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The Importance of Temperament and Acclimation to Handling on Beef Cattle Production

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The profitability of any cow-calf operation relies on the cow's ability to overcome the challenge of becoming pregnant and weaning a healthy calf that weighs about 50% of her body weight every year. The gestation period of a cow averages 283 days. Therefore, a cow must become pregnant within 77 days after calving in order to bring profit to the operation. Ultimately, many factors will influence the reproductive performance of beef females. Identifying cows and heifers that are able to overcome this challenge in farm conditions, while culling the ones that fail to do so, will determine the productivity and profitability of an operation. This article discusses the effects of temperament on the reproductive performance of a herd and offers strategies to decrease the prevalence of cattle with poor temperament.

What Is Temperament?

Temperament is defined as the behavioral response an animal will have while interacting with humans (e.g., when approached in a pasture or handled for management). Since cattle are considered prey, they can feel threatened in the presence of humans because they understand it could be a life-threatening event. This behavioral response is often referred to as stress, with excitable animals producing greater concentrations of cortisol (defined as the stress hormone). Cortisol is responsible for shifting the body's efforts from other tasks ¾ such as growth, milk production, and reproduction ¾ to fight or flight in an effort to cope with the stressor. This response is important for non-domesticated animals because surviving is more urgent than any other productive tasks.

How Can Temperament of Beef Cattle Be Classified?

There are many ways to measure and evaluate temperament in a herd, all of which rely on observing cattle behavior while being handled. When conducting research, we often assess temperament through chute and pen scores, as well as through exit velocities. These methods can be adapted to any operation to identify an individual animal's temperament.

Chute Score

The chute assessment relies on observing each animal's behavior while caught in the squeeze chute (Cooke et al. 2011). The observer assigns a score according to the behavior observed, where:

1 = Calm with no movement.

2 = Restless movements.

3 = Frequent movement with vocalization.

4 = Constant movement, vocalization, shaking of the chute.

5 = Violent and continuous struggling.

Pen Score

A pen score is assessed while the individual animal is in the pen with the presence of a human (Arthington et al. 2008). The observer assigns a score in a method similar to that for the chute score analysis, where the animal:

1 = Walks slowly, can be approached slowly, is not excited by humans.

2 = Runs along fences, stands in corner if humans stay away.

3 = Runs along fences, holds head up, runs if humans come closer, stops before hitting gates and fences, avoids humans.

4 = Runs, stays in back of the group, holds head high and very aware of humans, may run into fences and gates.

5 = Excited, runs into fences, runs over anything in its path.

Exit Velocity

Exit velocity is assessed by determining the speed of the animal exiting the squeeze chute by measuring the time traveled over a known distance. In research, a pair of infrared sensors is usually set at a predetermined spacing to measure exit velocity. Cattle with an excitable temperament will run away from the chute, whereas animals with an adequate temperament will calmly walk away from it. This measurement, however, can be adapted to fit the conditions of your operation. Having a reference point away from the chute and using a stopwatch to determine the time taken by the animal to reach that reference point is an effective way to assess exit velocities.

In addition, exit velocities can be compared within a herd by separating them into five categories and assigning an exit score from 1 to 5 (1 = cows in the slowest category, 5 = cows in the fastest category). Individual temperament scores can then be calculated by averaging individual chute or pen score and exit velocity score. This allows classification of individuals according to the final temperament score (temperament type) as adequate-temperament (temperament score ≤3) or excitable-temperament (temperament score >3) using a five-point scale.

What Is the Impact of Temperament on Reproductive Performance?

