2008
Florida & Georgia Dairy Road Show

Proceedings

March 4 - Okeechobee, Florida

March 5 - Mayo, Florida

March 6 - Madison, Georgia

March 7 - Tifton, Georgia

UF UNIVERSITY of FLORIDA
IFAS Extension

The University of Georgia

2008
Florida & Georgia
Dairy Road Show

March 4 - Okeechobee County Extension Office, Okeechobee, FL
March 5 - Lafayette County Extension Office, Mayo, FL
March 6 - Morgan County Extension Office, Madison, GA
March 7 - UGA Tifton Conference Center, Tifton, GA

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2008 Florida & Georgia Dairy Road Show Organization

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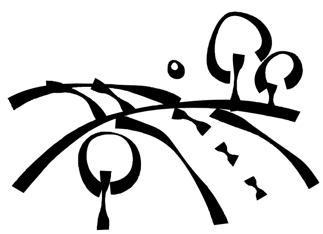

Program Schedule

AM	
10:00	**Welcome** *Local host*
10:15[1]	Okeechobee: **What is New in Dairy Reproduction?** *Dr. Jose Santos, University of Florida* Mayo: **Selection Index: What are Dairy Cattle Traits Worth?** *Dr. Albert De Vries, University of Florida* Madison: **What is New in Dairy Reproduction?** *Dr. William Graves, The University of Georgia* Tifton: **What is New in Dairy Reproduction?** *Dr. William Graves, The University of Georgia*
11:00	**Housing and Management in the Dry Period** *Dr. Geoff Dahl, University of Florida*
11:30	**Transition Cow Management** *Dr. Bradley Mills, Pfizer Animal Health*
PM	
12:00	**Lunch** (sponsored by **Pfizer Animal Health**)
12:45	**Feeding Management: Do's and Don'ts** *Dr. John Bernard, University of Georgia*
1:30	**Manure to Money??? Carbon and Renewable Energy Credits** *Dr. Mary Sowerby, The University of Florida*
2:00	Okeechobee: **Local Dairy Update** *Mr. Pat Miller, Okeechobee County Extension, University of Florida* Mayo: **Local Dairy Update** *Mr. Chris Vann, Lafayette County Extension, University of Florida* Madison: **Local Dairy Update** *Mr. Bobby Smith, Morgan County Extension, The University of Georgia* Tifton: **Forage Management During a Drought** *Mr. Jeremy Kichler, Macon County Extension, The University of Georgia*
2:30	**Adjourn**

[1] The originally planned presentation by Dr. Carlos Risco, "What is New in Dairy Reproduction?", unfortunately had to be cancelled just prior to the meetings. Substitute speakers are listed instead.

What is New in Dairy Reproduction?

Carlos A. Risco, DVM, Dipl. ACT[1]
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Has the reproductive performance in your herd improved, remained the same or declined over time? If your herd is typical for the Southeast, reproductive performance has declined over time. A study that evaluated reproductive performance from 1976 to 2002, in Florida and Georgia dairy herds, showed that days to first service, days to conception, and calving interval increased significantly over time (de Vries and Risco, 2006). Further, average pregnancy rates decreased from 22% to 11%. Although, causes for this decline is multifactorial, attenuation of estrus expression in high producing cows, embryonic mortality, energy metabolism early postpartum and its interactions with immune function play a major role (Wiltbank et al., 2006; Santos et al, 2007; Hammon et al., 2006). Further, the trend for larger herds has resulted in new challenges with compliance of reproductive programs, namely inseminating cows on a timely basis at the end of the voluntary waiting period (VWP).

The purpose of this manuscript is to review recent findings in reproductive management of dairy cows and how they may be applied to enhance reproductive efficiency in dairy cattle. The discussion centers on management considerations related to time specific events from parturition to the end of the VWP to accomplish the economic goal of pregnancy within 80 to 120 days after calving.

Periparturient and Postpartum Periods

Just prior to parturition, a depression in feed intake occurs in dairy cows, and after calving they mobilize fat as well as protein reserves. Consequently, many dairy cows are in a negative energy balance and at risk to develop ketosis during early post partum. As a result of the compromised energy balance, uterine health is affected predisposing cows to uterine infections. It is well accepted that uterine infection during post partum reduces the risk for pregnancy at the end of the VWP. Energy balance near calving was associated with uterine health disorders and fever in Holstein cows (Hammon et al., 2006). Cows with fever (days 1 to 10 post partum) and endometritis (cytology at 4 wks), experienced lower dry matter intake from -1 wk to + 5 wk, were ketotic from -2 to 4 wk post partum and neutrophil function was suppressed. The authors concluded that uterine infections are preceded by negative energy balance prior to calving and extend into early lactation. Further, ketosis has been associated with an increased risk to develop puerperal metritis (Markusfeld, 1984 and 1987), displaced abomasum (Geishauser et al., 1997) and mastitis (Syvajarvi et al., 1986).

