and eventually get her into a new pregnancy faster (Petit and Benchaar, 2007).

When supplementing rations being fed to animals in their new lactation, we want to look at rumen protected FA, also known as Rumen Bypass Fats (RBF). The goal of feeding RBF is to increase the energy density of the ration without sacrificing the bacterial activity within the rumen (Petit et al., 2001). Linoleic acid is also known as an essential FA, essential fatty acids are those not synthesized by the body and need to be supplied via feeding. These Fatty Acids, also defined, as PUFA's are required by the animal for many cellular functions; specifically cellular membrane functions as well as producing prostaglandins. Research suggests that supplementing rations with these essential FA can improve first service conception and overall conception rate (Theurer et al., 2009). Many sources of PUFA are available to dairy managers, but must be utilized carefully because feeding high levels of unsaturated fat can have negative implications on milk fat. PUFA must be fed as RBF because of the fact that rumen bacteria will biohydrogenate PUFA to saturated fats (Theurer et al., 2009), which as stated are already produced by the body thus making the cost of feeding them as a supplement inefficient.



Megalac-R is a common ration supplement to help reach these reproductive goals. It has been proven to reduce DFS, services per conception as well as days open (Bowen and Ax, 2006). Megalac is a long chain fatty acid that is a common comparison to the Prequel 21/StrataG supplementation and is fed from 21 days prepartum to 60 DIM as well. As shown in the University of Maryland's Animal Science Department study, feeding a transition diet is important to keeping prepartum energy balance up, 10.0 Mcal/day vs. 4.2 Mcal/day for the control (Guo, et al., 2007). However, after calving, the control group: which was only receiving a dry cow ration had a higher energy balance than those treated (-5.8 vs. -8.9 respectively).

Combining the attributes of both Prequel21 and StrataG has been shown in studies to improve the breeding efficiency of a dairy herd (Figure 1)

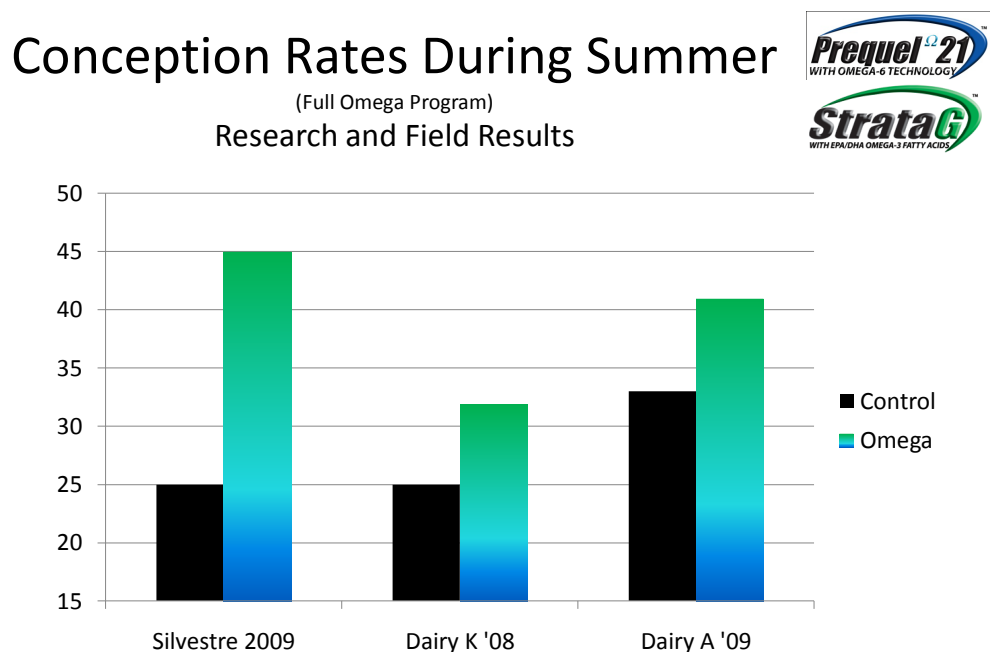


Figure 1: Omega Program Conception results

## MATERIALS AND METHODS

### *Background*

The study was conducted at Wickstrom Jersey Farms Inc. in Hilmar, California. The dairy began milking on the current site in 1973 and has been family owned and operated since. There are currently 2079 purebred jersey cows being milked on the farm 3x/day. In 2010 the milking facility was renovated from two double 7-herringbone pits to a 60 stall rotary barn. Breeding is done 100% by AI,

using Presynch/Ovsynch and Timed A.I. protocols. Animals were moved to the close-up pen when they were 21 days pre fresh.