Our research group at Virginia Tech has recently conducted an experiment aimed to determine the prevalence of excitable cattle in herds in Virginia, as well as to explore the effects of temperamental cattle on reproductive performance. We evaluated temperament in the first handling event of an estrus synchronization protocol in 297 replacement beef heifers from three different locations (Bland County Department of Corrections, Virginia Tech Campus, and Southwest Virginia Agriculture Research and Extension Center) in the state. Individual temperament was assessed through chute score and exit velocities. Exit velocities within each location were then separated into quintiles and assigned a score from 1 to 5 (1 = 20% slowest heifers, 5 = 20% fastest heifers). A final temperament score was then calculated by averaging chute scores and exit velocity scores. Heifers with a final temperament score ≤3 were considered adequate-temperament, whereas heifers with a final temperament score >3 were considered excitable-temperament.

Our research indicates that cattle in Virginia are mostly calm and of adequate temperament, with 29% of the heifers considered excitable (fig. 1). Interestingly, when exposed to an estrus synchronization and fixed-time artificial insemination protocol, excitable heifers had decreased fertility when compared to heifers of adequate temperament (36% and 55% pregnancy rate, respectively; fig. 2).

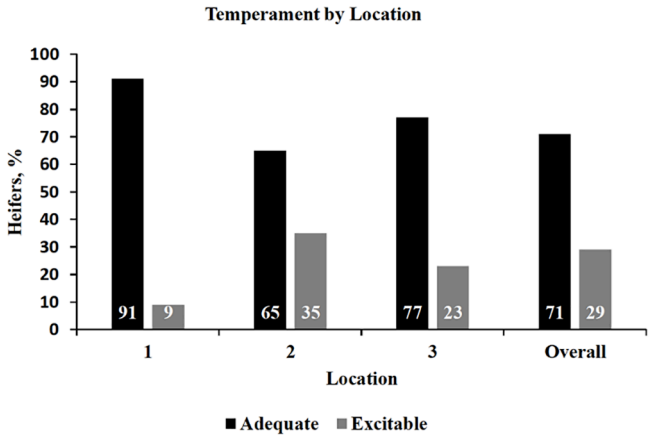

Figure 1. Bar chart describing the percentage of adequate- and excitable-temperament of replacement beef heifers at three locations in Virginia. Heifer temperament was assessed at the first handling event of the estrus synchronization protocol.

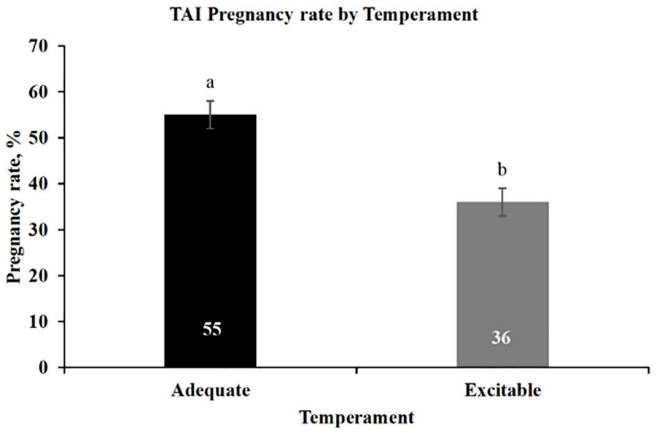

Figure 2. Pregnancy rates to timed-artificial insemination (TAI) of replacement beef heifers that were classified as adequate or excitable temperament. Heifers were enrolled in an estrus synchronization protocol and had temperament assessed at the first handling event.

[a-b] Means with different superscripts differ at $P < 0.005$.

Since Virginia is a traditional cow-calf state, decreasing the proportion of excitable animals by selecting for temperament will help improve overall pregnancy rates. This will ultimately result in a greater number of calves weaned and, therefore, greater profitability.

In fact, a study performed in Oregon (Cooke et al. 2012) analyzed how temperament of cows plays a role on their reproductive performance during the breeding season. In that study, adequate-temperament cows had improved pregnancy rates (94.6% versus 88.7% for calm and excitable cows, respectively) and increased calving rates (91.8% versus 85.0% for calm and excitable cows, respectively). As a result, calmer cows produced a greater number of pounds weaned per cow exposed to the breeding season. This means that calm cows not only have greater fertility, but they also get pregnant earlier during the breeding season when compared with excitable cows. If a cow gets pregnant earlier, she'll calve earlier. As a result, her calf will be older and heavier at weaning and will therefore bring more profit to the operation.