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A reduction in blood calcium concentration or hypocalcemia, is common after calving and appears to suppress immune function which predisposes cows to retained fetal membranes, mastitis and uterine infections. The response of immune cells is complex; a recent study showed that hypocalcemia at calving interferes with the activation of immune cells (Kimura et al., 2006). Furthermore, hypocalcemia acts as a stressor to the cow and cortisol is considered a major contributor to immune suppression. Typically, cows have a 3-4 fold increase in plasma cortisol as a component of the calving process. However, sub clinically hypocalcemic cows can have a 5-7 fold increase in plasma cortisol on the day of parturition and cows with milk fever may exhibit plasma cortisol concentration that are 10-15 fold higher than pre-calving plasma cortisol concentration (Horst et al., 1982). Because immune suppression has been reported to begin 1-2 weeks pre partum (Kerhrli et al., 1998; Horst et al, 1982) and the surge of cortisol is confined to the day of parturition, cortisol probably plays more of a contributing than a causal role in immune suppression.

The challenge in transition cow management is to implement feeding strategies before calving that enable the fresh cows to achieve optimal dry matter intake and recover quickly from hypocalcemia and ketosis. It is the opinion of the author that in many dairy herds, attention to transition cow management occurs after health problems occur. Therefore, periodic evaluation of prepartum transition cow management is recommended to determine whether or not there is an increase risk for calving related disorders to occur due to inappropriate management. The parameters in the checklist below can be used as a guide to determine whether or not management of transition cows is appropriate. These items should be evaluated periodically:

- Is the ration balanced for energy, fiber content (including effective fiber), protein, dietary cationic anionic difference (DCAD), minerals and vitamins?
- Is there enough feed bunk space (at least 2 feet per cow)?
- Is there adequate shade (50 square feet per cow)?
- Are there clean, well - designed calving facilities?
- Are urine pH’s evaluated to ascertain compliance of appropriate DCAD diet feeding?
- Is pre and postpartum energy status evaluated in selected groups?
- Is there ample clean water available for all cows?

Calving Management

On many dairy farms, veterinarians continue to observe inadequately trained employees when performing obstetrical procedures which results in calving trauma. Producers should make an effort to work with their herd veterinarian to design a herd health protocol that emphasizes first – aid calving assistance to get producers away from using improper techniques for delivering calves.

Dr. Maarten Drost from the University of Florida, College of Veterinary Medicine, has developed a web based visual guide titled the Drost Project Visual Guide, that enables producers and veterinarians train and educate employees on reproductive management that includes; AI, Pregnancy diagnosis, and management of obstetrics. These topics and others are available and can be accessed free at: www.drostproject.vetmed.ufl.edu.

Moving Fresh Cows through Pens Before and After Calving

Observations made by Dr. Ken Nordlund and colleagues from the University of Wisconsin, College of Veterinary Medicine suggests that cow behavior and social factors has emerged as the primary risk factor for ketosis, fatty liver and displaced abomasums. These investigators have pointed out that where poorly formulated rations and inaccurate delivery systems were once the primary risk factors for these conditions, they increasingly see poorly stage pen moves and overstocking as key risk factors. The mechanism appears to be a disruption of dry matter intake for vulnerable cows, leading to ketosis followed by the cascade of related diseases. To simplify labor, dairy farms create a grouping system of cows for specialized management which commonly includes:

- Far off dry cows: -60 to -20 day from calving
- Close up dry cows: -21 to -3 days from calving
- Maternity pen
- Fresh pen: 3 to 14 days after calving
- Sick pen: variable days after calving
- Various lactation and pregnant groups

In the above scenario, cows are often moved multiple times during the 3 weeks periods before and after calving, a time when cows are most vulnerable to develop ketosis. With each movement to a new pen or group, cows experience stress and must establish her rank within the social order of the pen and feed intake is reduced. It is well known that cows form dominance hierarchies, strongly associated with age, body size and seniority in herd (Dickson, 1970). In general, cows resident in a pen tend to maintain their rank compared to new arrivals (Scheim and Forhman, 1955). It has been reported that early lactation cows were more affected by regrouping than mid lactation cows (Kongaard and Krohn, 1978). Cows that are losing weight loose social rank within a group, while those gaining weight gain dominance. These observations suggest that too many cow movements early post partum may have an impact on fresh cow health as the early post partum period is a period of significant weight loss.

