Commercial application and cost analysis of a 5 day Co-Synch synchronization protocol

S.E. Davis, E. Curry, and J.R. Gibbons
Animal and Veterinary Sciences Department, Clemson University, Clemson, SC

Abstract

Artificial insemination (AI) is a tool available to progressive cattle producers to assist them in reaching reproductive, genetic and financial goals. Fixed-time AI programs decrease labor costs for estrus detection and ensure every cow is inseminated. Co-Synch + CIDR (controlled internal drug release) is a widely used ovulation synchronization protocol within the beef industry. The objective of the experiment within this technical report was to determine if the shortened 5 Day Co-Synch + CIDR sufficiently increased pregnancy rates to compensate for the added expense and increased labor of an additional injection and additional chute processing. Mature, multiparous Angus and Angus-cross cows ranging in age from 3-15 years averaging 500 kg bodyweight were synchronized using the 5 Day Co-Synch + CIDR protocol. (Day 0: administer 100 µg gonadotropin releasing hormone (GnRH) and insert CIDR, Day 5: remove CIDR and administer 25 mg prostaglandin $F_2\alpha$ ($PGF_2\alpha$), Day 5 + 8 hours: second injection of 25 mg $PGF_2\alpha$, Day 8 (72 hours after CIDR removal): administer 100 µg GnRH and fixed-time artificially inseminate). The pregnancy rate achieved using the 5 Day Co-Synch protocol was 53.7%, which was comparable to pregnancy rate (51.3%) achieved within the same herd using a modified OvSynch protocol (Day 0: 100 µg GnRH, Day 7: 25 mg PGF2α, Day 9: 100 µg GnRH, Day 9 +12 hours: fixed-time AI) the previous year. Although comparable to other AI systems in efficiency (pregnancy rates) the success of this approach did not compensate for the additional financial and labor input. However, dependent upon management system, this program can sufficiently decrease estrus detection cost and labor associated with an estrus synchronization program to make this fixed-timed AI protocol economically feasible.

Keywords: Cattle, Co-Synch + CIDR, estrus synchronization, ovulation synchronization

