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DEVELOPMENT OF PROTOCOLS TO SYNCHRONIZE ESTRUS IN BEEF CATTLE

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Development of protocols to manipulate the estrous cycle so all females are in estrus during a short, predefined period (synchronized estrus) while maintaining normal fertility has been a difficult goal to achieve; however, over the past two decades efficacious synchronization protocols have been created and are available to producers today. These protocols have been anticipated for a long time, but development of effective protocols depended on the creation and approval of products such as MGA, the CIDR, $PGF_{2\alpha}$, and GnRH as reviewed elsewhere. This manuscript was prepared to provide a review of estrus synchronization protocol development.

Although Syncro-Mate B® was one of the earlier products made available to beef producers it is no longer available in the U.S. today so I'll only mention it briefly. Reviews are available if one is interested (Kesler and Favero, 1995, Kesler and Favero, 1996). Although unrelated to the loss of Syncro-Mate® from the marketplace, an estrogen was included in the protocol. Estrogens have come under great scrutiny and availability of a protocol with an estrogen is unlikely today. Yet, a nearly identical product (Crestar®) is available in some other countries (Nelis, 1995). Estrogen use will be discussed in more detail later in the manuscript.

MGA-$PGF_{2\alpha}$ Protocol

Although progestogens synchronized estrus, subsequent fertility was compromised when used alone. Zimbelman et al. (1970) reviewed 24 studies that addressed the effectiveness of MGA fed for 10 to 18 days as an agent to synchronize estrus. The percentage of MGA-treated females in estrus in the 6 days following treatment was similar to the percentage of controls in estrus in a 20 day period. However, first-service conception rates were 14% lower for MGA-treated females than controls. After ultrasonography became available it was demonstrated ovarian follicles maturing during MGA feeding persist rather than regress, and undergo atresia. When MGA feeding ceased these persisted follicle ovulated. Although they were competent at fertilization, embryo development ceased at the 16-cell stage. However, there was an opportunity for protocol development.

Brown et al. (1988) demonstrated if one fed MGA (at a rate of 0.5 mg/day/head) for 14 days and injected $PGF_{2\alpha}$ 17 days after the last day of MGA feeding estrus was synchronized without compromising conception rates. Heifers were inseminated upon the expression of estrus over the five days after the injection of $PGF_{2\alpha}$. Results from this study were encouraging, particularly when used in heifers (69% conception rate). This protocol was used by several researchers. Kesler (2002) summarized eight studies

published from 1988 to 2002 with an average conception rate of 67%. Unfortunately, not all heifers were detected in estrus (an average of 72% in these studies) and pregnancy rates were 48%.

In 2000, two studies (Lamb et al., 2000, Deutscher, 2000) were published with a small modification of the treatment protocol: the $PGF_{2\alpha}$ was administered 19 days after $PGF_{2\alpha}$. Although only a small improvement in pregnancy rates was reported by Lamb et al. (2000), 99% of the heifers detected in estrus were in estrus with 72 hours of the $PGF_{2\alpha}$ treatment. This demonstrated greater synchrony when $PGF_{2\alpha}$ was administered two days later. A summary of four studies conducted between 2000 and 2002 consistently demonstrated that pregnancy rates were only marginally improved (from 67% to 70% in heifers with 17 and 19 days intervals, respectively). However, the improved synchrony of heifers synchronized with the MGA-$PGF_{2\alpha}$ protocol created an opportunity for fixed-timed AI (TAI) as was used, and considered an advantage, of Syncro-Mate B®. In 2002 I reported when TAI was employed pregnancy rates (52%) were equal to that of breeding upon the detection of estrus (50%). We have subsequently utilized a modified TAI protocol: if observed in estrus prior to 48 hours heifers are inseminated using the AM/PM rule and heifers not observed in estrus are inseminated at 72 hours concurrently with an injection of GnRH. After implementing to protocol we have obtained pregnancy rates of 62% (used over a period of four years).

