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Calving Season Considerations for Commercial Beef Cattle Operations

Managing the time of year in which cows calve can have significant implications for the profitability of a cow-calf operation (Figure 1). Cow-calf herds with no defined calving season are labor-intensive and potentially very inefficient, with significant management and marketing challenges due to widely varied cow requirements and calf age. Meeting the nutritional requirements of lactating cows is far more expensive during certain times of the year due to a lack of high-quality forage available for grazing. Likewise, some portions of the year present challenges for newborn calf survival without significant investments in facilities and labor for intervention. Management for a short, defined calving period is therefore a major opportunity to reduce costs and optimize productivity of the cow herd.

Figure 1. Managing the length of the calving season has significant implications for the profitability of a commercial cow-calf operation.

Spring versus fall versus winter calving

Traditionally, cow-calf enterprises with a defined calving season have made management decisions to ensure that calving occurs during the spring of the year. Spring calving ensures high quality forage is available at calving and throughout peak lactation. Because this is similar to seasonal breeding patterns of many wildlife species, this management strategy is sometimes referred to as "calving in synch with nature." Available forage often requires little to no supplementation of protein or energy, and calving can generally occur on pasture rather than in calving barns or pens. Therefore, spring calving seasons are inherently lower cost.

However, other factors should be considered when selecting a calving season. In Missouri, for example, calving in the true spring (e.g., April and May) results in the breeding period occurring in the summer. Reproductive rates during summer months can be severely reduced because of heat stress. Additionally, vasoconstrictive effects of alkaloids produced by endophyte-infected tall fescue can have a compounding effect, further reducing reproductive performance of cattle grazing predominately fescue pastures in the summer months. For this reason, calving in the late winter (e.g., January and February) has become popular to ensure the subsequent breeding period can be completed before peak summer heat. Another increasingly popular option is to calve during the early fall months (e.g., September and October), when cool season forages are beginning to enter a "second spring" of active regrowth. This is an attractive option for many producers in Missouri and much of the Mid-South, although it does involve carrying lactating cows and calves through the winter months.

Market considerations, lifestyle, and other enterprises of the farm or ranch all affect decisions about when cows are managed to calve (Table 1). For example, seedstock producers may wish to calve earlier than commercial producers because of considerations related to age of bulls at the time of marketing. Producers with integrated cow-calf and stocker operations may choose to calve at such a time of year as to ensure forage availability for the stocker enterprise. Likewise, diversified operations

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Table 1. Pros and cons associated with winter calving, spring calving, and fall calving systems in Missouri.

	Winter Calving	Spring Calving	Fall Calving
Pros	• Allows for the breeding period to occur in the spring, prior to summer heat and prior to peak concentrations of toxic alkaloids produced by endophyte-infected tall fescue • Opportunity to market weaned calves at greater weights and/or prices compared to spring-born calves • May avoid overlap of calving season and planting seasons in diversified cattle and row-crop operations	• Reduced need for calving facilities • Potentially reduced calf mortality and morbidity • Forage available after calving may reduce cost of meeting cows' nutritional requirements during early lactation • Winter feeding and supplementation costs may be reduced due to lower nutritional requirements of non-lactating cows	• Reduced need for calving facilities • Potentially reduced calf mortality and morbidity • Forage available after calving may reduce cost of meeting cows' nutritional requirements during early lactation • Potentially higher calf prices at weaning • Spring forage availability may provide flexibility for later weaning or for adding additional weight to calves
Cons	• Potentially higher rates of calf mortality and morbidity unless facilities and labor are available for calving assistance and intervention • Greater feed costs in order to meet nutritional requirements associated with early lactation	• Breeding period must occur during summer, creating potential for heat stress to reduce reproductive performance • Reproductive performance during the summer may be further reduced for cattle grazing predominatly endophyte-infected tall fescue pastures • Market prices for calves are often lowest in the fall when spring calves are weaned	• Lactating cow-calf pairs are carried through the winter months when feed costs are typically higher • Potentially higher feed costs in order to meet nutritional requirements associated with late lactation • Heat stress may present a challenge for newborn calves if calving occurs very early in the fall

This list of pros and cons is not exhaustive, and significant regional variation exists in calving season preferences and management opportunities. When selecting a calving season or if considering switching calving seasons, a thorough economic analysis is encouraged. Consult a regional Livestock Field Specialist through University of Missouri Extension.

with crop enterprises may wish to avoid calving during planting, harvest, or other busy seasons. Some operations managing multiple separate herds may strategically calve different herds in slightly different seasons to make better use of labor or facilities shared across herds. Regardless of the desired time of calving, managing overall length of the calving season is critical for the productivity and potential profitability of a herd.