Introduction

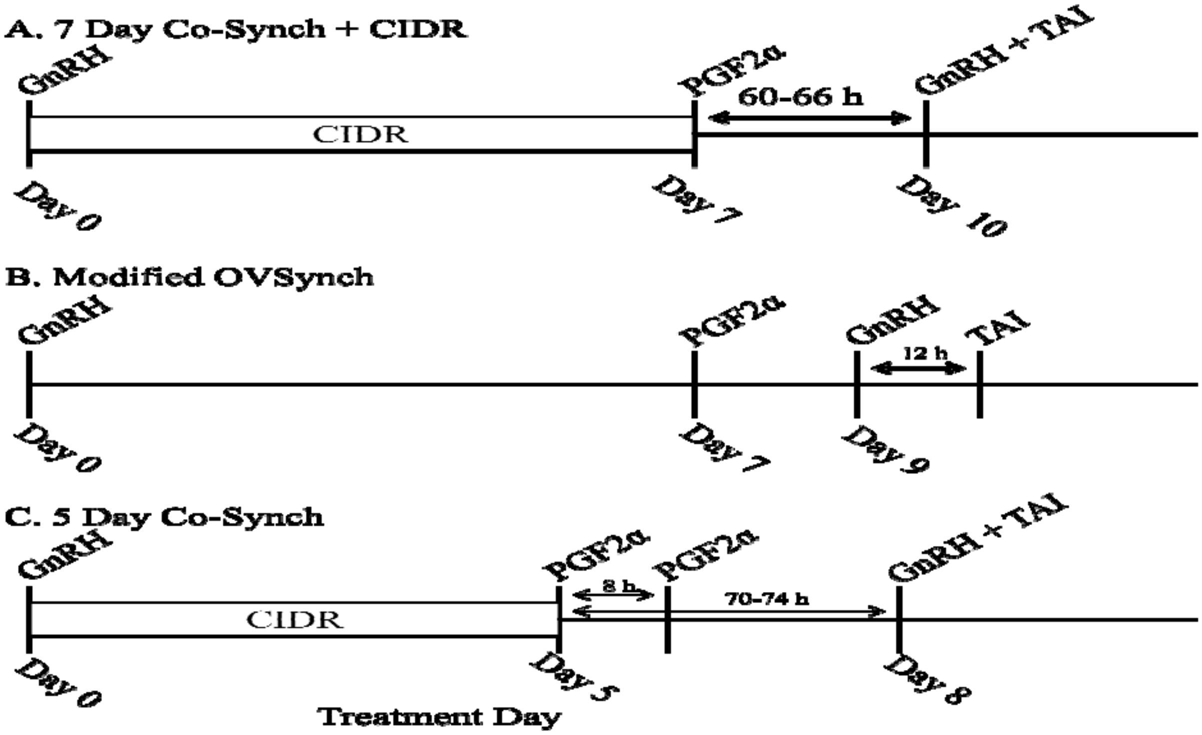
Artificial insemination is an important tool available to cattle producers that will facilitate increased genetic gain, propagation of more elite genetics from outstanding bulls, rapid improvement of economic traits, increased efficiency of sire selection and progeny testing and a decreased number of bulls that need to be maintained on an operation.[1] From a management standpoint, for a cow to maintain a yearly calving interval, she must conceive again within 85 days post-calving.[2] Artificial insemination implementation can reduce the amount of time necessary to breed cows, shorten the calving season and produce a more uniform calf crop at weaning and provide more predictable calving ease.[1,3] Acceptable pregnancy rates using AI are dependent on several management factors such as proper nutrition before, during and after breeding, proper health status, accurate record keeping, organization and planning of the breeding program, estrus detection (if applicable), semen quality, storage and handling, adequate working facilities and skilled technicians.[2] Several uncontrollable factors such as the weather, latitude and daylight can contribute to AI program efficiency as well. Artificial insemination is currently used to breed 72.5% of dairy cattle, with timed AI (TAI) programs used in 58.2% of dairy operations, and 7.6% of beef cattle in the United States.[4,5] There are many factors that contribute to the less frequent use of AI in beef cattle operations. Producers list labor, time and cost as the main reasons not to implement AI followed by too difficult or complicated, other various reasons, lack of facilities and lower confidence in effectiveness.[5] However, under the proper management strategy, AI can be used to add value to a calf crop to sufficiently cover added expense. Estrus synchronization can reduce the amount of time and labor needed for estrus detection and AI. The success of estrus synchronization programs relies heavily on proper estrus detection, as the detection efficiency correlates to pregnancy rates following AI or embryo transfer (ET). Synchronization programs call for estrus detection anywhere from three to eight days. This is labor intensive and in some cases cost prohibitive, as estrus detection costs range from $15-50 per cow per synchronization cycle.[6] There are many factors that influence detection efficiency which directly affect the cost associated with detection. These factors include the days needed for detection, the amount of time allowed for estrus detection per session and the frequency of detection per day. Others factors such as labor availability, facilities and management systems contribute to the ideal frequency and efficiency of detection. Fixed time AI is utilized in an ovulation synchronization program which further reduces the amount of labor needed for estrus detection because cattle are not examined for estrus and this also ensures that every cow is inseminated. Inseminating every cow adds the possible advantage of getting cows pregnant that might not have been observed in estrus with an estrus detection protocol, but do ovulate and may become pregnant. Artificial insemination along with ovulation synchronization facilitates the use of a timed AI program, which are now achieving pregnancy rates comparable to those achieved by estrus detection programs. The used of a CIDR (controlled internal drug release; a progesterone releasing device) can further increase the efficiency of an estrus synchronization protocol by inducing cyclicity in anestrous cows. An alternative method of delivering exogenous progesterone is the feed additive melangesterol acetate (MGA). This method of progesterone delivery is inexpensive (about $0.02/head/day); however, consistent administration is difficult to control because of inconsistencies with feeding habits and irregular feed intake. The addition of a CIDR has been shown to increase pregnancy rates by 10%, (58% vs. 48%) using a conventional CO-Synch protocol.[7] A commonly used fixed timed AI program in beef cattle is CO-Synch + CIDR. Average conception rates using this program in post-partum beef cattle are approximately 55%, with reported rates ranging from 31-80%.[7,9-15] The conventional 7 Day Co-Synch + CIDR AI program is initiated by administration of 100 µg GnRH, on Day 0 along with the insertion of a CIDR. On Day 7 the CIDR is removed and 25 mg $PGF_2\alpha$ is administered. Sixty to sixty-six hours after CIDR removal all cattle receive a second injection of 100 µg GnRH and are fixed-timed artificially inseminated. A modification to the conventional 7 Day Co-Synch + CIDR is to shorten the exogenous progesterone delivery to 5 days and administer two injections of $PGF_2\alpha$. Reported pregnancy rates using this protocol range from 55-80%.[15-17] The 5 Day Co-Synch + CIDR is initiated following the same protocol as the 7 Day Co-Synch + CIDR with administration of 100 µg GnRH and insertion of a CIDR at Day 0. A novel approach to the conventional system is to shorten the 7 Day CIDR interval to 5 days. On Day 5, the CIDR is removed and an initial injection of 25 mg $PGF_2\alpha$ is administered. Eight hours following the initial injection of $PGF_2\alpha$ a second dose of 25 mg is administered, which is necessary for the success of the shortened protocol. Ideally, the added advantages in terms of increase in conception rates of using the 5 Day Co-Snych + CIDR program should compensate for the added expense of an extra injection and labor associated with an additional chute processing. The primary goals of this technical report were to evaluate expenses and economical advantages or disadvantages with using a particular fixed timed AI protocol within a particular cowherd.