MGA Select

Several researchers have used the MGA-$PGF_{2\alpha}$ protocol in beef cows (Patterson et al., 2006). The MGA Select protocol consisted of 14 days of MGA feeding followed by an injection of GnRH 12 days after the last day of MGA feeding, an injection of $PGF_{2\alpha}$ a week after GnRH, and cows inseminated at a predetermined time (72 hours after the injection of $PGF_{2\alpha}$) and concurrently administered an injection of GnRH. At multiple locations Patterson et al. (2006) reported pregnancy rates of about 60% for both postpartum anestrous and estrous cycling cows. Although this protocol was demonstrated to be effective it is no longer recommended. In 1997 the FDA approved the use of feeding 0.50 mg of MGA/heifer daily for up to 24 days to suppress estrus in heifers intended for breeding; however, the use of MGA has not been approved for use in cows and use in cows is not advised.

Table 1. Pregnancy rates in cows synchronized with the MGA Select protocol.

Location/Reproductive Status	MGA Select	CO-Synch + CIDR
1: anestrus	73%	69%
1: cycling	61%	60%
2: anestrus	65%	70%
2: cycling	69%	74%
3: anestrus	52%	75%
3: cycling	69%	53%
4: anestrus	61%	60%
4: cycling	53%	64%
Combined: anestrus	64%	69%
Combined: cycling	59%	64%

7-11 Synch

Another protocol no longer recommended because of the use of MGA in cows is the 7-11 Synch protocol. This protocol involved the administration of MGA for 7 days with the injection of $PGF_{2\alpha}$ on the last day of MGA feeding. Three days later cows were administered GnRH followed by a second injection of $PGF_{2\alpha}$ 7 days after GnRH. A second injection of GnRH was administered concurrently when cows were inseminated 60 hours after the second injection of GnRH. This overall time duration of this protocol is shorter than for the MGA Select protocol; however, the 7-11 Synch protocol requires four animal handlings—an additional hassle factor. Results were quite satisfactory as reported in the following table (Table 2); however, not any better than pregnancy rates in cows synchronized with MGA Select protocol (Patterson et al., 2006).

Table 2. Pregnancy rates in cows synchronized with the 7-11 Synch protocol.

Location/Reproductive Status	7-11 Synch	MGA Select
1: anestrus	57%	65%
1: cycling	71%	67%
2: anestrus	56%	67%
2: cycling	60%	75%
3: anestrus	63%	64%
3: cycling	80%	75%
Combined: anestrus	58%	65%
Combined: cycling	69%	70%

Ovsynch

Ovsynch was first used in dairy cattle and it is still used considerably today; however, there was considerable history that paved the way to the development of the Ovsynch protocol (Table 3).

Table 3. Selected historical events pivotal to the development of GnRH and $PGF_{2\alpha}$ protocols.

GnRH History	
1955	Geoffrey Harris demonstrated the anterior pituitary gland released hormones only when cultured with hypothalamic tissue.
1963	Bruce Merrifield published a radically new approach to peptide synthesis.
1971	Andrew Schally reported the chemical structure of pig and sheep GnRH.
1973	Myron Brown and Allen Garverick's team administered GnRH to cows with ovarian cysts and characterized efficacy; clinical studies were conducted by Garverick, Britt, Seguin, and Oxender.
1977	Nobel Prize for Physiology or Medicine was awarded to Andrew Schally and Roger Gullemin (discovery of hypothalamic hormones).
1977	GnRH was approved by FDA for treatment of ovarian cysts in cattle.
1982	Kesler and coworkers demonstrated concurrent use of GnRH and $PGF_{2\alpha}$ (with a seven day interval) improved pregnancy rate (compared to $PGF_{2\alpha}$ alone).
1993	Silcox and coworkers demonstrated the ovulatory response of dominant follicles to GnRH.
1995	Pursley and Wiltbank reported the efficacy of Ovsynch in lactating dairy cows.
1998	Geary and coworkers demonstrated efficacy of CO-Synch in suckled beef cows.
2000	DeJarnette and coworkers demonstrated efficacy of Select Synch in beef cows.

When $PGF_{2\alpha}$ was introduced to the market it was understood it would only have an effect on estrous cycling females. However, even in estrous cycling females the interval from injection to estrus was greater than expected. Research using ultrasonography demonstrated that not only was it necessary to synchronize the luteal phase, as was done with $PGF_{2\alpha}$, but it was necessary to synchronize the follicular phase. Ovsynch was a protocol developed to synchronize not only the luteal phase, but the follicular phase as well.