In February of 2011, reproduction was a goal that the operation needed to improve on being that the herd started 2011 with numbers such as a 21% pregnancy rate with mid to high 30's percent conception rate. During this time management met with the current nutritionist as well as a nutrition representative



Figure 2: Facilities at Wickstrom Jersey Farms

from Virtus Nutrition about the Omega products available for transition dairy cows and how they could fit into the feeding program at Wickstrom Jersey Farms. All

lactating animals, etc. were housed in free stall barns (figure 2), which have been renovated to modern technology in the last 5 years (Figure 2). All breeding and lactating strings are outfitted with soakers and fans. With all of the technology that was provided to the herd the conception and pregnancy rates that was being achieved were sub par, especially during the summer (Figure 3). The dairy needed to see conception rates be less volatile throughout the year, staying around the 40% - 50% range on first service.

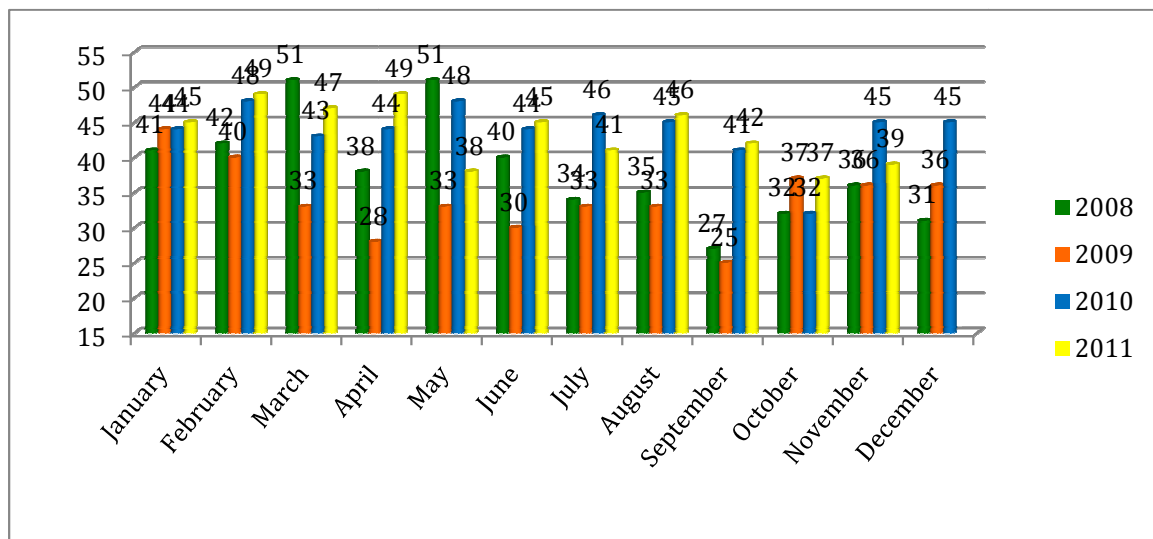


Figure 3: Graph of 1<sup>st</sup> service conception rates by month broken down by year

When we look at figure 3 it can be seen that the conception rates made a noticeable drop during the months of July, August and September compared to other months during the 2008, 2009 and 2010 years. This is likely due to the environmental conditions the California Central Valley experiences during the summer months.

### ***Supplementation***

The herd was being fed a Total Mixed Ration supplemented with Megalac-R and EnergII during the transition period to supply energy when starting a new lactation and being bred. It was determined that a change to the close-up and fresh cow rations could be an area of opportunity for reproductive improvements. Using Virtus Nutrition's Prequel21's ability to boost inflammatory response and StrataG's post parturition reduction in inflammation effects, the ration was updated in an attempt to meet these goals by replacing Megalac and EnergII.

