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

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The heat and humidity of a typical Arkansas summer combine to make a stressful 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 component 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 close to shade, since they will not travel great distances for water in a hot environment. Water should be

No Stress · Mild Stress · Medium Stress · Severe Stress

Deg F	Relative Humidity 0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
75														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													

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

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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, either in the shade of native trees or artificial shade. Water also should be clean, fresh and 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 sprinkling 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 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* (FSA30406) and *Cooling Dairy Cattle in the Holding Pen* (FSA4019) are available at http://www.uaex.edu/publications.

Consequence of Negative Energy Balance on Postpartum Fertility

Rick Rorie, Professor - Animal Science

Adequate energy is of key importance to normal reproductive function. Dairy cows are in a negative energy balance (i.e., use more energy than their intake) from about 2 weeks before calving through the first 8 to 10 weeks of lactation. During the last 2 weeks of gestation, feed intake decreases in association with decreasing progesterone, increasing estrogen and final growth of the fetus in preparation for parturition. Around 2 to 3 weeks of lactation, the negative energy balance reaches its maximum and then gradually recovers to zero energy balance over the next 6 or 7 weeks.

Growth hormone (GH) is an important coordinator of metabolism by stimulating the liver, muscle and fat to release metabolites such as glucose and nonesterified fatty acids (NEFA). Normally, GH results in release of insulin-like growth factor-I (IGF-I), which in turn provides feedback regulation of GH. During the period of time cows are in a negative energy balance, this system is disrupted, resulting in elevated GH and decreased IGF-I. Elevated GH and NEFA together block the effects of insulin, resulting in altered carbohydrate metabolism and a state of insulin resistance. The mammary system (milk production) is favored in this situation by increasing glucose uptake, whereas other tissues of the body have decreased glucose uptake.

> Cows that ovulate or re-establish reproductive cycles earlier postpartum have higher fertility and recover from negative energy balance earlier in lactation.

The elevated GH, decreased IGF-I and insulin resistance during negative energy balance affects reproductive function. Normally, IGF-I reduces GH secretion and increases responsiveness to insulin. Both insulin and IGF-I make the ovaries more responsive to the pituitary hormones, luteinizing hormone (LH) and follicle stimulating hormone (FSH). These pituitary hormones are necessary to support growth and development of follicles, ovulation, and formation of the corpus luteum after ovulation.

Variation among individual cows suggests there is a genetic component to how severe negative energy balance affects reproductive function. Holstein cows have a wave of follicular growth about a week after calving, irrespective of their energy balance. In 40 to 50 percent of cows, a follicle will mature and ovulate. The remaining cows will have follicular growth but fail to ovulate or ovulate at a later follicular wave. Cows that ovulate or re-establish reproductive cycles earlier postpartum have higher fertility and recover from negative energy balance earlier in lactation. One study reported that cows ovulating within 21 days of calving had a first service pregnancy rate that was about 10 percent higher than other cows cycling by 49 days of lactation.

Another consequence of negative energy balance before calving and during early gestation is suppressed immune function, making cows more susceptible to uterine infection (endometritis). Over 90 percent of dairy cows have bacterial contamination in their uterus during early lactation. While most cows eliminate the contamination over the first few weeks of lactation, some persist and develop into clinical or subclinical endometritis.

The incidence of subclinical endometritis for cows ovulating within 21 days of calving was about half that of cows ovulating by 49 days. Thus, early ovulation may indicate better energy balance and overall health.

An approach to stimulate early cyclicity in cows is to feed high starch diets, which should increase insulin concentrations, stimulate follicular growth and increase the incidence of ovulation. However, such diets can have negative effects on subsequent embryo development. In contrast, high fat diets improve fertilization and embryo development. Therefore, sequential feeding of high starch diet to stimulate follicular development and establishment of estrous cycles, then switching to a high fat diet during the breeding period has been evaluated. In a small study, such sequential feeding resulted in a 120-day pregnancy rate of 60 percent compared with 27 percent for other cows maintained on either high starch or high fat diets. Although the results were limited, this approach may have promise for improving fertility.