Length of the breeding period

Traditionally, managing timing and length of the calving season has been accomplished by managing the timing and duration of bull exposure. For example, bulls would be introduced into the herd approximately 283 days prior to the desired start of the calving season, and bulls would be removed approximately 283 days prior to the desired end of the calving season. In this case, the length of time for which cows were exposed to bulls effectively dictates the potential length of the calving season. When planning the length of the breeding period, however, length of the previous calving season should be carefully considered. Gestation length, postpartum anestrus, length of the estrous cycle, and incidence of early embryonic pregnancy loss all impose biological limitations on potential length of a practical breeding period.

Gestation length and postpartum anestrus

Gestation length in cattle is approximately 283 days, although there is some variation based on breed, sex of calf, and history of selection for birth weight or calving ease within the herd. Gestation length limits the length of the breeding period that may be practical, depending on length of the previous calving season (Figure 2). Very long calving seasons will extend into the subsequent breeding period and result in fewer cows having an opportunity to become pregnant early in the next breeding period. For example, if a 90-day breeding period is used in order to manage cows to calve over a 90-day period, the latest-conceiving and therefore latest-calving cows will not even have calved when the next year's breeding period is already beginning.

For a period of time following calving, cows do not have normal estrous cycles and are not receptive to mating. This period of time, known as postpartum anestrus, varies in length based on age, genetics, body condition, nutrition, presence of the suckling calf, and a

multitude of other factors. As with length of gestation, length of postpartum anestrus also places a limitation on the length of the breeding period that may be practical. Later-calving cows may not be cycling and therefore may not be capable of becoming pregnant early in the subsequent breeding period. Additionally, a proportion of cows will have an abnormally short luteal phase after the first estrus following calving. As a result, breeding that occurs on the first postpartum estrus will result in lower conception rates on average.

Given that limitations imposed by the length of gestation and the length of postpartum anestrus, it may appear that long breeding periods are simply a necessity to achieve high pregnancy percentages in cow herds. However, the opposite is true. Long breeding periods perpetuate a vicious cycle of poor reproductive performance in the cow herd, resulting in long calving seasons that in turn result in a need for long breeding periods. Instead, managing for a short breeding period ensures a short calving season. This in turn ensures that all cows in the herd have calved prior to the next breeding period and are afforded time postpartum to resume cyclicity.

Estrous cycle length and early embryonic loss

Although short breeding periods can be highly effective, there are some biological limitations for how short the breeding period can be. Cows are only receptive to mating during behavioral estrus or "standing heat." Estrus occurs for a period of approximately 18 hours only once during an estrous cycle. The estrous cycle in cattle ranges from 18 to 24 days in length. Therefore, if all cows are cycling normally and no synchronization of estrus is used, it would take a minimum of a 24-day breeding period to ensure that all cows are serviced at least once. However, not all cows that are serviced will conceive, in large part because of naturally occurring embryonic loss. Although fertilization rates after estrus have been observed to be in excess of 95% in many studies, a significant proportion of embryos fail to establish pregnancy. Because the majority of this loss occurs prior to day 17 of pregnancy, females exhibit no obvious signs of early embryonic loss and simply return to estrus on a normal interval. With this understanding, breeding periods that only afford cows a single opportunity to be serviced are discouraged, as this would result in pregnancy percentages that are impractically low for commercial production

Short breeding periods

To give cows multiple opportunities to conceive but also limit the number of cows calving late in the calving season, use of breeding periods of 45 to 60 days are encouraged. In most cases, this would result in cows having two to three opportunities to conceive during the breeding period. Use of estrus synchronization