Starting on March 29 2011 the close up rations included Prequel21 at a rate of .27 lbs. per day per cow. The additive was purchased at a rate of \$90/ton. Following, on April 15, 2001 StrataG was added to the fresh pen rations at a cost of .34 lbs. per day per cow. This additive was purchased at a cost of \$675/ton. Beginning in May 2011 100% of the animals that had gone through the transition cycle had been part of the entire omega cycle as well.

### ***Comparison***

When I looked at the effects of the supplementation, it was necessary to see if it in fact was financially feasible to include it in the transition rations. To accomplish this, data collected at the end of the study was compared to the reproduction information stored on the previous three years, (2008, 2009, 2010). This was the first restriction of the study that will cause the results to be slightly less reliable. A desirable situation would include two completely separate groups, one being a control receiving unchanged rations. Comparing to the past three summers also poses a problem when considering the ambient temperatures of the 2011 summer

months compared to the previous years, nonetheless, trends and data was still observed and collected.

## RESULTS AND DISCUSSION

For the first half of the year in 2010, the rations on the dairy were including Megalac-R, a ingredient comparable to the Prequel21 and StrataG products tested in this study for transition animals. Because of this, data from 2011 possibly showed a greater improvement over 2008 and 2009 than it will for 2010.

I also feel it necessary to note that during the trial there was a management shift on the farm. During the month of September the nutritionist that was formulating rations at the start of the trial was replaced by a new nutritionist. The feed additives and their inclusion rates were not compromised or changed, but other aspects of the rations were improved.

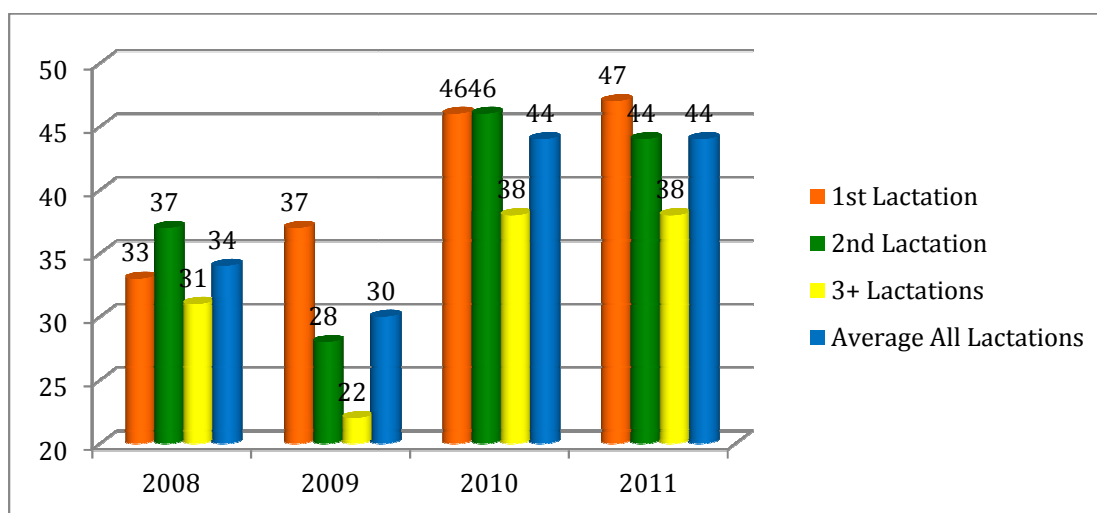


Figure 4: 1<sup>st</sup> Service Conception Rates June-September (Summer)

### ***Breeding Comparison***

Looking at Figure 4, the first thing I drew from it was the similar conception rates across all lactations in 2010 and 2011. However, because of the limiting factors of the study design, I will compare 2011 to the average of the previous 3 years, which calculates out to 36%. If the dairy can stay at a constant 44% conceptions per breeding, the 8% increase could save the operation \$11,397 in semen costs alone per year, this is based on the 2011 bredsum of 4,743 breedings through out the year with average semen prices of \$30/unit.

When considering feeding protocol changes, there should be a goal set out that should be worked towards to make the change worthwhile. In my case Virtus Nutrition has a calculator that determines the value of utilizing the Omega combination. Figure 5 is the proposed return that Wickstrom Jersey Farms can expect from the custom built report. This however does not take into account the other factors that were seen during the study such as weather and previous rations.