Ovsynch consists of an injection of GnRH, followed seven days later with an injection of $PGF_{2\alpha}$, and a second injection of GnRH 48 hours after $PGF_{2\alpha}$. Cows are bred via AI 16 hours after the second injection of GnRH. The initial injection of GnRH provokes a preovulatory-like LH surge (Pursley et al., 1995). Studies have demonstrated this single injection of GnRH induces ovulation in most cows, including >80% of late-calving anestrous cows suckling calves (Thompson et al., 1999). A new follicular wave is then initiated about two days after the GnRH-induced ovulation (Kojima and Patterson, 2003). $PGF_{2\alpha}$ is administered to provoke luteolysis of any existing corpora lutea. The second injection of GnRH provokes a prevoulatory LH and is administered to stimulate ovulation of the mature, dominant follicle. This sequence of events synchronizes both the follicular wave and the luteal phase.

The second injection of GnRH results in a wide range of follicle sizes being ovulated (Perry et al., 2003). Lamb et al. (2001) demonstrated pregnancy rates increased as follicular size at the time of second GnRH injection (for the CO-Synch protocol) increased to 16.0 to 17.9 mm and then dropped. Furthermore, Mussard et al. (2003) demonstrated when embryos of similar quality were transferred into cows induced to ovulate small (< 12 mm) or large (> 12 mm) follicles, pregnancy rates were significantly higher in cows that ovulated with large follicles. More recently Perry et al. (2005) demonstrated GnRH-induced ovulation of follicles 11 mm in diameter or smaller resulted in decreased pregnancy rates and increased late embryonic mortality. This decrease in

fertility was associated with lower circulating concentrations of estradiol on the day of insemination, a decreased rate of increase in progesterone after insemination, and, ultimately, decreased circulating concentrations of progesterone. The goal in a timed AI protocol is to administer the second GnRH injection at a time when cows have large follicles, yet before spontaneous ovulation—a difficult goal to achieve. GnRH-induced ovulation of physiologically immature follicles has a negative impact on pregnancy rates and late embryonic/fetal survival as described in more detail later in this manuscript.

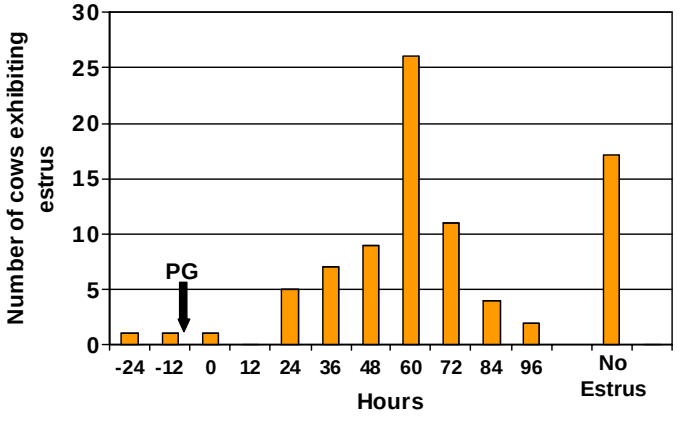
Although the Ovsynch protocol was developed for use in dairy cattle it was applied in beef situations. Three studies reported pregnancy rates of 51, 53, and 55% (Lamb et al., 2001, Cline, 2002, Hall, unpublished data). However, the hassle factor was animal handling; Ovsynch required four animal handlings. This basic procedure was then adapted for use in beef operations as follows.

Select Synch

Select Synch is an abbreviation of the Ovsynch protocol for use in beef cattle. Seven days after the injection of GnRH cows are administered an injection of $PGF_{2\alpha}$ to induce regression of corpora lutea, if present. Although 25-33% of the estrus-cycling cows will not have corpora lutea and do not need the $PGF_{2\alpha}$, it is not efficient to attempt to differentiate cows with corpora lutea from those without corpora lutea. Therefore, all cows receive an injection of $PGF_{2\alpha}$ seven days after the GnRH injection.

Cows synchronized with the Select Synch protocol are bred based upon the detection of estrus. The majority of cows will exhibit estrus 36 to 72 hours after $PGF_{2\alpha}$ (Stevenson et. al., 2000). However, a small percentage will exhibit estrus outside this peak period (see Figure 1), including 8 to 10% that show estrus prior to the injection of $PGF_{2\alpha}$ (Geary et al., 2000).

