



Dairy Briefs

The Latest Information on Dairy Cattle Nutrition



Oh Daisy, Twins Again!

By Pedro Nogueira

It's not uncommon to hear dairy farmers worried about the increasing incidence of twin births on their farms. Sometimes we are asked if nutrition could have a role in this increased incidence. Nutrition doesn't seem to be directly involved with this problem. Nevertheless, it is known that high milk production is involved with twinning and high milk production is only possible with a high plane of nutrition. This high plane of nutrition (and the associated elevated dry matter intake) can have implications with the hormonal aspects leading to increased rate of double ovulations and consequently to twins.

Twinning is a complex trait with multiple causes. It seems that both genetic and environmental play a role as risk factors in cattle. Risk factors for twinning include: Genetics, Season, Parity, Ovulation Rate, and Milk Production.

The observation that twinning has increased in the dairy cattle population over time suggests that with the increasing intensification of milk production we've probably changed one or more of these causative factors. One of those factors might be the emphasis we've put in genetics. Dr. Matthew Lucy, from the University of Missouri, says that selection indices for dairy cattle are heavily weighted for milk production. By selecting for milk production, we have created dairy cattle that have to use a lot of nutrients for milk production, not only coming from the feeds, but also from their own fat reserves, that they mobilize during early lactation. The negative energy balance associated with high production puts cows at an increased pressure to conceive again. It's what Dr.

Milo Wiltbank, from Wisconsin University (and one of the researchers that developed the ovulation synchronization technique Ovsynch) calls the high-producer paradox – as dairy cows' milk production rises, pregnancy rates fall and reproductive difficulties increase.

Incidence of Twins and High Milk Production:

Cattle, under most

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Inside this Issue...

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Volume 3, Issue 4
August 2010

circumstances, have one calf after a successful pregnancy. Occasionally, however, the reproductive process in cattle results in the birth of twins. In some beef cattle production systems, twinning is considered a desirable thing that can enhance the overall profitability of the production enterprise by increasing weaned calf weight produced per cow. By contrast, twinning in dairy cattle is an undesirable trait that reduces the overall profitability of a dairy operation through negative effects on cows calving twins as well as on calves born as twins.

The ovaries of the cow are where the eggs are being produced. Nature is intelligent, so instead of producing only one egg a time, there are multiple eggs (follicles) growing at the same time. In case something goes wrong with one of them, there is a backup ready to go to work. One of those eggs is the dominant one and eventually it will be the one that ovulates and gets fertilized. The interesting thing is that during the growth phase of the eggs, both the biggest one and the second bigger one grow at the same rate and either of them have the ability to become the dominant egg. Because dairy cows generally only have one calf per gestation, at some point, there is a mechanism that tells all the eggs to stop growing except for the one that is supposed to ovulate. However, sometimes, for some reason, this inhibitory mechanism doesn't work, and so both eggs ovulate. If both are fertilized the cow will carry twins, in this case non-identical twins because each calf originates from one egg. Research shows that this double ovulation rate appears to be the cause of increased twinning rate in dairy cows, with 93% of twins being non-identical. Drs. Wiltbank and Fricke also found out that low producers had double-ovulation rates of 7%, high producers had rates of 20%, and top producers had rates above 50%. This is a huge difference in double-ovulation rate!

The question is: Why doesn't the inhibitory mechanism that stops the growth of more eggs always work, and how is high production related to that?

In a large study on risk factors for twinning, Dr. Kinsel, from Ohio University, concluded that parity of the dam is clearly associated with twinning rate, with the greatest increase occurring between the first and second calving, and also that "the single largest contributor (>50%) to the recent increase in the rate of twinning is the increase in peak milk production".

The mechanism involved seems to be the following: high milk production generally results in high dry matter intake (DMI). Because all this feed has to be digested, high dry matter intake is likely to stimulate high blood flow to the digestive tract. All blood flow from the gut must pass through the liver - in fact research shows that liver blood flow is greater in lactating (1561 ± 57 L/h) than similar size and age non-lactating (747 ± 47 L/h) cows. Because one of the functions of the liver is to eliminate certain substances from the blood, this increased liver blood flow would be expected to increase steroid metabolism because blood that passes through the hepatic circulation is essentially cleared of steroid. Other hormonal factors might also be cleared at an increased rate with elevated DMI. Thus, it is probable that high production and the consequent high DMI leads to increased

