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Breeding Lactating Dairy Cows During Hot Weather

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Getting lactating dairy cows bred to maintain a reasonable calving interval can be challenging any time of year but especially during the hot summer months. Heat stress can occur in lactating cows at temperatures of 80°F or higher. Several factors contribute to reduce fertility in lactating cows during summer breeding. Even during cooler times of the year the percentage of estrus periods detected is often around 50%. During summer, cows may have less mounting activity, exhibit estrus for shorter periods of time and may not exhibit estrus until after the temperature cools at night. As a result, the percentage of cows detected in estrus during summer may only be about half of that percentage detected during the cooler months.

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Heat stress can affect the viability of oocytes, reducing their ability to fertilize, and/or the ability of the resulting embryos to develop into viable offspring. From initial growth of a follicle within the ovary of a cow, until it is fully mature and ready to release the oocyte at ovulation, is about a 100-day process. Severe heat stress during this follicle maturation period can reduce the developing oocyte's viability. Due to the length of this follicle/oocyte maturation period, there can be a lag period of a few months after the heat stress ends before normal fertility returns.

Heat stress during fertilization and the first day or two of embryo development can be very detrimental. After this initial period, the developing embryo becomes more tolerant of heat stress, until pregnancy recognition begins about 15 days after estrus. Heat stress may reduce production or alter metabolism of progesterone, which is necessary for pregnancy maintenance and the uterine secretions that nourish the developing embryo. This altered uterine environment can result in retarded embryo development. Heat stress also can increase production of prostaglandin F2alpha by the uterus, which in turn can cause regression of the corpus luteum, leading to loss of progesterone production and pregnancy failure.

Overall, the reduced fertility during summer can be considered to be the cumulative effect of poor estrus detection, reduced oocyte viability, retarded embryo development and altered uterine function. Semen quality would also contribute to lower fertility if natural mating were used during summer but should not be a concern when using frozen-thawed semen purchased from the various semen companies.

The percentage of cows detected in estrus might be improved by the use of mount detectors such as the Estrotect heat detection patch. The need for estrus detection can be eliminated altogether by use of estrous synchronization protocols developed for use with timed insemination (TAI). Various recommended protocols can be found at the Dairy Cattle Reproduction Council website (http://www.dcrcouncil.org/protocols.aspx). These protocols are designed to control when follicles undergo final growth and maturation, and the time of ovulation. It is important to

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closely follow the recommended timing of the various hormone treatments.

Dairy cows have a very limited ability to sweat and naturally cool down by evaporative cooling. A common method to reduce heat stress is to provide housing or shade, and evaporative cooling with fans and misters or foggers. In countries with high summer temperatures, repeated cooling cycles with sprinkling followed by ventilation during the hottest times of the day has been shown to be effective in maintaining milk production and improving conception rates. Of course, high humidity reduces the effectiveness of evaporative cooling.

Based on what is known about the effects of heat stress on fertilization and early embryo development, the most critical time to cool cows would be the first two or three days after onset of estrus and during pregnancy recognition (days 15 to 20 after estrus). Progesterone supplementation (via CIDR insert) during the second and third week after estrus has been evaluated as a method for improving pregnancy rates, but with varying results. Although it may not be practical for most producers, collection and cryopreservation of embryos during the cooler times of the year and transfer of those embryos during hot weather has been shown to increase pregnancy rate over what can be achieved by AI of heat-stressed cows.

Forages are known to generate more heat during digestion than high grain rations. Feeding high quality forages during summer reduces the amount needed to meet requirements, producing less heat during digestion. Feeding the majority of the ration when temperatures are cooler (8 p.m. to 8 a.m.) might also be beneficial in reducing heat stress. Heat stress increases free radical production that can damage oocytes and embryos. Feeding antioxidants to reduce free radical production during heat stress periods may improve pregnancy rates. One study has reported that feeding 400 mg per day of beta-carotene starting 15 days after calving and continuing 90 days improved pregnancy rate during hot weather breeding.

In summary, the conception rate of lactating dairy cows in summer might be increased by using estrous synchronization protocols that allow for timed insemination, providing shade and evaporative cooling, altering the ration to reduce heat generated during digestion and feeding the majority of the ration during the cooler times of the day.