In this particular study (Cooke et al. 2012), calving distribution was not evaluated. However, a different study (Rodgers et al. 2012) demonstrated that calves born earlier in the calving season had greater weaning weights than calves born later in the calving season. Although this experiment did not measure temperament as an effect of calving, it clearly demonstrates the economic benefits of increasing the proportion of cows that calve early in the season.

The Influence of Temperament and Stress on Fertility of Cattle

Reproduction and the events controlling the estrous cycle and ovulation in cattle are complex and are greatly influenced by metabolic and environmental factors.

In a stressful situation, more cortisol is produced and shifts the body's efforts to cope with the stressor. This results in less energy being available for reproduction. In addition to this indirect effect of stress and cortisol on reproduction, cortisol also plays a direct role in controlling reproduction. This hormone acts in the brain to decrease the production and sensitivity of gonadotropin releasing hormone ¾ the main hormone responsible for orchestrating reproduction. In our study described above, heifers that were classified as excitable and were later diagnosed as pregnant had lower concentrations of cortisol at the day of artificial insemination when compared with heifers that were classified as excitable and were open (fig. 3). This indicates a direct effect of cortisol on reproduction because, even in excitable animals, those with a decreased sensitivity to the stress response have improved fertility. This begs the question: Can we come up with strategies to improve the temperament of the herd, and therefore decrease cortisol concentrations prior to the breeding season and thus, improve the herd's fertility? This is, in fact, of extreme importance because cattle with excitable temperament can increase the excitability of other animals in the herd, and decrease the fertility of those animals as a consequence.

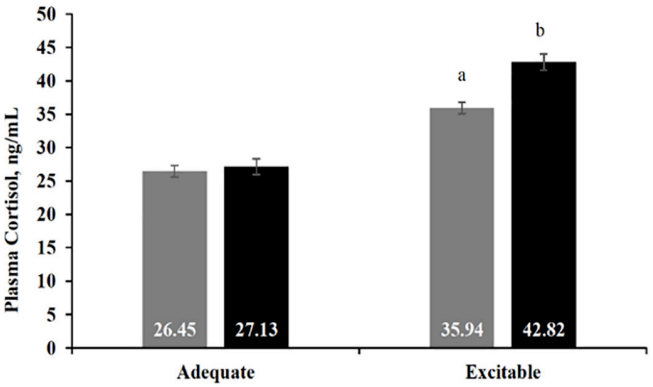

Figure 3. Circulating cortisol concentrations at the day of artificial insemination between heifers that were later diagnosed as pregnant (grey bars) and nonpregnant (black bars), characterized as having adequate or excitable temperament.

[a-b] Means with different superscripts differ at $P < 0.01$.

What Can We Do To Decrease the Proportion of Excitable Animals In the Herd?

Any productive trait is influenced by both genetics and the environment (part nature, part nurture), and temperament is no different. Therefore, in order to decrease the effects of temperament on the reproductive performance of herds, there are two approaches to be explored: genetics and the environment. Ultimately, strategies that combine both approaches are ideal, but let's consider what can be done to improve temperament through both of these approaches.

Genetics

Many breed registries have an expected progeny difference (EPD) for temperament or docility. Adding temperament to your sire selection criteria ¾ whether it's prior to purchasing bulls or prior to purchasing semen for artificial insemination ¾ is a strategy available to improve temperament in a herd. Docility traits, however, have been shown to have poor to moderate heritability. This means that temperament won't be quickly improved through breeding, and therefore, breeding will be an

important tool for a long-term solution. This isn't necessarily bad news. If temperament is a trait that is little influenced by the genetic (nature) component, it means that temperament is greatly influenced by the environment (nurture), and there is much we can do to improve the environment.