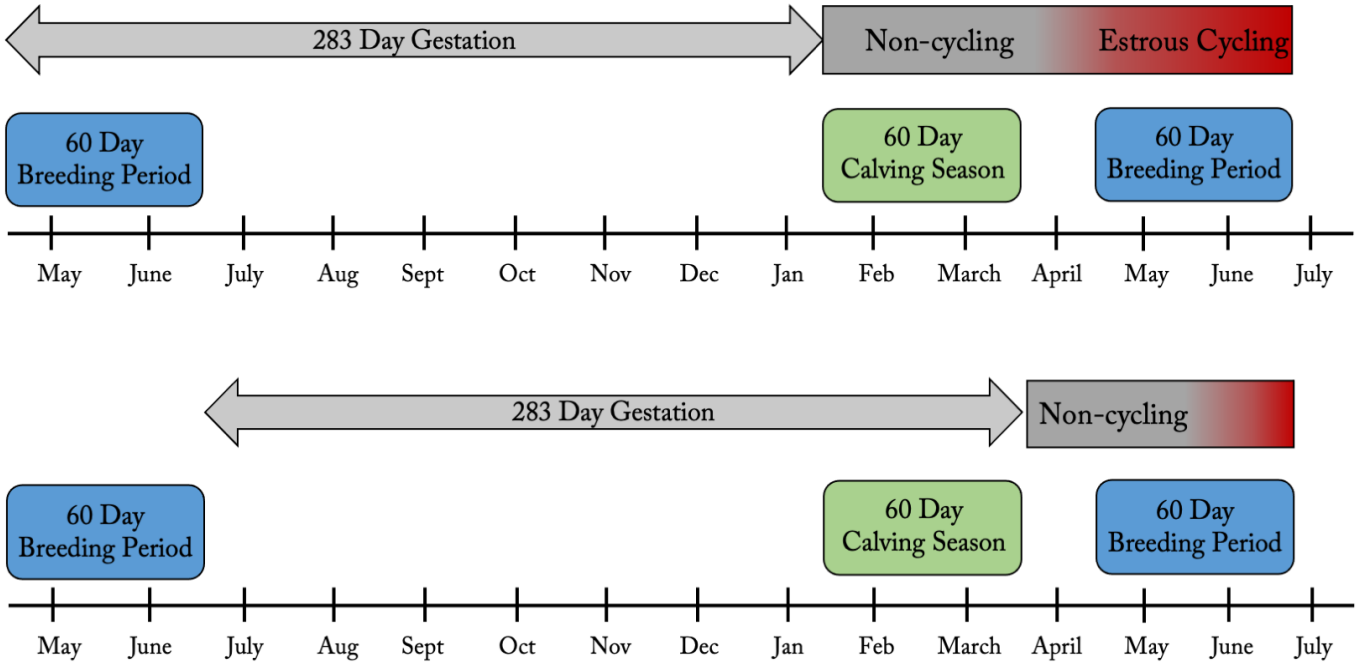

Figure 2. An example of early conception (top) and late conception (bottom) within a typical winter-calving production calendar. Note that even when managing for a defined and relatively short calving season of 60 days in this example, data of conception within one breeding period impacts potential reproductive performance in the following breeding period. Length of gestation and length of postpartum anestrus results in late-conceiving females potentially being non-cycling for a portion of the next year's breeding period, leaving fewer opportunities to become pregnant.

protocols should be considered in order to afford cows the maximum number of opportunities to conceive within a short breeding period. When synchronization is used, occurrence of the first estrus can be managed to occur around the first day of the breeding period. This results in cows having an opportunity to conceive earlier on average, and this also affords all cows the maximum number of total opportunities to conceive during the breeding period. Use of progestin-based estrus synchronization protocols is especially encouraged, as progestins can induce earlier resumption of normal estrous cyclicity among anestrous cows. For more information on estrus synchronization prior to artificial insemination or natural service, see MU Extension publication g2024: Estrus Synchronization Recommendations for Artificial Insemination of Beef Cows and MU Extension publication g2027: Estrus Synchronization Recommendations for Natural Service Bull Breeding.

Considerations for heifers

Unless all late-conceiving heifers can be profitably marketed as bred heifers or as young cow-calf pairs after calving, very short breeding periods are strongly recommended for commercial replacement heifers. Compared to mature cows, two-year-old cows or "first-calf heifers" undergo a longer period of postpartum anestrus, on average 3 to 4 weeks longer than typical cows. Length of anestrus is further extended if heifers were underdeveloped prior to calving or if post-calving nutrition is limiting. From a systems perspective, therefore, reproductive performance of the young cow herd is largely dependent on reproductive management and selection criteria used among replacement heifers.