Figure 1
Estrus Distribution with Select Synch



Furthermore, not all cows are detected in estrus—ranging from 7 to 61% in the published data. It is recommend estrus detection begin the day before injecting $PGF_{2\alpha}$ followed by up to 7 days of estrus detection—including the day $PGF_{2\alpha}$ is administered. Although the injection of GnRH may induce the first postpartum ovulation and hasten conception, fertility in cows in poor body condition will still be low (Stevenson et al., 2000; Table 4).

Table 4. Pregnancy rates in suckled beef cows after treatment with Select Synch

Body Condition	Select Synch
4.0 or less	28%
4.5	39%
5.0 or greater	50%

The Select Synch procedure was developed for operators who do not object to, or feel more comfortable with, breeding upon the detection of estrus. The Select Synch protocol has been effectively utilized with very encouraging results as reported in Table 5. As shown in Table 5, estrus detection rates and pregnancy rates are highly correlated ($r = .96$; $P < .01$). Low responses may be due to compromised estrus detection efficiency, postpartum anestrus, or a combination of both. However, it does illustrate the importance of estrus detection and of using this protocol only when one is fully committed to thorough monitoring of estrus.

Table 5. Estrus response rates and pregnancy rates in cows administered the Select Synch protocol

Study	Estrus Response	Pregnancy Rate
Kojima et al., 2000	69%	47%
DeJarnette et al., 2001a:		
experiment 1	93%	70%
experiment 2	78%	52%
Stevenson et al., 2000:		
experiment 1	59%	38%
experiment 3	63%	44%
Patterson et al., 2001	67%	45%
Constantaras et al., 2004	80%	65%

CO-Synch

The CO-Synch protocol utilizes the same strategy as Select Synch; however, it uses a single fixed time AI. No estrus detection is required with CO-Synch—a major attribute of this protocol. Like Select Synch, cows must be in good body condition as results are compromised in cows in poorer body condition, as illustrated in Table 6 (Lamb et al., 2001).

Table 6. Pregnancy rates in suckled beef cows after treatment with CO-Synch

Body Condition	Select Synch
4.5 or less	30%
4.5 to 5.0	41%
5.5 or greater	59%

The CO-Synch protocol has been used in a large number of diverse situations quite successfully. Table 7 is a summary of the available published data where CO-Synch was used. Overall, pregnancy rates have average 47%. The protocol is quite simple to employ as all injections and timed AI can be done at the same time of the day. However, details must be followed closely. In the study by Larson et al. (2006) cows were bred at 54 hours after the injection of $PGF_{2\alpha}$, by design in this case, and pregnancy rates were compromised.

Table 7. Pregnancy rates in cows administered the CO-Synch protocol

Study	**Pregnancy Rates**
Geary and Whittier, 1998:	
location 1	49%
location 2	52%
location 3	46%
Stevenson et al., 2000	33%
Geary et al., 2001	49%
Geary et al., 2001	54%
Stevenson et al., 2003:	
experiment 1	61%
experiment 2	31%
Lamb et al., 2001:	
location 1	52%
location 2	54%
location 3	38%
location 4	53%
Perry et al., 2002	47%
Larson et al., 2004	43%
Constantaras et al., 2004	48%

Some have speculated short-term calf removal, from the time of $PGF_{2\alpha}$ until AI is completed, may improve pregnancy rates. Geary and co-workers (2001) examined this concept and demonstrated an improvement in one experiment, but not another as illustrated in Table 8. Similar results were observed when short-term calf removal was used with Syncro-Mate B®. It is important to note in order to utilize short-term calf removal one must have excellent facilities. Another advantage of short-term calf removal is processing of cows is simplified and calf injury is eliminated.