Comparison of Seven Winter Annual Forages for Fall Forage Production

John Jennings, Professor and Forage Specialist; Kenny Simon, Program Associate - Forages; Dirk Philipp, Associate Professor - Forages; Paul Beck; Professor - Stocker Cattle Management; and County Agriculture Agents in Ouachita and Ozark Districts

Quality forage production during the fall season requires planning to ensure adequate yield that fits the production system. Early fall planting involves risk of dry weather and pest pressure but has higher yield potential. Later planting typically has less risk from dry weather and pests, but also has lower yield potential.

A research trial was conducted in fall of 2016 at the University of Arkansas research centers at Fayetteville and Hope to compare seven winter annual forages for fall forage yield for early and late planting dates. Forages tested were spring oat (Jerry), winter oat (Coker), rye (Elbon), wheat (VNS), triticale (Fridge), ryegrass (Winterhawk) and rape (Winfred). Early planting dates were August 24 (Fayetteville) and August 30 (Hope). Late planting dates were October 7 (Hope) and October 11 (Fayetteville). Plots were harvested on November 22 (Fayetteville) and December 2 (Hope).

Results

Fayetteville

The Fayetteville test was planted on a tilled, prepared seedbed. Soil conditions were dry at planting, but heavy rain occurred the day after planting. However, only 1.3 inch of rain was recorded for the next month with day temperatures of 85-90 for 18 days in September. Good rainfall occurred in October (5.3 inches), but only 0.7 inch occurred in November. Rust leaf disease was significant on the August-planted wheat, and stinkgrass infestation was significant in the August plantings of wheat and ryegrass. Both disease and weed pressure impacted yield for those species.

To plan for fall grazing, but to hedge against risk of poor fall conditions, some selected acreage can be planted early for fall grazing and the remaining acreage can be planted at traditional later dates for winter/spring grazing.

Dry matter (DM) yield on November 22 exceeded the 1,200 pounds per acre level recommended for fall grazing for all forages planted in August except wheat and ryegrass (Figure 1). DM for rye, triticale, winter oat, rape and spring oat ranged from 1,386 pounds per acre to 3,740 pounds per acre (Figure 1). Spring oat (August planting) produced the highest DM of all species. DM yield was below the recommended 1,200 pounds per acre level for all species planted in October.

Hope

The Hope test was no-till planted on a fallow site. Weeds and vegetation were sprayed and mowed prior to planting. Soil conditions were wet at planting due to heavy August rain, but conditions became hot and dry after planting. Only 2.5 inches of rain occurred over the next 80 days until late November. Day high temperatures exceeded 90 degrees for

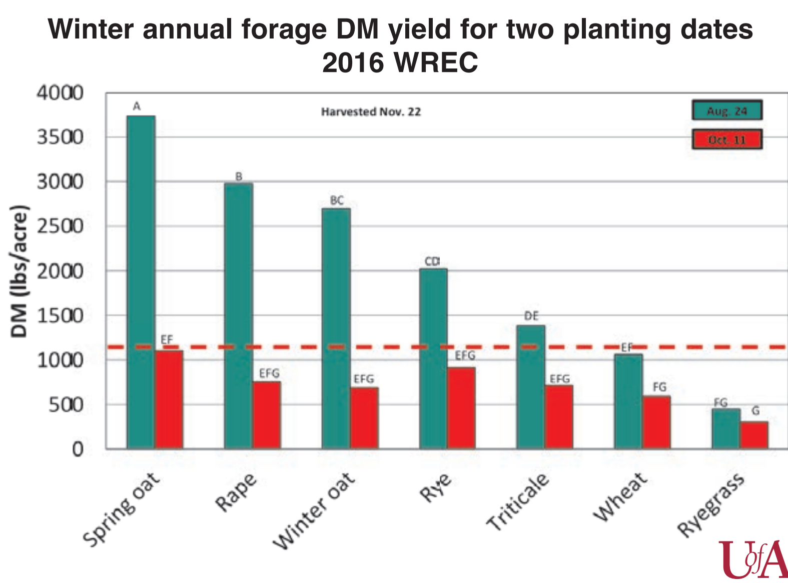

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Figure 1. DM yield for seven winter annual forages planted on two dates – Fayetteville, Arkansas – 2016. (Bars topped by the same letter(s) are not significantly different.)