It is imperative to select early-conceiving heifers in order to achieve acceptable reproductive performance in young cows. Heifers that conceive later in their first breeding period calve later in their first calving season. As a result, they are more likely to conceive later in their next breeding period or fail to conceive at all. Long-term research efforts have made it clear that heifers conceiving early in their first breeding period stay in the herd longer, wean more total calves due to their longer productive life in the herd, and wean older and therefore heavier calves each year. For more guidance on breeding management and selection criteria for replacement heifers, see MU Extension publication g2028: Selection of Replacement Heifers for Commercial Beef Cattle Operations.

Breeding periods of 30 days for heifers are becoming increasingly common for commercial operations. Likewise, breeding programs that involve heifers having only one or two opportunities to conceive to artificial insemination are effective for some operations. Additionally, some producers elect to begin the breeding period for heifers 2 to 3 weeks prior to the beginning of the breeding period for cows. This provides first-calf heifers with additional time postpartum prior to the start of their next breeding period, mitigating the longer period of postpartum anestrus among first-calf heifers. Although this strategy involves breeding heifers at a slightly younger age, this is usually not a limitation for heifers of early-maturing breeds or crosses. An additional benefit of calving first-calf heifers prior to cows is that labor or facilities for calving can be better focused on first-calf heifers, which may be more likely to require more calving assistance or other intervention.

Reducing length of the calving season

When shortening length of the breeding period, operations risk reducing the pregnancy percentage obtained in the cow herd. As a result, short-term cash-flow considerations often make aggressive shortening of the breeding period impractical in a herd in which the previous calving season was very long. In such cases, it is necessary to shorten the length of the breeding period progressively over successive years. Other strategic steps can also be taken to manage the length of the calving season, however. As an alternative to shortening length of the breeding period or as a complementary management practice, commercial cow-calf operations should carefully evaluate strategic marketing opportunities for underproductive females.

Marketing underproductive cows

When developing replacements, heifers need to reacA simple strategy to begin reducing the length of the calving season is to simply market underproductive cows after the calving season. In this case, cows that have not calved by a desired date can be marketed as bred cows or, if non-pregnant, as open cows. Additionally, later-calving cow-calf pairs can be sold prior to the start of the breeding period as open pairs, or after the breeding period as exposed or pregnant "three-in-one" packages.

Another strategy is to market later-conceiving females on the basis of a pregnancy determination. In most cases, pregnancy determination is suggested to be performed, ideally via ultrasound, within 90 days from the start of the breeding period. This allows for an accurate determination of fetal age in order to identify early-conceiving females. At this time, females that are non-pregnant or not-detectably pregnant can be identified for sale. Additionally, pregnant females that conceived after a decided cutoff point in the breeding period should also be considered for sale. Sale of later-conceiving females is especially encouraged if a longer breeding period was used and/or if marketing opportunities for bred females are strong. Heifers determined to be

non-pregnant could be sold immediately or enter a stocker or finishing program. Cows determined to be non-pregnant or not-detectably-pregnant at the time of pregnancy determination could be sold, either as cow-calf pairs or as open cows after weaning the calf at side. Underproductive late-conceiving females may or may not be sold immediately after pregnancy determination; however, these females should be identified or sorted off for planned sale. In some cases, early weaning calves of open cows or late-conceiving cows may be prudent in order to market these underproductive cows as quickly as possible.

Compared to simply marketing underproductive cows after the calving season, marketing cows based on pregnancy determination allows for forage or feed resources to be allocated more profitability. Rather than carrying underproductive cows through calving, breeding, or weaning, consider the potential margin that could be generated if forage or feed resources were instead used for productive cows or for other enterprises. Of course, market value of animals at the time of sale can also differ substantially based on the stage of production or pregnancy status. Therefore, considerations related to when underproductive cows are sold should be reevaluated regularly based on market conditions and other strategic opportunities of the farm or ranch.

Calving distribution and profitability

The benefits of managing for a short calving season are numerous. These may include reductions in labor costs associated with calving observation, decreases in calf mortality or morbidity, and opportunities for simplified herd management due to more uniform stage of production among cows. Additionally, although reproductive traits are lowly heritable, management for an early-conceiving cow herd does maintain selection pressure for fertility. Aside from the immediate commercial production value, this selection pressure has long-term genetic value if replacement heifers or herd sires are retained from within the operation.