Materials and methods

Mature, multiparous Angus, Angus cross and Hereford cattle (n=123) ranging in age from 3-15 years and averaging 500 kg body weight, were administered 100 µg of GnRH and a CIDR (Eazi-Breed™ CIDR®, Pfizer Animal Health, New York, NY) was inserted on Day 0. CIDR removal and administration of 25 mg $PGF_2\alpha$ occurred simultaneously on Day 5. Approximately 7 hours after CIDR removal, all cattle received a second dose of 25 mg $PGF_2\alpha$. On Day 8, each cow received 100 µg GnRH and were inseminated with frozen-thawed semen from several Angus (N=4) or Hereford (N=2) bulls (Figure). Cattle exhibiting signs of estrus the next day after fixed-timed AI were eliminated. Approximately two weeks after TAI, bulls were placed with the cows for 45 days. All cows were subjected to transrectal ultrasonic evaluation of their reproductive tracts to determine pregnancy 30 days after insemination. Cattle determined to have conceived from AI were again evaluated ultrasonically on Day 70 to determine fetal sex.

In another study cattle from a similar origin and environmental conditions were synchronized with a modified Ovsynch program. On Day 0 cows (n=152) were administered 200 µg GnRH. On Day 7, cows were given 25 mg $PGF_2\alpha$ and on Day 9, given 100 µg GnRH. Any cows that were observed in estrus before Day 9 were eliminated. Twelve hours after the second GnRH injection, the cattle were randomly divided into control (N=75) and HeiferPlus™ (HP; n=77) groups.[18] The control group was inseminated with 0.5 mL of frozen-thawed semen which had been incubated at 37°C for 20 min and the HP group was inseminated with 0.5 mL frozen-thawed semen HeiferPlus™ treated semen.[19,20] Pregnancy was determined via ultrasonic evaluation 36-38 days after AI. Fetal sex was determined via ultrasonic evaluation 55-58 days after AI.

Figure: Timeline for ovulation synchronization protocols



Cost analysis

All prices used to calculate $/pregnancy and $/female calf are subject to the assumption that all drugs were purchased from the same vendor (Valley Vet Supply; Marysville, KS[21]). It is a realistic assumption that producers would purchase their drug inputs from a single supplier and price fluctuations for different inputs could be substituted in the calculations. Also, even though two year's worth of data were used, the price of inputs would carry minimal variation from year to year and assigning a dollar amount for each protocol was critical for economic evaluation. The prices for injections on a per cow basis were:

GnRH = $2.90/dose
$PGF_2\alpha$ = $2.67/dose
CIDR = $10/CIDR
MGA = $0.02/head/day[20]
Chute Processing = $1/head/time through the chute; chute charges were calculated based on $12.48 per hour wage ($10.00 + 28% benefits) for four individuals for two hours on a hundred cow basis.
Estrus Detection = $15/head/synchronization; estrus detection fees were based on checking for estrus for four days with two checks per day for 30 minutes and two laborers at $12.48/hour ($10.00 + 28% benefits) on a 100 cow basis.

