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Low Cost Cow/Calf Program: The School – Part I

Dr. Diven begins the Low Cost Cow/Calf Program School with a discussion on length of the postpartum period and what effects how soon a cow will rebreed after calving, and that 45 day breeding seasons should be the norm not the exception.

Postpartum Interval (PPI) – How Long

The average length of gestation for cattle is 282 days. With 365 days in a year the cow needs to be rebred within 83 days after calving if she is to calve again by the same time next year (365 – 282 = 83). However, she does not experience first estrus until her reproductive tract has had a chance to repair from calving (*uterine involution*) which can take from 20 to 40 days. How long postpartum anestrous, aka postpartum interval (PPI), lasts beyond uterine involution is influenced by the cow's body condition at time of calving, the time of year she calves, and her nutrition afterwards. A beef cow in good body condition at time of calving and provided adequate nutrition during early lactation will have a shorter PPI and more readily rebreed within 83 days. She will also have a shorter PPI the closer she calves to the longest day of the year.

45-Day Breeding Season

Over a three year period cows in a 63-day (9-week) or longer breeding season will progressively calve later and later with most calves born in the last 45 days of the season in the third year. This will occur even in a herd were all the cows are fertile and have experienced at least two or more normal estrous cycles. The reason for this is that the cows that calved during the latter part of a 63 day or longer breeding season are not capable of conceiving any earlier in subsequent seasons with a few of the midway calvers conceiving later each season. What results is that most of the cows calve within a 45 day or less period.

The highest probability of conception does not generally begin until approximately 100 days after the first calf is born regardless of breeding season length. So the beginning of a breeding season prior to this is not necessarily warranted and a 45 day season begins at the time of high conception probability. However, whether a producer chooses to have a 45 day breeding/calving season or longer the main focus of this school is getting the cows rebred to calve the same time next year and doing so at the least cost possible without sacrificing performance.

Body Condition Scoring

Body Condition Scoring is a common scoring system developed to estimate the average body condition of cows and ewes. The system provides producers a relative score based on an evaluation of fat deposits and muscling in relation to skeletal features. It can be an effective management tool for evaluating the energy reserves of cows and ewes and the whole nutritional program throughout the year. The most widely used body condition scoring system for beef cattle in the U.S. assigns scores from 1 to 9 (see Table 1 for descriptions) and for ewes from 1 to 5 (see Table 2 for descriptions).

The body condition a beef cow is in at time of calving has a strong influence on her chances of rebreeding within 90 days postpartum. Selk, et al (1988) found that the percentage of cows pregnant 90 days postpartum when in a body condition score (BCS) of 4, 5, 6 or 6.5 at time of calving was 25, 50, 75 and 90%, respectively. The provision of additional energy to cows prior to calving to obtain a BCS of 6 or 6.5 may be warranted, as trying to improve her condition after calving can be difficult as most of the energy she consumes after meeting her maintenance needs goes for milk production and not fat deposition.

In addition to improved conception rates, a Colorado State University study found that cows in a BCS greater than 5 at time of calving tended to have healthier calves (Odde, K.G. 1997). Dr. Odde found that calves nursing cows in a BCS of 3 or 4 had lower serum immunoglobulin levels than those nursing cows in a BCS of 5 or 6. Thin cows and those not fed properly prior to calving tended to produce lower volumes of colostrum and therefore had weak calves that were more susceptible to disease. Thin cows at calving also had higher incidences of calving difficulty, with weaker calves that generally had lower weaning weights.

These studies and others provide ample evidence that cows in a BCS of 5 to 7 at time of calving have a greater chance of rebreeding within 83 days postpartum compared to those in a BCS < 5. Thus, a management decision a rancher faces is what is the most economically sustainable way to ensure his or her cows will be in good body condition at time of calving? Is it providing harvested feeds or allowing the animal to do the harvesting themselves. Obviously time of year a cow calves will influence this. Dormant grass might contain an adequate amount of energy to increase a cow's body condition during her third trimester of pregnancy but not enough protein, and not enough of either when the cow is in lactation, whereas green growing grass generally does, especially during the vegetative stage (leaves and no stems). In addition, there appears to be another factor interacting with body condition that influences conception rates – day length (photoperiod).