Table 8. Effect of short-term calf removal on pregnancy rates of cows synchronized with CO-Synch

Study	Pregnancy Rates
Geary et al., 2001:	
with calves	54%
calf removal	63%
Geary et al., 2001:	
with calves	49%
calf removal	46%

Select Synch & Timed AI

Select Synch & Timed AI is a blend between Select Synch and CO-Synch. This procedure was created to optimize pregnancy rates in cows administered GnRH-$PGF_{2\alpha}$ protocol. Because the interval from $PGF_{2\alpha}$ to estrus is variable, as illustrated in Figure 1, it is impossible to select a single time all cows have an excellent opportunity to conceive. Therefore, the insemination time for CO-Synch is the single time expected to achieve the highest pregnancy rate—not the optimum time when each individual has the best opportunity to conceive. In order for more cows to have an opportunity to conceive one may breed upon the detection of estrus for a period of time followed by a clean up timed AI—the Select Synch & Timed AI protocol. Upon examination of Figure 1, one will note the highest percentage of cows in this study were in estrus at 60 hours after the $PGF_{2\alpha}$ injection.

Therefore, the ideal time for clean up timed AI for the majority of the cows is around 72 hours. In the Select Synch & Timed AI protocol it is recommended that the clean up timed AI be done at 72 to 84 hours after $PGF_{2\alpha}$. This clean up timed AI is only for cows not previously detected in estrus. Furthermore, cows detected in estrus do not need an injection of GnRH at insemination. However, cows at the clean up timed AI should be concurrently administered an injection of GnRH. This will improve the likelihood that ovulation will be synchronized with the insemination. Results from published data are summarized in Table 9.

Table 9. Pregnancy rates in cows administered the Select Synch & Timed AI protocol

Study	Estrus Response	Pregnancy Rates
Stevenson et al., 2000	19%	34%
DeJarnette et al., 2001b:		
experiment 1	44%	44%
experiment 2	74%	47%
Larson et al., 2004		53%
DeJarnette et al., 2004:		
herd A-01	75%	51%
herd A-02	60%	44%
herd B-F-01	100%	71%
herd C-00	75%	67%
herd C-01	23%	23%

The results are variable (overall average of 48% [data in Table 9]) and don't appear considerably higher than for Select Synch (overall average of 52% [data in Table 5]) and CO-Synch (overall average of 47% [data in Table 7]); however, it will allow one to maximize the opportunity for obtaining the greatest overall pregnancy rates or avoiding busts. Similar to results in Table 5 for Select Synch, the estrus response was correlated ($r = .90$; $P < .01$) to pregnancy rates. Again this suggests poor estrus detection and/or postpartum anestrus compromised efficacy. Some have even suggested if the estrus response before the timed AI is poor, following up with the timed AI should be reconsidered.

Select Synch + ReCycleSynch

Because not all cows are inseminated in the Select Synch protocol, cows not detected in estrus and inseminated may be resynchronized for a second breeding. This potentially reduces the time to conception and allows for utilization of AI. This procedure was used on a group of cows by administering CO-Synch beginning six days after the original injection of $PGF_{2\alpha}$ to cows not observed in estrus and inseminated. Because we started breeding the day before $PGF_{2\alpha}$ we had a 16-day breeding period. Pregnancy rate at the end of the Select Synch protocol was 65% (Constantaras et al., 2007). With the additional cows conceiving to the CO-Synch protocol, the 16 day AI breeding pregnancy rate was 78%. This is only a slight increase in drug cost as only the cows not inseminated after Select Synch were administered CO-Synch; however, there is a significant increase in time and labor.

CIDR and $PGF_{2\alpha}$ Protocol

The Eazi-Breed^{TM} CIDR (CIDR) was approved by FDA in 2003; however, it was approved for use as a protocol. The approved protocol was the administration of the CIDR for seven days and $PGF_{2\alpha}$ on day 6 (the day before CIDR removal). Heifers and cows were observed for estrus and breed at estrus. The CIDR insert releases progesterone from a silicone matrix inserted once in the vagina. Progesterone concentrations rise within hours of insertion and fall within hours of removal. By the sixth day of insertion all females will have a corpus luteum that will respond to an injection of $PGF_{2\alpha}$. Furthermore, progesterone has been demonstrated to hasten puberty and postpartum fertility. In theory, all females will be in estrus during the five days after CIDR removal. Lucy et al. (2001) reported the efficacy of this protocol (Table 10).

Table 10. Pregnancy rates (for the 3 days after CIDR removal) for beef cattle treated with CIDR and $PGF_{2\alpha}$ protocol.