Results

The pregnancy rate achieved with the 5 Day Co-Synch + CIDR was 53.7%. The pregnancy rate achieved using the modified Ovsynch protocol within the same herd in a previous year was 48% (36/75) for the control group and 54.5% (42/77) for the HP group. When these two groups were combined the total herd pregnancy rate was 51.3% (78/152). The pregnancy rate data were combined in the treatment and control groups because there was no treatment effect within the study. Also, this protocol did not affect fertility within the herd from previous years or when compared to the present study. The pregnancy rate for the 5 Day Co-Synch was not statistically different from either the control group pregnancy rate from the previous study or for the control and HP groups combined (there was no treatment effect within study).

Table: Comparison of $/AI, $/pregnancy and $/female calf for different protocols

Synchronization Protocol	$/AI	$/Pregnancy	$/Female Calf
Traditional 7 Day Co-Synch + CIDR	$21.67	$39.40	*
5 Day Co-Synch + CIDR	$25.34	$47.19	$111.32
Modified Ov-Synch	$12.47	$24.30	$52.65
2 Injection $PGF_2\alpha$	$22.91	$65.43	*
Select-Synch	$23.24	$51.64	*
MGA + 2 Injection $PGF_2\alpha$	$23.55	$33.64	*

Assumptions:
GnRH = $2.90/dose
$PGF_2\alpha$ = $2.67/dose
CIDR = $10/CIDR
MGA = $0.02/head/day fed
Chute Processing= $1/head/time through the chute
Estrus Detection = $35/head/synchronization cycle
* Not analyzed in study.

Calculations for $/AI and $/pregnancy for the traditional Co-Synch used a pregnancy rate of 55%. The modified Ov-Synch and 5 Day Co-Synch + CIDR were calculated using data collected, finding 51.3% and 53.7% pregnancy rates, respectively. Calculations were based on field trial studies by Patterson and Smith which found the estrus response rate for the 2 Injection $PGF_2\alpha$, the Select-Synch and the MGA + 2 Shot to be 57%, 67% and 93%, respectively. Also, pregnancy rates were 35%, 45% and 70%, respectively.

Discussion

Although the conception rates achieved in this study were slightly lower than other published data using the same protocol,[15-17] the pregnancy rate of 53.7% is still an acceptable value for a fixed-timed AI protocol. Although not demonstrated in the current report, an increase in cost per pregnancy might be accompanied by an increase in pregnancy rate which would enhance economic viability of this approach. However, an increase in the cost of inputs (labor, pharmaceuticals, etc.) may not be associated with an increase in pregnancy rates, so producers should evaluate all protocols to determine the improvements needed within their herd and if these improvements are cost effective within their production system. Using a pregnancy rate of 55% for the conventional 7 Day Co-Synch protocol, and all posted assumptions (Table), within this herd, a pregnancy rate of 64.5% would be needed to make the shortened 5 Day Co-Synch protocol more financially advantageous. Although pregnancy rates in this study did not approach this value, it is however within the range of published conception rates for the 5 Day Co-Synch protocol.[16] This further shows the need for a classic control group beyond the scope of this technical report. On farm, similar pregnancy rates were achieved using the modified Ov-Synch protocol without a CIDR and cost significantly less. The three estrus detection protocols were comparable to the fixed-timed $/AI protocols; however, when comparing the $/pregnancy, an increase in cost was observed when estrus response was lower. The MGA 2 Injection $PGF_2\alpha$ was the least expensive in terms of $/pregnancy with excellent estrus response and pregnancy rates; however, supplementing MGA requires a feed or protein carrier and consistent delivery on a per head basis is difficult to control. The cost per female calf was outside of the scope of this project; however, was included in the calculations to show that the two protocols studied within this herd did not alter sex ratio and this dollar amount could potentially be of valuable to certain producers. Also, estrus detection costs were calculated on the minimal end of the price spectrum (ranges from $15-50 per cow per synchronization cycle) and increased estrus detection intensity would increase costs and labor associated and efficacy of detection would also impact the number of cattle observed in estrus and subsequently artificially inseminated. Labor costs are also impacted by herd size, which should be taken into account when determining which, if any, estrus synchronization program would be the most economically feasible. The larger the herd size, the less viable the more intensive programs that require several trips through the chute will be. Alternatively, a smaller herd size could potentially be cost-prohibitive because price could increase to a $/head amount that is not financially feasible. Herd size should be an important consideration when developing a proper synchronization protocol. In conclusion, the 5 Day Co-Synch protocol produces acceptable pregnancy rates for a TAI protocol, but within this herd, did not increase the pregnancy rates to sufficiently compensate for the added expense.

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