The calving distribution (Figure 3), or the proportion of calves born in 21-day intervals of the calving season, is valuable information in assessing the productivity

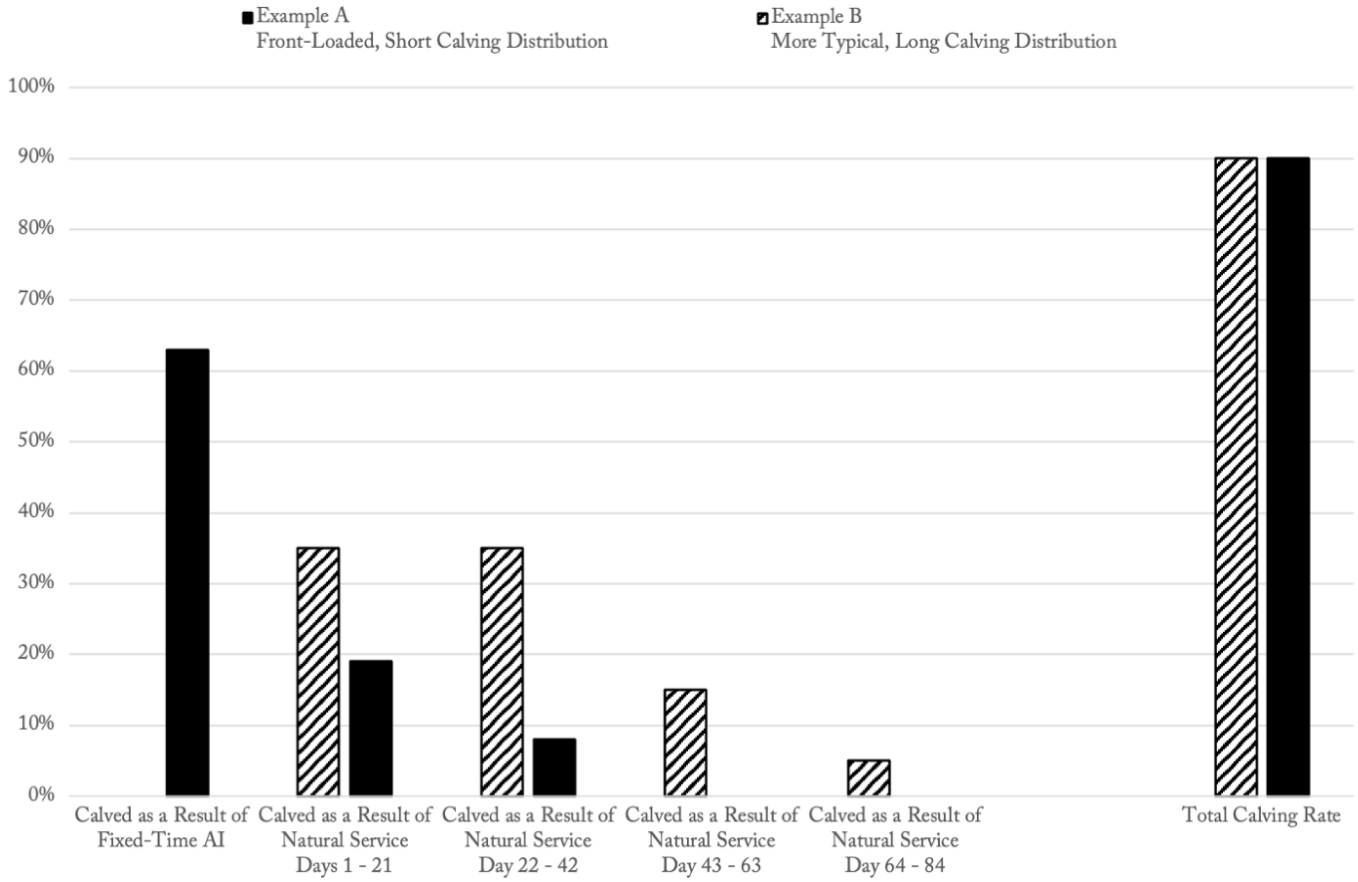

Figure 3. This illustration compares the calving distribution produced by two herds in which the breeding period had been managed differently. In Example A, all cows received a fixed-time artificial insemination on Day 0 of the breeding period, followed by exposure to natural service bulls for two full estrous cycles after AI. In Example B, all cows were exposed to natural service bulls from Day 1 to Day 84. In both examples, the same final pregnancy percentage or calving rate of 90% is assumed. However, the calving distributions illustrate herds with very different levels of reproductive performance.