Day length and the Postpartum Interval

The animal family *Bovidae* of which cattle, sheep and goats belong are seasonal breeders where photoperiod cues the onset of breeding activity. However, domestication of cattle, sheep and goats has resulted in them being

able to breed at any time of the year. There is evidence though that a vestige of sensitivity to photoperiod still remains. Dr. Jan Bonsma, a South African Animal Scientist, observed in the 1940's that moving cattle north 10° latitude (about 700 miles) stopped estrous cycling for one year. He also noted that sexual activity in African bovine species was greatest during the periods of equinox (i.e. around March 21 and September 22).

So what does this mean for the beef cattle producer in NE Wyoming? Well if you're moving your herd to Saskatchewan, Canada then maybe you will need to be prepared for them not to breed for a year. I don't know whether this holds true if they are moved a comparable distance south but what is noteworthy is that latitude and resultant photoperiod have an effect on bovine sexual activity. British researchers found a strong relationship between a cow's body condition and photoperiod at time of calving on length of her PPI (Peters and Riley 1982). The better condition she was in (BCS from 5 to 7) resulted in a shorter time before her first estrous cycle and the closer she calved to the longest day of the year shortened this period even more. This would explain why sexual activity of African bovine was greatest around March 21 (southern hemisphere) and September 22 (northern hemisphere). If these bovine have a nine month gestation period birthing would then be near the longest day of the year.

The southern boundary of Johnson, Campbell, and Weston Counties is 43.5° N latitude and the Wyoming border with Montana is 45° N. From an equation developed by Peters and Riley (1982) it can be calculated what the PPI (in days) would be for a cow in BCS 5 to 7 at time of calving for whatever latitude she is at. Using 44° N as our latitude location in the equation we'll find that the shortest PPI is 24 days for a cow in BCS 7 that calved in June and the longest interval is for one in BCS 5 that calved in December (Table 3). The equation was not designed to determine the PPI for cows in a BCS lower than 5 or higher than 7 but it can be assumed that the length of time, based on other studies, would be even greater for those in thin body condition. The PPI for a cow in a BCS greater than 7 are probably similar to those in 7 but there are calving problems associated with obese cows and the cost to get them to this condition is high.

Equation for PPI (days) = (181.6 – (6.798 * BCS)) – (0.12 * photoperiod in minutes)

Example for third week of March:
(181.6 – (6.798 * 6)) – (0.12 * 720) =

(181.6 – 40.8) – 86.4 = 140.8 – 86.4 = 54.4

Most if not all beef cattle cow-calf producers have known that they need to have their cows in a BCS of 5 or better (7 max) at time of calving if they wanted them to rebreed in time to calve the same time next year. However, most probably did not realize that photoperiod affects length of the PPI and its impact on conception rates. If a cow herd of this region calves between February 1 and March 31 and their average BCS is 6 what would be the cows' PPI? From Table 3 we would find it to average 67 days for the February calvers and decline to 57 days for the March calvers. From observations of heifers in Kentucky it was found that their conception rates increased by about 21% if they were allowed to have two normal estrous cycles (≈ 21 days per cycle) before being bred in their third cycle (Patterson et al. 1992). What percent of the herd would experience two or more cycles within 83 days post calving? Let's look at the cows that calve in February first (next page):

Days post calving to first estrus cycle = 67 (average of 71 for Feb 1 and 62 for Feb 28)

Percent of cows experiencing one cycle prior to 83 days = $\frac{83 - 67}{21} = \frac{16}{21} = 76\%$

Only 76% of the cows that calve in February will experience their first estrus cycle within 83 days post calving and none will experience a second cycle within 83 days postpartum. The good news is they have until June 22 (114 to 141 days) to get bred to calve by March 31st next year, so most likely all of them will conceive in time; however, the odds are they gradually will calve later and later into the season.