17 days in September. Rust leaf disease was significant on the August-planted wheat and rye. Broadleaf weed infestation was significant in all species for the August plantings ranging from 35 percent to nearly 80 percent. A combination of drought, disease and weed pressure impacted yield for the August planting. Weed and disease pressure were very low for all species of the October planting. Dry matter (DM) yield on December 2 was below the 1,200 pound per acre level recommended for fall grazing for all forages for both planting dates (Figure 2).

Summary

Early planting has risk of dry weather, disease and weed pressure. Conditions observed in this trial for the August planting were unusual, especially for the disease and weed pressure at both locations. Early planted winter annuals have good yield potential to produce valuable fall grazing with normal weather conditions. Planting in October produced low fall forage yield at both sites. August plantings had more problems with drought, weeds and disease, while October plantings had very few problems. But the August-planted forages at Fayetteville produced significantly more forage than the October plantings. This is the tradeoff between the two planting dates.

To plan for fall grazing, but to hedge against risk of poor fall conditions, some selected acreage can be planted early for fall grazing and the remaining acreage can be planted at traditional later dates for winter/spring grazing. Remember that seed left in the bag produces no grazing.

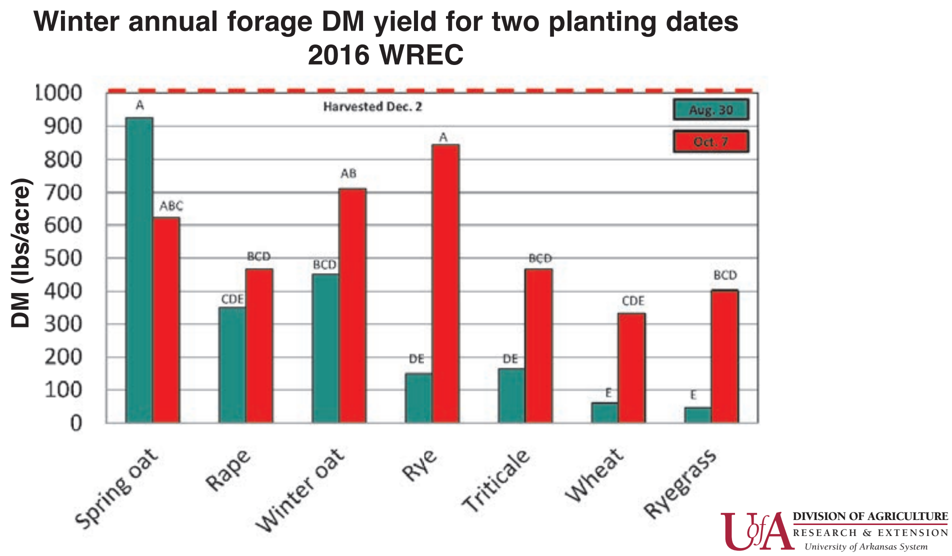

Figure 2. DM yield for seven winter annual forages planted on two dates – Hope, Arkansas – 2016. (Bars topped by the same letter(s) are not significantly different.)

Current Pest Update: Fall Armyworms and Face Flies

Kelly M. Loftin, Professor and Extension Entomologist

Fall Armyworms

And we thought fall armyworms were early last year! This year, fall armyworms of mixed sizes and well above the treatment threshold occurred in early June. Now through early fall we should regularly scout pastures and hay meadows to identify infestations before significant losses occur. Infestations can be overlooked when the caterpillars are small and eating very little. Once they grow large and consume more grass, damage becomes apparent.