Performance of Replacement Heifer Calves Following Deworming

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Internal parasites are estimated to cost the U.S. cattle industry over $2.5 billion annually. Parasite burdens have been reported to decrease animal appetite, feed efficiency, ADG and total gain performance. Parasites also have potential to negatively affect reproductive performance of cows and developing heifer calves due to their effect on gain performance. According to the USDA's National Animal Health Monitoring System, only slightly over 40% of replacement heifers and cows are dewormed at least one time a year.

A recent study focused on the effects of deworming on the gain performance of replacement heifers. The study took place during the summer of 2014, with 83 head of replacement heifers located at University of Arkansas Research Station near Fayetteville. The heifers were allocated to one of three deworming treatments based on body weight, fecal egg counts and days of age. The three treatments were 1) negative control (no dewormer); 2) a combination of a full label dose of Cydectin pour-on and a full label dose of Synanthic drench (Combo); and 3) a label dose of LongRange injectable treatment (Table 1).

Heifers grazed in multiple groups, with only one treatment represented per grazing group, and had access to forage available in the assigned pasture and were fed a corn gluten supplement at 1% of body weight daily. Heifers were processed for body weights and fecal egg counts on multiple dates throughout the study (Table 2).

Over the 84-day study, heifer body weights (Table 3) were similar on day 0, 14, 28; however, heifer body weights were

Table 1: Treatments are as follows.

Treatment Group	n	Description
1	28	Negative control treatment.
2	28	Cydectin/Synanthic combination
3	27	LongRange

Table 2: Timeline for study.

Day -14 (May19, 2014)	Fecal egg counts and body weights.
Day 0 (June 2, 2014)	Fecal egg counts and body weights.
Day 14 (June 16, 2014)	Fecal egg counts and body weights.
Day 28 (June 28, 2014)	Fecal egg counts and body weights.
Day 56 (July 30, 2014)	Fecal egg counts and body weights.
Day 84 (August 25, 2014)	Fecal egg counts and body weights.

Table 3. Performance of replacement heifers.

Body weight (lb)	Treatment			P-value
	Control	Combo	LongRange	
Day 0	496	496	498	0.98
Day 14	502	502	505	0.99
Day 28	516	514	522	0.84
Day 84	578	593	622	0.06
Total ADG (lb/day)	1.0^{b}	1.20^{ab}	1.52^{a}	<0.01

^{a,b} Means within a row without common superscript differ ($P \leq 0.05$).

greatest for LongRange treated heifers, intermediate for Combo heifers and least for the Control groups. Heifer average daily gain (ADG) overall was highest for LongRange treated heifers at 1.52 lb/day, intermediate for combo treated heifers at 1.2 lb/day and least for negative control heifers at 1 lb/day.

Fecal egg counts were similar amongst heifers on day 0. On day 14, Combo and LongRange treated heifers exhibited lower fecal egg counts compared to control heifers. LongRange and Combo heifers were similar on day 28 and again had lower fecal egg counts compared with the control treated group. Control heifers exhibited the highest fecal egg counts on day 84, the Combo treated group was intermediate, and LongRange heifers had the lowest fecal egg counts.

In this study, treatment against gastrointestinal nematodes positively impacted replacement heifer body weights, ADGs, and fecal egg counts. LongRange treated heifers reported the strongest benefit over the 84-day study period.

Table 4. Fecal egg counts (FEC; GM) of replacement heifers.

Fecal Egg Counts	Treatment			P-value
	Control	Combo	LongRange	
Day 0	35	23	26	0.70
Day 14	68b	1a	4a	<0.01
Day 28	144b	5a	8a	<0.01
Day 84	164c	80b	6a	<0.01

[a,b,c] Means within a row without common superscript differ ($P \leq 0.05$).