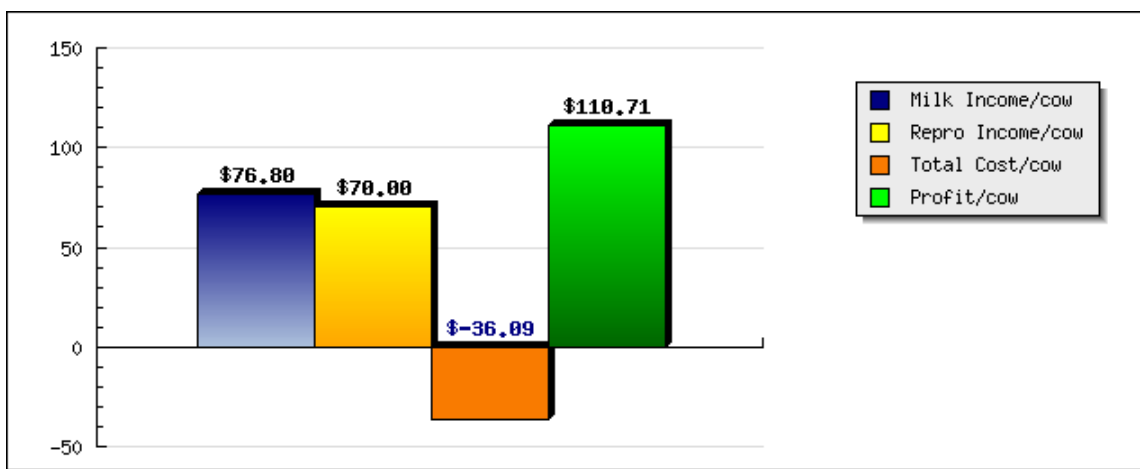


Figure 5: Omega value per cow report for Wickstrom Jersey Farms (virtusnutrition.com)

## Production Comparison

Because of the limits in the research design, combined with the possible milk income per cow that is available with the omega program, it was determined that milk production should be analyzed. Often a useful tool to see how cows are advancing up into peak milk is week 4 (avWK4) and week 8 (avWK8) milk charts (Figure 6). This used test day results for animals that were in week 4 or 8 of their lactation for a given test day to see where their average daily production was at with respect to a standard lactation curve. The purpose of this in my study was to see if in fact the Omega additives are assisting our herd in the post-fresh portion of the transition period and helping the new lactation get off to the correct start.

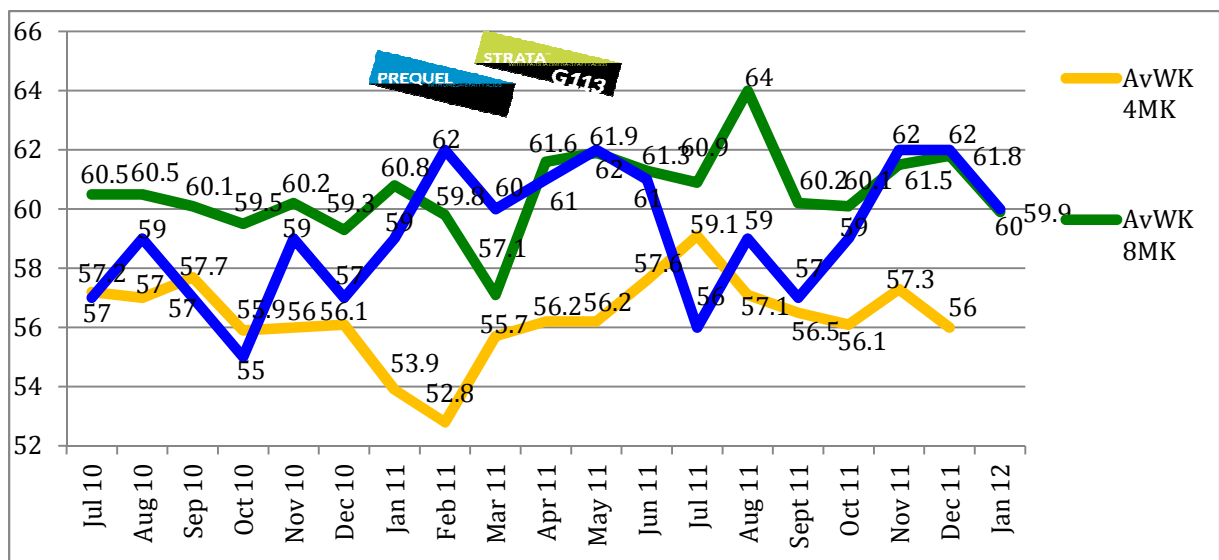


Figure 6: Average Test Day Milk for Week 4 and Week 8 (Blue: whole herd @ test day)

