The daily challenge of getting cows pregnant is nothing new to any dairy producer. What is new is the variety of approaches that researchers are taking to understand the mechanisms underlying this problem and propose effective solutions to it. Our applied reproductive research program is focused on controlling ovarian physiology to optimize fertility of lactating dairy cows. Our goal is to develop and utilize new information to improve the fertility potential of Ovsynch.

Ovulation Synchronization

During the past decade, hormonal synchronization programs have been included in the toolbox of many successful reproductive management systems. With the advent of Ovsynch, dairy producers can synchronize ovulation and inseminate dairy cows by appointment, independently of heat detection without any negative effect on hard-earned conception rates. Ovsynch works by controlling follicular development and luteal function based on a scheme of injections of gonadotropin-releasing hormone (GnRH) and prostaglandin F2α (PGF2α). Ovsynch allows ovulation to be timed with insemination, so that both egg and sperm are available at the correct time for fertilization.

Chink in the Armor

Given that, you might ask why we continue to work on Ovsynch. Have you ever noticed those cows that come into heat around the time of administration of PGF2α of Ovsynch or approximately 1 week after timed AI? If Ovsynch was working perfectly, those cows would not be showing heats. In fact, those heats are an indication of a chink in the armor of Ovsynch. Then, the question follows: how big is this chink in the armor? Is it worth getting concerned about it? Several research studies indicate that 10 to 30% of the cows treated with Ovsynch may fall in this category and may not have a chance to conceive (1-4). In these cows, ovulation is not synchronized with timed AI, which voids the already-low chances of a pregnancy... we are talking about up to 30% of your Ovsynch breedings!

New Program

Previous research indicated that ovulatory response to first GnRH of Ovsynch is a key determinant for a subsequent successful synchronization outcome (2, 4). Thus, in order to succeed, we needed to tackle Ovsynch where least
expected: upfront. As easy as it sounds, ovulation to first GnRH of Ovsynch is not that simple to attain because of the variability among cows in the status of follicular development at any given time. So, we went back to the drawing board. We focused on designing a program that would maximize the percentage of cows in early stages of the estrous cycle in order to maximize the percentage of cows that respond to the first GnRH of Ovsynch. The outcome is a new program now being called G6G.

The scientific basis for G6G arises from previous research indicating that days 5 to 9 of the estrous cycle is the optimal interval of the estrous cycle to initiate Ovsynch (4, 5). How was G6G/Ovsynch designed to work? G6G consists of a set of two hormonal injections that precede Ovsynch (Figure 1). It starts with an injection of PGFα, which is intended to induce luteolysis of all mid and late cycle corpora lutea. Then, a GnRH injection follows 2 days later, aimed to induce an ovulation. Taken together, the two injections of G6G are intended to induce cows to initiate a new estrous cycle. It is no coincidence that Ovsynch is scheduled to start 6 days later. By this time, cows are already on day 6 of a new estrous cycle and are very likely to have a functional dominant follicle, capable of ovulating in response to the first GnRH of Ovsynch. In short, the design of Ovsynch was aimed at optimizing the physiological setting in which Ovsynch is initiated and intended to lay the groundwork for a successful synchronization outcome to Ovsynch and the timed AI.

Putting G6G/Ovsynch to Work

The key question is: does G6G/Ovsynch work? Our research group put this idea to test on 137 first service, lactating dairy cows at Nobis Dairy, a commercial farm in St. Johns, Michigan. In addition to G6G, other alternative pre-Ovsynch treatments were compared with traditional Ovsynch in their effectiveness to synchronize ovulation. Transrectal ultrasonography performed throughout the synchronization protocols allowed us to assess the response of ovarian follicles and corpora lutea to G6G/Ovsynch versus Ovsynch alone. Moreover, blood samples collected at key timepoints during synchronization were used to measure circulating concentrations of progesterone and estradiol in cows. These measurements allowed us to study the morphological and functional response of the ovarian structures to the treatments of interest. So, what were the results? G6G/Ovsynch clearly outperformed traditional Ovsynch by increasing the percentage of cows that ovulated in response to first GnRH of Ovsynch: 85 to 54 %, respectively (P< 0.03; Figure 2).

Ovulation to first GnRH of Ovsynch is the key to successful synchronization of ovulation with timed AI. Thus, it was not surprising that 92 % of G6G/Ovsynch cows were successfully synchronized to timed-AI compared with only 69 % of Ovsynch cows (P<0.05; Figure 2). The next logical outcome to evaluate and compare between the treatments would certainly be conception rates. Unfortunately, the number of cows in this

![Figure 1. G6G/Ovsynch in lactating dairy cows: Schedule of injections, underlying ovarian dynamics and synchronization response (P is Follicle, CL is Corpus Luteum, X is Luteolysis, Ov is Ovulation).](image1.png)

![Figure 2. Effect of treating dairy cows with Ovsynch or G6G/Ovsynch on percentage of cows that ovulated in response to first GnRH of Ovsynch and on percentage of cows in which an ovulation synchronized with timed AI was detected.](image2.png)

![Figure 3. Example of a weekly schedule of injections for G6G/Ovsynch.](image3.png)
experiment was too small to test for differences in conception rates between the treatments.

Results

Despite the numerical difference observed between the groups in favor of G6G/Ovsynch, the data are not strong enough to claim an effect of G6G/Ovsynch on fertility of lactating dairy cows. However, it is only logical that cows that synchronize to Ovsynch are more likely to be inseminated at an optimum time relative to ovulation, and thus, to establish a pregnancy. Thus, the more cows that have a synchronized ovulation, the more cows that have a chance to become pregnant. In addition, in this study we identified three potential predictors of fertility in lactating dairy cows, namely concentrations of progesterone at the time of PGFα of Ovsynch, size of the ovulatory follicle, and preovulatory concentrations of estradiol at final GnRH of Ovsynch.

Recently, a second study re-confirmed the high synchronization rates of G6G/Ovsynch.

Our current and future research is to determine if the Ovsynch protocol can be manipulated to enhance fertility of dairy cows. We believe that as heifers become cows the follicles and the eggs they hold are negatively affected by changes in reproductive hormones. Based on the studies discussed in this article, we believe we can alter Ovsynch to make the follicle growth of a cow more like that of a heifer, and thus improve the fertility of the cow.

Summary

If you are using Ovsynch in your reproduction program, the addition of G6G could optimize your synchronization response. If you are willing to try it, Figure 3 provides an example of the schedule of injections for G6G/Ovsynch within a weekly calendar. For more detailed information, check the complete scientific article in the September 2006 issue of Journal of Dairy Science and contact Dr. Richard Pursley, at the MSU Department of Animal Science, pursleyr@msu.edu or 517-432-6178.

References