Face Flies

Kelly M. Loftin, Extension Entomologist/Associate Professor

Face flies, *Musca autumnalis*, began appearing last month at near treatment levels. In Arkansas, face flies do not reach the abundance to cause economic concerns every year. In general, face flies are more of a concern in the northern half of Arkansas than the south. These flies are economically important as an annoyance to cattle and horses. When face fly abundance is high, grazing may be disrupted, resulting in weight and milk production losses. In addition, they can be vectors of *Moraxella bovis*, a principal cause of pinkeye, and are implicated in the transmission of the eyeworm (*Thelazia* sp.) in cattle.

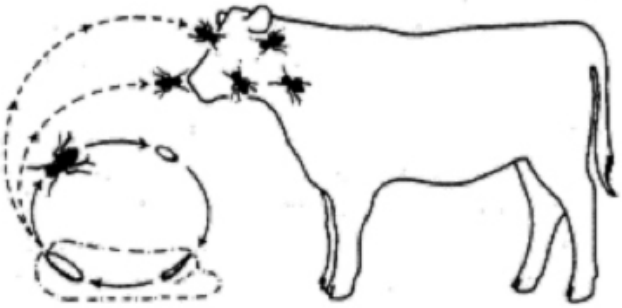
Like several important insects, face flies are an introduced pest, most likely being introduced into Nova Scotia from Europe in the early 1950s and began spreading. By the early to mid-1970s, face flies were common in parts of Arkansas. Although face flies are not a major pest in Arkansas every year, they are major pests in the north and northeastern U.S.

> When fly abundance is high, grazing may be disrupted, resulting in weight and milk production losses.

Face flies are found primarily on the face, neck and head of cattle and horses. Unlike the horn flies (*Haematobia irritans*) that feed on blood, face flies are non-blood feeders similar to house flies (*Musca domestica*). Instead of blood feeding, they feed using their sponging mouthparts on mucous secretions found around the eyes, nose, mouth and wounds. Nearly all face flies that are found on the animal are female. This is because only females feed on the animal to consume the rich protein secretions necessary for their egg production. Male face flies primarily feed on nectar. It has been estimated that only about 4% of the face fly population is on the animal at any given time. In appearance, face flies are very similar to house flies except about 20% larger. Adult activity begins in early spring and ends in late autumn.

Face flies feeding on secretions around the face of a calf. *Photo by Clemson University CES.*

In some ways, the face fly life cycle is like the horn fly lice cycle. One key similarity to the horn fly is that the face fly will only lay eggs in fresh cattle manure. It take about 6 to 12 days for a newly deposited egg to become a fully mature larva (maggot). The fully mature larva transforms into a pupa under the manure pat. Then, from 6 to 11 days later, an adult fly emerges from the pupa. During optimum conditions, it takes from 12 to 23 days for an



Face fly life cycle.

egg to develop into an adult fly. Unlike horn flies that overwinter as pupae in the soil, face flies overwinter as adults in protected areas such as barns, outbuildings, lofts and attics. During warms spells in winter months, face flies can become household pests as they become active from brief warm-ups.

When an average of ten flies per face occur in the herd, economic loss can occur. When monitoring face flies, count the number of flies on the face of 10 to 15 animals. If the average number per animal begins to approach ten flies per face, treatment is warranted.

Face flies can be difficult to control for three reasons. First, they are primarily found on the animal's face, which is an area that is often difficult to treat. Second, only a very small percentage of the population is found on the host at any given time. Last, face flies are intermittent feeders, spending very little time on the animal.

With that in mind and when using traditional insecticides, frequent application is often necessary. In the northeastern U.S., dairy producers may install automated face misters/sprayers at the milking barn exit to apply pyrethins and sometimes pyrethroid insecticides to the cow's face.

Fortunately for us, our populations do not normally reach this extreme abundance. In terms of self-treatment, forced-use back rubbers equipped with fly flips charged with a pyrethroid such as permethrin are effective. A few of the insecticide impregnated ear tags cattle such as Cygard®, Python®, GardStar® plus and a few others can provide control. Because face flies only develop in cattle manure, feed-through larvicides/IGRs (insect growth regulators) such as ClariFly® will prevent new flies from emerging.

Products registered for use against insect pests of cattle are listed in the *2015 Insecticide Recommendations for Arkansas* (http://www.uaex.edu/publications/mp-144.aspx).