This particular chart compares the herd's week 4 and week 8 milk (yellow and green lines, respectively) to the whole herds average milk production at test day (blue line). When reviewing this portion we can see a steady trend up for both avWK4 and avWK8 during the summer months starting when both ingredients were implemented. At the same time, both figures were on a downward trend when the new transition protocols were implemented. Across the herd, with reasonable milk prices, this 5-10 lb./d increase per animal could pay significant dividends, undoubtedly paying for the added cost of the feed by itself.

### ***Weather***

Table 1: Average High and Low Temperatures by Month (wunderground.com)

<b>Average High/Low Temperatures</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Average</b>
<b>2008</b>	89/70	93/72	89/74	84/69	88.75/71.25
<b>2009</b>	92/66	90/73	86/69	86/63	88.5/67.75
<b>2010</b>	87/65	88/71	86/66	83/64	86/66.5
<b>2011</b>	86/59	88/67	83/73	84/67	85.25/66.5

As can be seen by Table 1, 2011 had the lowest averages for both high and low daily temperatures of the last three summers. This explains the ambient temperatures experienced in the valley that pose a disturbance to the study. Since the temperature was lower, the results of the study could have shown an improvement over the average that was not completely due to the supplementation being tested. However the temperatures don't vary enough to take full credit for the



reproduction and production improvements that were realized over the average from the 2008, 2009 and 2010 years.

Based on this set of factors, and assuming the loss in reliability due to experiment design, it is clear that the incorporation of the Omega program did in fact cause an improvement in not only breeding efficiency but in early lactation milk production as well.

## CONCLUSION

The importance of correctly feeding dairy cattle cannot be stressed enough. Different rations are formulated for different groups across the dairy, all to assist with different needs. The transition period is often seen as the foundation for the rest of the lactation cycle, resulting in a high responsibility of the transition rations. As can be seen with this study, adding the Omega program to the transition TMR improved the performance of those animals as they proceeded throughout their lactation. It can be argued that this study didn't show a huge improvement among parameters measured. However, it is important to consider that this herd was already implementing a proactive transition program to reap the highest performance from their herd, and improvement were still shown in addition to that.

When managing a progressive dairy herd today, it is important not to look at how to cut costs, but rather what costs are most beneficial to the bottom line of the business. When a dairy simply cuts costs, it risks reducing efficiency and in turn profitability. In this instance, rather than cutting feed costs in the transition period, supplements were added to reduce breeding costs and possibly increase milk

production instead, which combined would cover the costs of the supplementation quickly, especially with a mild summer such as this one.

In conclusion, Wickstrom Jersey Farms will continue to supplement their transition string based on the advantages that were discovered in this study. It was determined that the reproduction and production improvements and the profitability that was associated with both are beneficial enough to make feeding the Omega program, or a similar ration additive easily worthwhile.