Item	Control	CIDR and $PGF_{2\alpha}$
Anestrus Heifers	6% (107)	28% (105)
Cyclic Heifers	9% (144)	49% (116)
Anestrus Cows	4% (151)	26% (141)
Cyclic Cows	11% (134)	46% (140)

These data demonstrated the value of the CIDR as a tool for the synchronization of estrus. However, researchers continued to seek more efficacious use of the CIDR for the synchronization of estrus.

CO-Synch + CIDR

Upon the approval of the Eazi-Breed^{TM} CIDR researchers collaborated on a number of studies reported by others in these proceedings. Briefly, a collaborative study published by Lamb et al. (2001) demonstrated the inclusion of the CIDR with the CO-Synch protocol improved overall pregnancy rates. Bremer (2004) then altered the time of

the timed AI from 48 hours to 54 and 66 hours after the injection of $PGF_{2\alpha}$. Results from these two studies are reported in the following table (Table 11).

Table 11. Pregnancy rates in cow synchronized with CO-Synch with or without CIDR inclusion and various intervals to timed AI.

Study	Treatment	48 hour TAI	54 hour TAI	66 hour TAI
Lamb et al. 2001	CO-Synch	48%	---	---
Lamb et al. 2001	CO-Synch + CIDR	58%	---	---
Bremer et al. 2004	CO-Synch + CIDR	56%	67%	71%

Additional Considerations

Heifers

Early studies concluded GnRH-based protocols with timed AI (Ovsynch and CO-Synch) should not be used in heifers. For example, Martinez et al. (2002) reported pregnancy rates of 39% in heifers synchronized with CO-Synch. This compares to a 68% pregnancy rate in heifers synchronized with a CIDR-based system in the same study (Martinez et al., 2002) and an average 56% pregnancy rate for heifers synchronized with an MGA-based system (14 days of MGA followed by $PGF_{2\alpha}$ 19 days after the last day of MGA feeding; Kesler, 2003) in other studies. Select Synch has been successfully used in heifers with good fertility. Lamb et al. (2004) conducted a multi-herd study: heifers were administered Select Synch, two injections of $PGF_{2\alpha}$, or the MGA-based system. A greater percentage of MGA treated heifers (83%) were detected in estrus during the targeted-breeding week than for Select Synch and $PGF_{2\alpha}$ treated heifers (74% and 75% respectively). Most of the heifers displayed estrus between 24 and 72 hours. The peak period for Select Synch treated heifers was between 24 and 48 hours after $PGF_{2\alpha}$, whereas the peak period for the MGA treated heifers was between 48 and 72 hours. Conception rates ranged from 63% to 68% and pregnancy rates ranged from 47% to 56% and were not different. Funston et al. (2004) also conducted a multi-herd study. They similarly demonstrated the MGA-based protocol was more effective in synchronizing estrus; however, conception rates and overall AI pregnancy rates for the MGA-based protocol and Select Synch were similar. Combined, these data suggest Select Synch will effectively synchronize estrus in heifers; however, attempting to inseminate at a predetermined time is not recommended at this time. Other protocols using MGA and the CIDR (as discussed elsewhere in these proceedings) are the recommended protocols.

Bos Indicus cattle

Data discussed to this point has been on European cattle (*Bos taurus*). *Bos taurus* are cattle with the most data; however, in the southern part of the U.S. there are many *Bos indicus* cattle or cattle with *Bos indicus* genetics. The limited *Bos indicus* data are summarized in Table 12.

Table 12. Pregnancy rates in *Bos indicus* cattle synchronized with GnRH and $PGF_{2\alpha}$ protocols.

Study	Protocol	Pregnancy Rates (%)
Ahuja et al., 2005	Select Synch	0%
Ahuja et al., 2005	CO-Synch	28%
Lemaster et al., 2001	Select Synch	21%
Lemaster et al., 2001	CO-Synch	31%
Lemaster et al., 2001	Select Synch & Timed AI	36%

Because of the poor results (averages of 11%, 30%, and 36% for Select Synch, CO-Synch, and Select Synch & Timed AI, respectively) many researchers have gone to using estrogen rather than GnRH in the synchronization protocols. The use of estrogen will be discussed later. The published data, however, does demonstrate Select Synch, CO-Synch, and Select Synch & and Timed AI are somewhat efficacious in *Bos indicus* cattle; albeit, lower than when used in B*os taurus* cattle. One factor that will compromise efficacy is the environmental temperature. The *Bos indicus* cattle are in areas with elevated temperatures. Another factor often mentioned in many of the *Bos indicus* studies is body condition. These cows often have poor body condition and as demonstrated in the *Bos taurus* cattle body condition will compromise efficacy. Clearly, more research is needed.