The Environment

There is no golden-rule solution that would be effective in all operations based on the simple fact that no two operations are alike. However, there are many points to be inspected in handling management that can improve cattle temperament. Adjusting the handling facility design to better adapt the response of your herd is one of the main strategies to adopt. Let's take a look at the points that should be on your checklist.

Herding Cattle to the Handling Facilities

Cattle are herd animals that have a flight zone response. The flight zone (fig. 4) is the animal's personal space. and the size of this zone is determined by the animal's tameness. Many of us know this concept from experience. While handling cattle, we unconsciously use the flight zone concept to our advantage to get the herd to go in the direction we want them to, by entering into their flight zone. This action makes them move in the opposite direction from you to reestablish that original comfortable distance. You can use the flight zone response to handle the cattle using plastic paddle sticks or flag sticks to increase your reach into the desired position of the flight zone, making animals move how you prefer and avoiding loud noises and wasting energy. This is important because loud noises are known to induce stress in cattle.

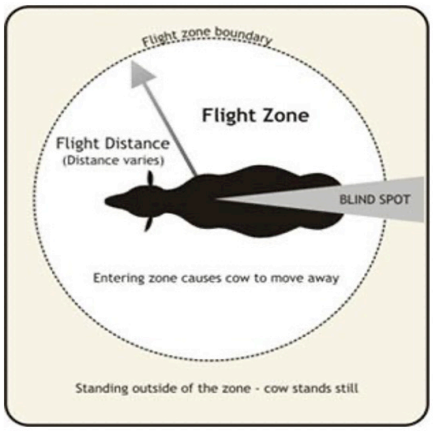

Figure 4. A diagram shows a view from above of a cow inside its circular flight zone. It indicates the flight distance from the cow to the flight zone boundary, as well as the cow's blind spot.

It's also recommended that you bring the herd calmly from one place to another; cattle should walk rather than run (Grandin 1980). When bringing cattle to the crowd pen, avoid overloading it. Cattle need room to move and be oriented to the entrance of the chute. When doing so, the challenge is to get the first animal to enter the chute while the others see the first one entering. That is because cattle will follow the first animal into the chute. This is also useful when loading cattle into the squeeze chute. Before letting the cow that is currently in the squeeze chute go, open the back gate and allow the next cow in line to see the first one walk out of the chute. The second cow will often follow the first one, which avoids having to push the second in line up to the squeeze chute. It is also important to avoid having a single animal in the crowd pen. Cattle will often have an intense stress response when handled alone. Try placing a second animal in the crowd pen before loading them in the chute.

Facility Design

When herding cattle into the handling facilities, the first thing on your checklist should be illumination. A cow will not go into someplace she can't see; therefore, having a well-illuminated handling facility is key to avoiding balking. Shiny objects along the way and other distractions (ropes, brushes, hoses) are also reasons for cattle to balk, either out of fear or distraction. This is because cattle don't have the ability to perceive depth and will easily get distracted by such objects. Therefore, walking the path the animal needs to walk to get through the handling facilities while inspecting for objects that may scare or distract your animals is a simple and cheap way to improve your handling events. Take the time to look for loose wood panels, exposed nails, and any objects that can hurt the cattle.

For overall calm herds, as often seen in Virginia, the Bud box facility design is recommended. The Bud box system is designed to be a portable, low-cost system that can be built with portable panels. This design takes advantage of cattle's natural behavior, where after cattle are brought to the facilities and pushed to a dead end, a gate is closed right where the entrance of the alley is. With that, as the handler approaches the cattle from the back, they will circle right and directly to the entrance of the alley (fig. 5).