What about the ones that calve during March?

Days post calving to first estrus cycle = 57 (62 for Mar 1 and 51 for Mar 31)

Percent of cows experiencing two cycles prior to 83 days =

$$\frac{83 - 57}{(2 * 21)} = \frac{26}{42} = 62\%$$

Thus at least 62% of these cows should calve again in March next year but potentially 38% will not be bred in time to calve by the end of March or will not become bred at all if the bulls are pulled by June 22. Out of a 100 head cow herd this could potentially be 19 cows (assuming that half the herd calved in March).

What if the calving season was moved to May 1 to June 30? The PPI would be 36 days for the May calvers and 31 days for the June calvers for a 33.5 day average overall.

Percent of cows experiencing at least two cycles prior to 83 days =

$$\frac{83 - 33.5}{(2 * 21)} = \frac{50.5}{42} = 100\%$$

With all the cows experiencing at least two estrus cycles within 83 days postpartum they all should become bred to calve again between May 1 and June 30 the next year. In addition, none of the cows should have their calving date creep later and later into the season over the years. Although a 100% breeding success rate (within the defined breeding season) may not occur for various reasons there is a greater chance of achieving it with no additional, most likely less, inputs if calving occurs in late spring instead of late winter.

There is also some evidence that heifer calves born in late spring compared to late winter will reach puberty at a younger age ≈ 12 months vs. 13.5 months @ 45º N (Grass, et al. 1982 and Hansen, et al. 1983). If it is desired to have replacement heifers calve by their second birthday (730 days of age) breeding must occur by 15 months (448 days) of age. As noted above in the Kentucky study (Patterson et al. 1992) heifers that had two normal estrous cycles before being bred on their third had about 21% higher conception rates.

Nutrition and the Postpartum Interval

It was mentioned above that besides the BCS the cow is in at time of calving, her nutrition, especially energy, following calving also influences the length of her PPI. Bellows and Short (1978) at the Fort Keogh Livestock and Range Research Laboratory near Miles City, Montana looked at the effect of BCS at time of calving and two levels of Net Energy maintenance (NEm) in the diet of Hereford and Angus cows post-calving on the length of their PPI. The cows calved over a 45 day period beginning in mid-March. They found that the cows in good body condition at time of calving (fed during late gestation to achieve this) had a shorter PPI compared to those that were considered thin (Figure 1). They also found that level of NEm in their diet post-calving also affected length of their

PPI. For cows in good body condition at time of calving, their PPI was shorter if they received 21 Mcal/day of NEm in their diet compared to those receiving 18 Mcal (Figure 1). However, those in thin condition at time of calving fed the higher NEm diet post-calving had a longer PPI compared to those fed the lower NEm diet, especially for the Herefords. This is not a reflection on Hereford cattle as much as it is an indication that a 0.5 difference in BCS when cows are in a thin condition can greatly negatively impact the length of the PPI.

Bellows and Short did not know why the cows in thin condition at time of calving and fed the higher energy diet had a longer PPI compared to those fed the lower energy diet but speculated that that the additional grain in the high energy ration may have stimulated milk production instead of going for body conditioning. A study at the University of Missouri with first calf heifers found that increasing the amount of NEm in the post calving diet from 0.43 Mcal/lb to 0.56 Mcal/lb increased milk production at the expense of growth (increase in body condition) although there was no difference in the PPI for the two groups (Lalman et.al 2000). However, they were able to improve body condition of first calf heifers with rations containing 0.69 and 0.81 Mcal NEm/lb and decrease the PPI from 130 days for the 0.43 and 0.56 Mcal NEm/lb groups to 120 and 114 days, respectively.