Estrogen Use

It is important to point out some scientists have reported the use of estrogen—estradiol and estradiol benzoate—may improve synchronization efficacy; however, extensive multi-location studies do not exist. Estrogen administration via anabolic implants has been demonstrated to be safe by the FDA. Yet, in 2002 the Women's Health Initiative reported post-menopausal estrogen therapy increased the incidence of breast cancer. However, more recently, after more thorough review of their data they greatly reduced their warning. This was partially due to the data that demonstrated estradiol-only therapy to post-menopausal women had no effect on increasing the incidence of breast cancer whatsoever (Nelson et al., 2002). However, there is still considerable public concern and we do not need to further concern the public with the safety of the product beef producers provide. Besides, estradiol and estradiol benzoate are not approved by FDA for this use. Hence, it is not an extra-label use—it is illegal to use estradiol or estradiol benzoate to synchronize estrus and ovulation.

GnRH Products

The efficacy of the specific GnRH product used with the Select Synch, CO-Synch, and Hybrid Synch protocols has been discussed. Much of the discussion was caused by a study published by Martinez et al., (2003). Martinez et al. (2003) reported Cystorelin® provoked a greater LH surge than Fertagyl® and Factrel®. Similarly, Cystorelin® induced a higher ovulation rate; however, all products synchronized follicular wave emergence. GnRH is a decapeptide—a linear chain of ten amino acids. The base for Cystorelin®—and Fertagyl® (and Ovacyst™ another GnRH product not included in the Martinez study)—is diacetate, tetrahydrate. Therefore, Cystorelin®, Fertagyl®, and Ovacyst™ are chemically identical. Factrel® has a HCl base which should not alter bioactivity. If the GnRH products are chemically identical, then why did Martinez et al. (2003) observe differences? Being quite familiar with pharmaceutical manufacturing I realize companies

are permitted to include a wide range of active compound in the product. It is unknown if the company manufactures at the low or high end of this range. Hence, the results of Martinez et al. (2003) may only be a difference in active GnRH within the product. One must remember, the dose was selected based on the treatment of cystic ovarian disease—the clinical claim for GnRH products. This raises a previously mentioned point. One should use a full dose of GnRH as more variable responses, including decreased efficacy, has been reported when cows are administered a half dose of GnRH (John B. Hall, personal communications). Although all dominant follicles (≥ 10 mm) have the ability to ovulate in response to a GnRH-induced LH surge, Sartori et al. (2001) demonstrated a larger dose of LH was required to induce ovulation of a 10 mm follicle compared to larger follicles. Certainly, this subject needs further study.

Implications

Although Ovsynch, that utilizes the GnRH-PGF program, was developed for dairy cows and is less attractive for use in beef operations, it has been used successfully (Geary et al., 1998, Lamb et al., 2001). In three studies where it was used pregnancy rates were 51 to 55%. In one operation where Ovsynch was used for five years the owner/operator estimates 63% of his calves were AI calves as a result of Ovsynch synchronization (Sutphin, 2005). Although his records indicate there was an increase of $14 per pregnancy ($41/AI pregnancy vs. $27/natural service pregnancy) his records also indicate there was a reduced death loss with AI (3.5 % vs. 5.5%), more resistance to pneumonia and scours, and less delivery assistance was required (1.3% vs. 2.9%). Overall, his records suggest the operation realized $145 more profit from AI calves (from AI cows) if they were retained to harvest.

Other scientists are summarizing results utilizing progestins (MGA- and CIDR-based systems) and can be found elsewhere in these proceedings. Although the progestin-based systems may have higher pregnancy rates in some situations, the GnRH-based systems without progestins have value. In fact, a supermarket of estrus synchronization protocols for producers with different needs exists today. There isn't one protocol that fits every situation and one needs to select the protocol that best fits his or her operation.

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