## WORKS CITED

- Bellows, L., M. Bunning, and M. MacDonald. 2010. Omega 3 Fatty Acids. Colorado State University Extension food and nutrition. 9.382
- Borcherding, J.R., and D. Wanner. 1987. Product report: megalac. *Successful Farming*. 85: 54
- Bowen, A., and R. Ax. 2006. Cows fed magalac-r saw improves ovarian activity, reduced incidence of clinical and subclinical endometritis, and increased cumulative pregnancies. *Research Bulletin: Arm and Hammer Animal Nutrition*. 1-4
- Burhans, W.S., and A.W. Bell. 1998. Feeding the transition cow. *Cornell Nutrition Conference for Feed Manufacturers*. 60:247-258.
- Burke, C.R., C.V.C. Phyn, S. Meier, J.K. Kay, Y.J. Williams, and L. Hofmann. 2010. Effects of an acute feed restriction at the onset of seasonal breeding period on reproductive performance and milk production in pasture-grazed dairy cows. *J. Dairy Sci.* 93: 1116-1125.
- Chibisa, G.E., T. Mutsvangwa, G.N. Gozho. 2009. Effect of propylene glycol supplementation on microbial protein production in transition dairy cows. *Canadian Journal of Animal Science*. 89: 419-423.
- Garnsworthy, P.C., A. Lock, G.E. Mann, K.D. Sinclair, R. Webb. 2008. Nutrition, Metabolism, and Fertility in Dairy Cows: Dietary fatty acids and ovarian function. *J. Dairy Sci.* 10: 3824-3833.
- Gogus , U., and C. Smith. 2009. N-3 omega fatty acids: a review of current knowledge. *International Journal of Food Science and Technology*. 45: 417-436.
- Gordon, M.B., R. Rajamahendran, and N. Dinn. 2010. Effects of presynchronization and postinsemination treatments of pregnancy rates to a timed breeding ovsynch protocol in dairy cows and heifers. *Canadian Journal of Animal Sciences*. 90:35-44.
- Guo, J., R.R. Peters, and R.A. Kohn. 2007. Effect of a transition diet on production performance and metabolism on periparturient dairy cows. *J. Dairy Sci.* 90: 5247-5258.
- Lien, T.F., C.P. Wu, Y.M. Horng, and L.B. Chang. 2010. Effects of propylene glycol on milk production, serum metabolites and reproductive performance during the transition period of dairy cows. *Asian-Australasian Journal of Animal Sciences*. 23:372-378.
- Miller, R.H., H.D. Norman, M.T. Kuhn, J.S. Clay, and J.L. Hutchinson. 2007. Voluntary waiting period and adoption of synchronized breeding in dairy herd improvement herds. *J. Dairy Sci.* 90: 1594-1606.

- Petit, H.V., and C. Benchaar. 2007. Milk production, milk composition, blood composition and conception rate of transition dairy cows fed different profiles of fatty acids. *Canadian Journal of Animal Science*. 921: 591-600.
- Petit, H.V., R.J. Dewhurst, J.G. Proulx, M. Khalid, W. Haresign, and H. Twagiramungu. 2001. Milk production, milk composition, and reproductive function of dairy cows fed different fats. *Canadian Journal of Animal Science*. 695: 263-271.
- Proudfoot, K.L, D.M. Veira, D.M Weary, and M.A.G. von Keyserlingk. 2009. Competition at the feed bunk changes the feeding, standing and social behavior of transition dairy cows. *J. Dairy Sci*. 92: 3116-3123.
- Rastani, R.R., M.C. Wiltbank, D.G. Mashek, M.C. Schwab, R.R. Grummer, S.J. Bertics, and A. Gumen. 2005. Reducing dry period length to simplify feeding transition cows: milk production, energy balance, metabolic profiles. *J. Dairy Sci*. 88: 1004-1014.
- Silvestre, F.T., T.S.M. Carvalho, N. Francisco, J.E.P. Santos, C.R. Staples, T.C. Jenkins, and W.W. Thatcher. 2011. Effects of differential supplementation of fatty acids during the peripartum and breeding periods of Holstein cows: I. Uterine and metabolic responses, reproduction and lactation. *J. Dairy Sci*. 94: 189-204.
- Smith, K.L, W.R. Butler, and T.R. Overton. 2009. Effects of prepartum 2,4-thiazolidinedione and performance in transition dairy cows. *J. Dairy Sci*. 92: 3623-3633.
- Stevenson, J.S. 2008. Progesterone, Follicular, and estrual responses to progesterone bases estrus and ovulation synchronization protocols at five stages of estrous cycle. *J. Dairy Sci*. 12: 4640-4650.
- Theurer, M.L., E. Block, W.A. Sanchez, M.A. McGuire. 2009. Calcium salts of polyunsaturated fatty acids deliver more essential fatty acids to the lactating dairy cow. *J. Dairy Sci*. 92: 2051-2056.
- Zachut, M., A. Arieli, H. Lehrer, L. Livshitz, S. Yakoby, and U. Moallem. 2010. Effects of increased supplementation of n-3 fatty acids to transition dairy cows on performance and fatty acid profile in plasma, adipose tissue, and milk fat. *J. Dairy Sci*. 93: 5877-5889.

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