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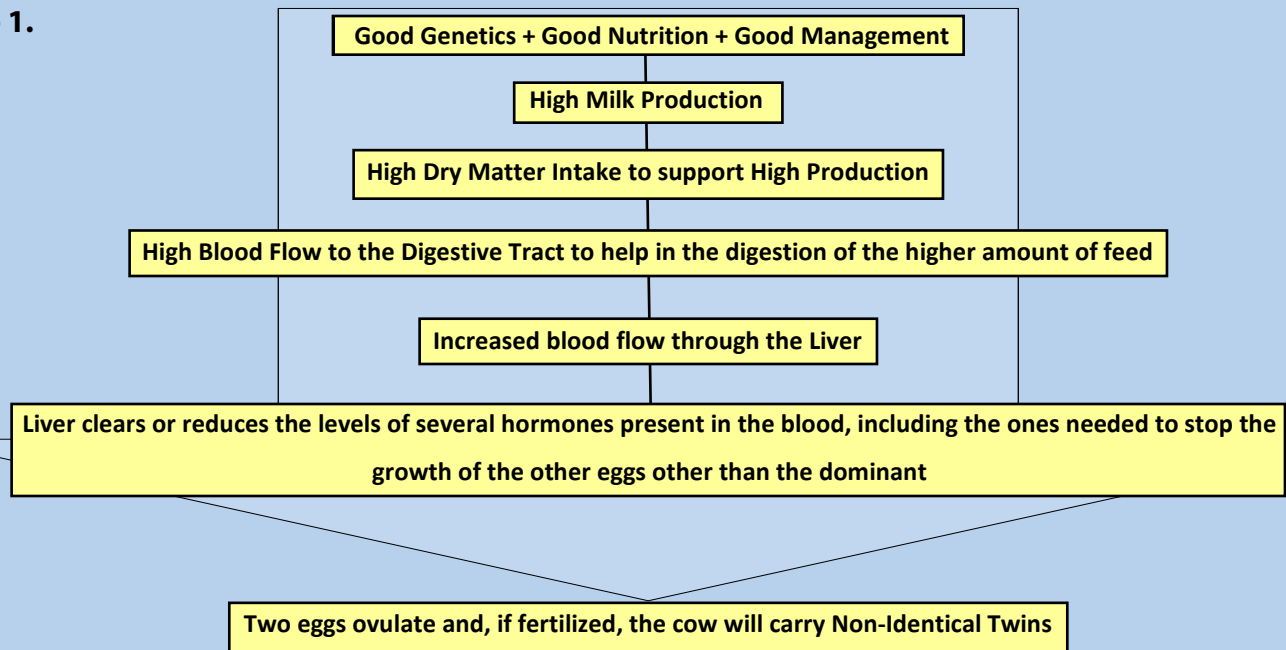
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Wayne, Judy and Keith Paxton
Brunner, Ontario



metabolism of follicular factors that are fundamental to avoid that more than one egg is produced. This process is outlined in Figure 1.

Figure 1.



In the opinion of Dr. Wiltbank, a continuous high plane of nutrition in lactating cows appears to chronically elevate liver blood flow and the consequent higher metabolism of steroid hormones to approximately double the amount observed in similar size and age non-lactating cows.

Drs. Wiltbank and Fricke made an interesting study with 240 cows that had ovulation synchronized with Ovsynch protocol, to determine if level of peak production could explain twinning rate. In this study, the mean milk production, determined 3 days before ovulation, was 36.5 ± 0.81 L/day (80.5 ± 1.8 lb/day) and cows were segregated by whether they were below or above the mean value. Double ovulation rate in cows that were above average production was 20.2% compared to 6.9% in those below average ($P < 0.05$). They also reported results of a study that evaluated naturally ovulating dairy cattle and found a similar relationship between milk production and double ovulation rate. Cows that produced less than 40 L/day (88 lb/day) had a very low double ovulation rate, whereas, cows producing above 50 L/

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Mike, Andrew, & Ed

The Van Engelen Family, Van Engelen Dairy Farms Ltd.

Brothers Ed and Mike Van Engelen, along with Ed's son Andrew, own and operate Van Engelen Dairy Farms Ltd. in Thedford Ontario. The Van Engelen's milk 350 cows, and have been working with Kenpal Farm Products Inc. for about 30 years. They are especially happy with Kenpal's BBB program.

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Mike, Ed and Andrew Van Engelen
Van Engelen Dairy Farms Ltd.
Thedford, Ontario

day (110 lb/day) had more than a 50% double ovulation rate. They concluded that although they cannot explain why there is such a dramatic inflection point in double ovulation rate as milk production increases above 40 L/day (88 lb/day), this increase in double ovulation rate is likely to continue to increase twinning rate in dairy herds as milk production increases. Another conclusion is that this effect of milk production is most related to the level of production within the 2 weeks before the cow ovulates and not to total milk production during the entire lactation.

So, what can we do?

It appears that for now we'll have to accept this trend. Dr. Wiltbank says that there are numerous intriguing possibilities, but they still lack sufficient data to allow recommendation at this time. What he and other researchers suggest is that we act upon management procedures. He suggests that dairy producers must set a program to diagnose twins. Twinning cows will calve earlier (10 to 14 days on average) and are likely to have more problems during the calving process. Dr. Paul Fricke recommends that, based on research in beef cows, feeding dairy cows carrying twin fetuses a higher plane of nutrition, especially during the last trimester of gestation may be beneficial. Furthermore, because gestation length of cows calving twins is reduced, most cows carrying twins miss at minimum a portion of the 2 to 3 week transition diet feeding period if calculated based on the estimated calving date of non-twinning cows. Thus, earlier dry off and feeding of a transition diet may reduce the incidence of physiologic and metabolic disorders associated with cows calving twins. Finally, providing assistance at calving for cows carrying twins may reduce complications associated with dystocia and may reduce economic losses by reducing the incidence of neonatal calf mortality.

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