Table 2. Illustration of the impact of calving distribution on age and weight of calves at weaning.

	Calving Period	Number of Calves	Age at Weaning	Weaning Weight	Pounds of Calf Weaned
Example A Front-Loaded, Short Calving Distribution	Calved as a result of fixed-time AI	63	220 days	510 lbs	32,130 lbs
	Calved as a result of natural service, Days 1 - 21	19	199 days	468 lbs	8,892 lbs
	Calved as a result of natural service, Day 22 - 42	8	178 days	426 lbs	3,408 lbs
	Overall	**90**	**212 days**	**494 lbs**	**44,430 lbs**
Example B More Typical, Long Calving Distribution	Calved as a result of natural service, Days 1 - 21	35	210 days	490 lbs	17,150 lbs
	Calved as a result of natural service, Day 22 - 42	35	189 days	448 lbs	15,680 lbs
	Calved as a result of natural service, Day 43 - 63	15	168 days	406 lbs	6,090 lbs
	Calved as a result of natural service, Day 64 - 84	5	147 days	364 lbs	1,820 lbs
	Overall	**90**	**191 days**	**453 lbs**	**40,740 lbs**

This illustration compares the age and weight at weaning for the calf crops produced by the two herds presented in Figure 3. Herd size is assumed to be 100 cows for each example. In Example A, cows conceiving to natural service are assumed to have conceived at the end of each 21-day period, as estrus was synchronized in this example to occur prior to fixed-time AI on Day 0. In Example B, cows conceiving to natural service are assumed to have conceived at the midpoint of each 21-day period on average, as no estrus synchronization was used. These calculations assume a 70 lb birth weight and an average daily gain of 2 lbs from birth to weaning. Weaning was assumed to have occurred on Day 220 after the start of the calving season. Despite identical pregnancy percentages obtained overall, the front-loaded, shorter calving distribution from Example A produces nearly 10% more total pounds of calf weaned.

and potential profitability of a commercial beef cattle operation. Front-loaded calving distributions, in which the majority of calves are born in the first 21-day interval, are inherently more efficient and maximize metrics like pounds of calf weaned per cow exposed or percentage of cow body weight weaned (Table 2).

Managing the length of the breeding period and marketing late-conceiving cows are two key strategies in moving toward a more front-loaded calving distribution. Likewise, estrus synchronization is effective tool to front-load the calving distribution, as this affords the maximum number of cows an opportunity to become pregnant as early as possible in the breeding period. Figure 3 and Table 2 illustrate the clear advantages of a front-loaded, short calving distribution achieved through use of estrus synchronization and a short breeding period. While some benefits are realized even in the first year of use, the most substantial improvements are often realized after successive years of systematic use of synchronization.

Finally, managing for a short, front-loaded calving season is critical for cow-calf profitability from both a revenue and cost standpoint. The calving distribution of an enterprise dramatically impacts gross margin (revenue minus cost of goods sold) per cow. Later-conceiving females wean younger and therefore lighter weight calves. For example, because a modern beef calf can often gain 1.7 to 2.2 lbs per day from birth to weaning, a 45 to 60-day difference in calf age could equate to a difference of 100 lbs in weaning weight. This results in later-conceiving cows generating substantially less weaned calf value (i.e., revenue) in spite of similar year-long cow carrying costs. Because calves are often sold in groups or load lots, younger and lighter-weight calves can also impact value of the older and heavier calves due to the reduction in uniformity among the calf crop. Additionally, later-conceiving females not only wean lighter calves annually but wean fewer total calves over their shorter productive lifespan in the herd. This results in fewer weaned calves per over which to spread the cost of replacement females required by the operation. With this understanding, long calving seasons that allow for later-conceiving females simply are not profitable for commercial beef cattle operations.

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