With Warming Weather, It's Time to Start Thinking About Heat Stress

Karl VanDevender, Professor - Extension Engineer

The heat and humidity of a typical Arkansas summer combine to make a very uncomfortable environment for lactating dairy cows. During hot summer weather, milk production may decrease by as much as 50 percent, and reproductive proficiency of lactating dairy cows is greatly diminished. Some data indicate that only 10 to 20 percent of inseminations in "heat stressed" cows result in pregnancies.

Some signs of heat stress in lactating cows are obvious, especially the reduced milk production and the lethargic behavior of the cows. Moderate signs of heat stress may occur when the temperature is between 80° and 90°F with the humidity ranging from 50 to 90 percent These signs include rapid shallow breathing, profuse sweating and an approximately 10 percent decrease in milk production and feed intake by cows. As heat stress increases, the cow will show severe depression in milk yield and in feed intake as her body temperature elevates. She will begin exhibiting more significant signs of heat stress, such as open mouth breathing with panting and her tongue hanging out.

The first step to reduce heat stress is to provide cool water and shade for all milking and dry cows plus heifers. Water is the primary nutrient needed to make milk, accounting for over 85 percent of the content of milk. Also, water requirements increase as the environmental temperature rises. It also is very important that cows have water in a location that is close to shade, since they will not travel great distances for water in a hot environment. Water should be placed away from the milking parlor but in an exit lane from the barn as well as near the feeding location of the cows. Water should be available for cows near their loafing area,

Relative Humidity

Deg F	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
75				No Stress										72	72	73	73	74	74	75	75
80							72	72	73	73	74	74	75	76	76	77	78	78	79	79	80
85			72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
90		72	73	74	75	76	77	78	79	79	80	82	83	84	85	86	86	87	88	89	90
95		75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	91	92	93	94	95
100	77	78	79	80	82	83	84	85	86	87	88	90	91	92	93	94	95	97	98	99	
105	79	80	82	83	84	86	87	88	89	91	92	93	95	96	97						
110	81	83	84	86	87	89	90	91	93	94	96	97									
115	84	85	87	88	90	91	93	95	96	97											
120	86	88	89	91	93	94	96	98													

Mild Stress
Medium Stress
Severe Stress

Impact of Temperature and Relative Humidity on Heat Stress Levels. Temperature Humidity Index (THI) Values for Dairy Cows. Modified from "Heat Stress in Dairy Cattle" FSA3040. http://www.uaex.edu/publications/PDF/FSA-3040.pdf.

either in the shade of native trees or in artificial shade. Water also should be clean, fresh, at approximately ground temperature.

Shading from direct sunlight is also very important, as this allows cows to rest in a more comfortable environment. The possible sources of shade range from trees to portable shade cloth structures to permanent roofed structures. Each approach has its own set of advantages and disadvantages.

The second step to alleviate heat stress in lactating cows is to provide a more comfortable environment in the holding and feeding areas. Ideally, the holding pen area is cooled with a combination of shade, air movement and evaporative cooling water additions. When combined with air movement, added water can increase cooling ability of the cow. However, adding water in humid or poorly ventilated holding pens can increase heat stress. If it does not evaporate from the cow, the water can actually limit cooling.

One system that works very effectively is sprinkle water onto the cows just long enough to wet their backs. Fans are then used to help remove evaporated water vapor away from the cow. When the cows' backs are dry in a few minutes, the process is repeated. Avoid allowing water to run onto the udder. If water does reach the udder, it is possible that bacteria can be transferred into the mammary gland and result in more mastitis. If possible, blow air onto the cows continuously. However, in some cases the fans may need to be off for the period when the sprinklers are running so the water droplets land on the cows' backs. The floor of the holding area should be grooved or rough-surfaced concrete or some other suitable footing so that cows do not slip in the wet environment. As a general rule, water should not stand in the holding pen and the feet of cattle should be exposed to limited water. Also, care and design should be used to avoid unintended consequences with manure and heavy use area management.

For additional information the publications *Heat Stress in Dairy Cattle* (FSA3040) and *Cooling Dairy Cattle in the Holding Pen* (FSA4019) are available at http://www.uaex.edu/publications.