Take Home Message

Cows, including first calf heifers, have a much better chance of rebreeding within 83 days after calving if they are in a body condition score of at least 5 and preferably 6 to 7 at time of calving. And it is much easier, and probably cheaper, to get a cow into good body condition prior to calving than it is to do so during the postpartum period but it is also important that the cow be on a positive plan of nutrition during lactation. In addition, there appears to be a relationship between day length and days to first estrus with longer days resulting in a shorter PPI. Based on these factors a late spring calving season may result in less costs compared to a late winter season. However, whenever the calving season is it can and should be 45 days or shorter to have a more uniform group of calves at market time.

In the next issue we will cover Dr. Diven's discussions on dietary energy, its various components and how they are measured, and sources of. As well as how stage of production along with size and body condition affects a cow's energy needs. This will be getting into the meat of the School as regardless of when the calving season is getting the cows bred back to calve within a year's time is critical for a sustainable ranching operation. In order to obtain this it is important that the cow herds' nutritional needs are being met. This generally will include providing supplements but at the lowest cost possible.

References

See page 8 for citations listed in this paper.

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Table 1: Body condition scoring system for beef cattle
Adapted from Wagner, et al., 1988, J. Anim. Sci. 66:603 (% body fat from Fox, et al., 1988)

1 **Severely emaciated** - starving and weak; no palpable fat detectable over back, hips or ribs; tailhead and individual ribs prominently visible; all skeletal structures are visible and sharp to the touch. Animal has difficulty standing or walking. (% body fat = 5.0)
2 **Emaciated** - similar to BCS 1, but not weakened; little visible muscle tissue; tailhead and ribs less prominent. (% body fat = 9.4)
3 **Very thin** - no visible fat over ribs or in brisket; backbone easily visible, and individual muscles in the hindquarter are easily visible. (% body fat = 13.7)
4 **Thin** - individual ribs noticeable but overall fat cover is lacking; increased muscling through shoulders and hindquarters; hips and backbone slightly rounded versus sharp appearance of BCS 3. (% body fat = 18.1)
5 **Moderate** - increased fat cover over ribs but less than 0.25 inch; generally only 12^{th} and 13^{th} ribs are individually distinguishable; tailhead full, but not rounded. (% body fat = 22.5)
6 **Good** - smooth appearance throughout; back, ribs, and tailhead slightly rounded and spongy when palpated; slight fat deposition in brisket. (% body fat = 26.9)
7 **Very good** - cow appears fleshy and carries fat over the back, tailhead, and brisket; ribs are not visible, 0.5 to 0.75 inch of fat on last two to three ribs; back appears square due to fat; area of vulva and external rectum contain moderate fat deposits; may have slight fat in udder. (% body fat = 31.2)
8 **Fat** - squared appearance due to excess fat over back, tailhead, and hindquarters; extreme fat deposition in brisket and throughout ribs, 1 to 1.5 inch of fat on last two to three ribs; excessive fat around vulva and rectum, and within udder; mobility may begin to be restricted. (% body fat = 35.6)
9 **Very fat** - similar to BCS 8, but to a greater degree; majority of fat deposited in udder limits effective lactation. (% body fat = 40.0)

Table 2: Body condition scoring system for sheep
Adapted from Russell, A. 1991, Sheep and Goat Practice

1 **Emaciated** - spine prominent and sharp; loin eye muscle is shallow with no fat cover; transverse processes are sharp and fingers can easily pass under ends; it is possible to feel between each process.
2 **Thin** - spine prominent but smooth; loin eye muscle has little fat cover and is of medium depth; transverse processes are smooth and slighted rounded, and it is possible to pass fingers under the ends with some pressure.
3 **Average** - spine smooth and rounded; moderate fat cover over loin eye muscle and it is full; transverse processes are smooth and well covered, and firm pressure is needed to feel over the ends.
4 **Fat** - spine detected only with pressure as a hard line; loin eye muscle is full with a thick fat cover; transverse process cannot be felt.
5 **Obese** - spine cannot be detected; there is a depression between fat where spine would normally be felt; loin eye muscle is very full with a very thick fat cover; transverse processes cannot be detected.