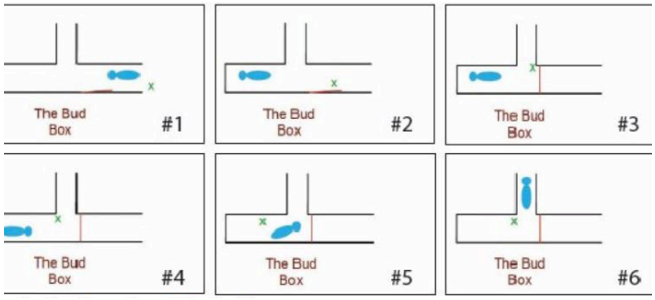

Figure 5. Six simple line diagrams of a cow in different locations in a Bud box, with an X indicating the location of the handler in each example.

For overall excitable herds, the chute that leads from the crowd pen to the squeeze chute should be curved with solid sides. By walking in a curved path, animals understand they are returning to the point of origin, and having solid sides avoids cattle seeing people and other stressors that are present in the facilities. Solid sides are also important in the squeeze chute for the same reason, and the squeeze chute should be designed to have a lighted hole at the head gate for the animal to follow (Grandin 1980).

Acclimation

After you've adapted your facilities and handling events to better suit the cow's natural behavior, you can explore acclimation as a strategy to decrease the intensity of your herd's stress response. This means that training your herd to go through your handling facilities will ultimately familiarize the herd with the handling event and decrease the stress response.

A study performed in Florida (Cooke et al. 2009) evaluated the effects of acclimating heifers after weaning on reproductive performance. Acclimated heifers were brought to the handling facilities three times a week for four weeks. As a result, a greater percentage of acclimated heifers reached puberty earlier than non-acclimated heifers. Acclimating heifers to handling decreases the stress response intensity and therefore cortisol levels, thus improving reproductive performance.

In fact, in our study performed in Virginia, heifers that were considered adequate-temperament had lower concentrations of cortisol than excitable heifers in all three handling events of the protocol. Regardless of temperament, cortisol concentrations were decreased for all animals at the completion of the protocol when compared with the first handling event (fig. 6). This indicates that the protocol's handling events acclimated the heifers to future handling events. Therefore, adopting an acclimation program to reduce herd stress response prior to the beginning of the breeding season is an interesting strategy to decrease circulating cortisol concentrations and improve overall herd fertility to artificial insemination.

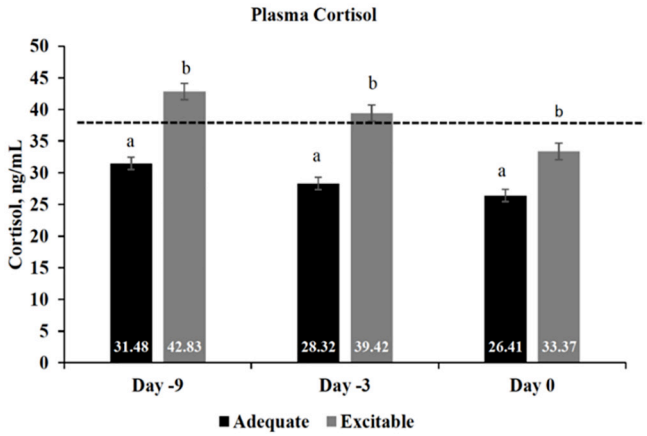

Figure 6. Mean circulating concentrations of cortisol between adequate- and excitable-temperament heifers at the different handling events of the protocol. The dotted line defines the threshold for intense fear (Grandin 2014), indicating that the handling events of the protocol acclimated excitable heifers to a level below that of intense fear. Plasma cortisol concentrations were affected by day ($p = 0.031$), temperament ($p = 0.015$), and the interaction of temperament and day ($p = 0.046$).

[a-b] Means with different superscripts differ at $P < 0.005$ This means they will only allow you to approach to a certain distance within which they feel comfortable.

Conclusion

Temperament, or the intensity of stress response of cattle when handled by humans, significantly reduces fertility. There are, however, many strategies to decrease the proportion of excitable animals in the herd and increase overall performance and profitability of the operation. Most of the strategies presented in this publication don't require a big monetary investment. Rather, these strategies require labor and adaptation of handling methods and training of handlers to better suit the cow's natural instinct.

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