Fall Armyworms (*Spodoptera frugiperda*).

Clues to fall armyworm infestations include: 1) field appears "frosted," 2) presence of birds in the field or 3) the odor of fresh grass. Armyworm outbreaks usually occur in waves about 30 days apart. However, when mixed worm sizes are found, overlapping generations are present and new infestations occur more frequently than 30 days. When scouting, carefully examine grass blades, stems and organic debris at plant base for armyworms. It is best to take at least ten one-foot-square random samples across the pasture or hay meadow. Make note of the armyworm size and number, as this will help you make good management decisions.

Insecticide application is warranted when three or more fall armyworms per square foot occur in a field. Per-acre insecticide cost will vary from as low as about $3.00 up to over $12.00. When calculating cost, always consider the cost per acre and not the cost per gallon of product. Also consider residual activity of the product, especially if you are seeing overlapping generations (all sizes of fall armyworm caterpillars) and heavy armyworm pressure. Pyrethroid insecticides such as Karate® (lambda-cyhalothrin), Mustang Maxx® (zeta-cypermethrin) and Baythroid XL (beta-cyfluthrin) have short-duration residual activity. In contrast, products such as Prevathon® (chlorantraniliprole), Besiege® (chlorantraniliprole and lambda-cyhalothrin) and Intrepid® (methoxyfenozide) have longer-duration residual activity and can reduce the number of applications necessary to produce a hay crop. Also remember, if the grass is ready, cutting for hay will avoid the need to make an insecticide application.

For additional information on armyworms, see *Managing Armyworms in Pastures and Hayfields,* available at http://www.uaex.edu/publications/PDF/FSA-7083.pdf, and *2017 Insecticide Recommendations for Arkansas*, available at http://www.uaex.edu/publications/pdf/mp144/c-forages.pdf.

Face Flies

This marks the third year in a row we have face fly (*Musca autumnalis*) infestations well above the economic injury level. In mid-June, face fly abundance of over ten flies per face has been observed on several herds in north Arkansas. When face fly abundance is high, grazing is disrupted, resulting in weight and milk production losses. In addition, this fly can be a mechanical vector of *Moraxella bovis*, a principal pinkeye pathogen. Face flies spend little time on the animal and feed intermittently. Because a face fly may feed on multiple animals on the same day, they can spread the pinkeye pathogen to several animals.

When an average of ten flies per face occur in the herd, economic loss can occur and control should be initiated. To monitor face flies, count the number of flies on the face of 10-15 animals. If the average number per animal begins to approach ten flies per face, treatment is warranted. Face flies can be difficult to control because 1) they are primarily found on the hard-to-treat animal's face; 2) only a very small percentage of the population is found on the host at any given time; and 3) face flies are intermittent feeders and spend little time on the animal.

Face flies are normally treated with self-treatment devices or insecticide-impregnated ear tags. A few pour-on insecticides that allow for application to the face are effective. Forced-use back rubbers equipped with Face Flyps charged with a pyrethroid such as permethrin or an organophosphate such as coumaphos are effective. Paired insecticide dust bags will also provide control when hung properly. Some of the insecticide-impregnated ear tags for cattle will provide control while others simply reduce the population. Be certain to read the ear tag label. Ear tags with label statements that read "controls face flies" are generally more effective than ear tags with labels that read "reduces face flies." Because face flies only develop in cattle manure, feed-through larvicides/IGRs (insect growth regulators) such as ClariFly® will prevent new flies from emerging. However, proximity to untreated herds and the longer flight range of face flies can reduce the level of control. Products registered for use against insect pests of cattle are listed in *2017 Insecticide Recommendations for Arkansas* (http://www.uaex.edu/publications/mp-144.aspx).

Face flies (*Musca autumnalis*) clustered below an animal's eye.