Table 3: Impact of cow body condition scores 4 to 7 and average monthly day length (hours) upon length of the postpartum interval in days at 44° N latitude.

		Body Condition Score						
Month	Day length	4.0	4.5	5.0	5.5	6.0	6.5	7.0
Jan	9.1	89	85	82	79	75	72	68
Feb	10.2	81	77	74	70	67	64	60
Mar	11.7	70	67	63	60	57	53	50
Apr	13.3	59	56	52	49	45	42	39
May	14.6	49	46	43	39	36	32	29
Jun	15.2	45	41	38	34	31	28	24
Jul	14.9	47	44	40	37	33	30	27
Aug	13.8	55	52	49	45	42	38	35
Sep	12.2	66	63	59	56	53	49	46
Oct	10.7	77	74	71	67	64	60	57
Nov	9.4	87	83	80	77	73	70	66
Dec	8.7	91	88	85	81	78	74	71

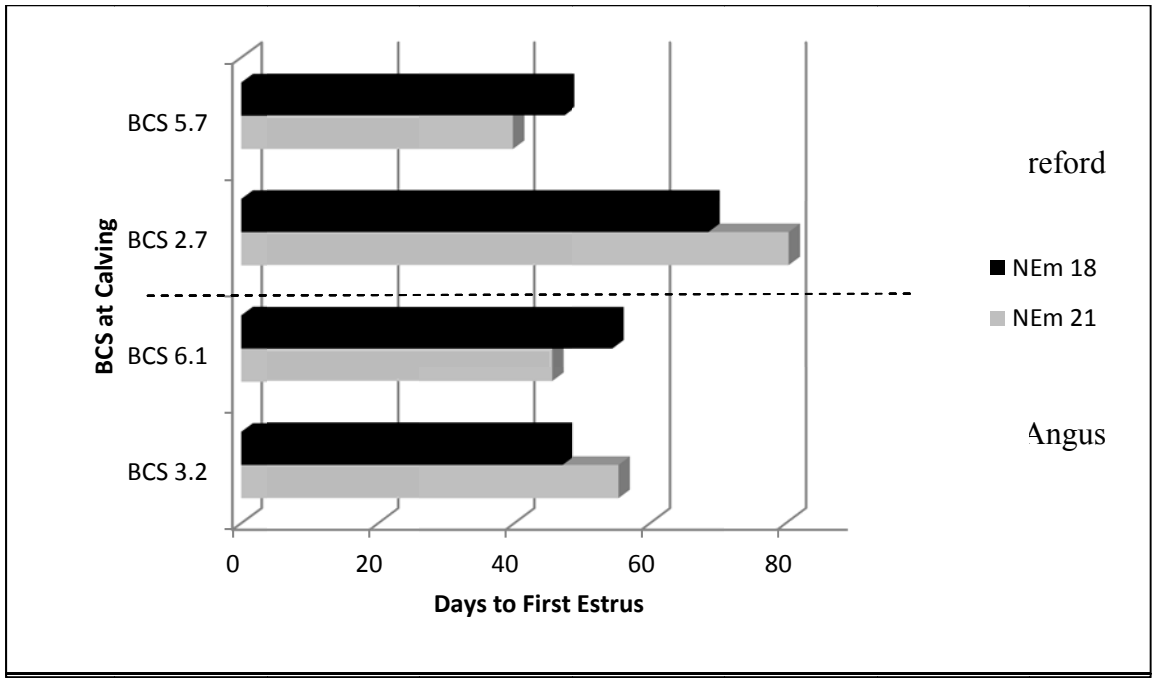

Figure 1: Effect of postcalving feed levels (Mcal/day) upon postpartum interval (45 day calving period beginning March 15) for Hereford and Angus cows.

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Note: This reference was not cited in the above paper but Dr. Diven listed it in his school notebook. It is pooled data from two years of research by three Universities.

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Note: Did not cover this material in the above paper but Dr. Diven did discuss how the presence of bulls can help shorten the postpartum interval, especially in cows in a BCS of 4.5 to 5.5.