The sick pen in some dairy farms may have daily entries of new cows, and Dr. Nordlund describes it as a state of constant social turmoil as each new cow attempts to establish her rank within the social order of the pen. It should also be kept in mind that sick pens have been reported to be contaminated with bacterial pathogens that include Salmonella (Peek et al, 2004); thus, presenting a substantial risk to cows that are stressed and immunosupressed. In some dairies fresh cows are moved through the sick pen until colostrum is cleared to group “non – salable” milk, this is a high risk practice. Another group of cows that often are moved to the sick pen are cows with metritis that require antibiotic treatment. With the availability of Excenel RTU® (Pfizer

Animal Health) labeled for metritis, that do not require milk withdrawal, cows with metritis can be treated with this antibiotic and remain in the milk herd to avoid the social turmoil that reduces feed intake. I have often wondered, that if cows could talk, they would say “I can live with the disease but not the movement to a new pen “.

Health Monitoring During Post Partum

Postpartum health monitoring strategies have become popular in many dairies because it allows the opportunity to identify sick cows early and provide supportive therapy. In general, as discussed in a previous Dairy Road Show Seminar by the author, monitoring postpartum health involves the examination of all cows early post partum by trained farm personnel. Parameters commonly used to evaluate health include rectal temperature, attitude, milk production, uterine discharge, and urine ketones.

A study was conducted in Florida that described the rectal temperature of cows with metritis before diagnosis and documented the association between metritis, and reproductive performance in dairy cows (Benzaquen et al., 2006). Cows experiencing an abnormal calving had greater odds to develop metritis than cows with normal calving. Heifers had greater odds of metritis in the cold season and multiparous cows showed no seasonality in the occurrence of metritis. Evaluation of daily rectal temperature distinguished cows with metritis with or without fever (Temp. > 103). A high proportion of cows did not have fever (58%) at the time metritis was diagnosed. Prior to diagnosis, daily increases in rectal temperature on 2 consecutive days prior to the actual diagnosis could serve as a predictor of metritis in cows that subsequently develop a fever at the time metritis is diagnosed. In cows diagnosed with metritis and treated, first-service conception risk and cumulative pregnancy risks by 150 d postpartum were comparable to cows that did not experience metritis. The take home message from this study when monitoring uterine health in fresh cows is:

- Because cows with metritis may not present with a typical fever > 103. 0, diagnostic and treatment consideration for metritis should include attitude of the cow, the condition of the uterus and not rectal temperature alone.
- Identification of cows with metritis early and prompt treatment may ameliorate the effects of metritis on reproduction.
- Cows that experience an abnormal calving such as retained placenta or dystocia are more likely to develop metritis. Therefore, cows with these conditions should be monitored carefully.

Strategies to Maximize Pregnancy Rate at the End of the Voluntary Waiting Period

It is well accepted that the most economical strategy to improve pregnancy rate (PR) is the use of timed insemination protocols such as Ovsynch. Pregnancy rates increases when the protocol Ovsynch is initiated during days 5 to 12 of the estrous cycle (Moreira et al., 2001). This can be accomplished by pre-synchronizing cows with prostaglandin ($PGF2\alpha$) 12 days before the initiation of Ovsynch or more effectively two treatments with PGF2α 14 days apart and initiation of Ovsynch 12 days after the second prostaglandin injection (Presynch-Ovynch; Moreira et al., 2001). Studies conducted in lactating dairy cows indicate that PR improved by 6 to 18 percentage points when the Presynch – Ovsynch protocol was employed (Moreira et al., 2000; EL-Zarkouny et al., 2004).

A meta-analysis study of various breeding programs examined 71 treatment and control comparisons extracted from 53 research papers (Rabiee et al., 2005). Programs evaluated included Ovsynch, Natural Service, prostaglandin injection, (and modifications of the Ovsynch protocol Select Synch, Heat Synch and modified Ovsynch). Pregnancy rates for Ovsynch programs did not differ significantly from those with natural breeding programs. Results of Ovsynch vs. PGF2*α* programs showed that the risk of conception and pregnancy rates did not differ significantly. Comparisons between Ovsynch and SelectSynch demonstrated that the risk of conception and pregnancy rates did not differ significantly between these groups. Examination of Ovsynch vs. modified Ovsynch programs showed that the risk of pregnancy in cows synchronized with modified Ovsynch was similar to those treated with Ovsynch.

Meta-analyses identified that the conception and pregnancy rates obtained with the prostaglandin, SelectSynch, and modified Ovsynch (including Presynch and CoSynch) programs were comparable with the Ovsynch program. Modifications to the Ovsynch program such as pres-synchronization and timed artificial insemination at the time of second GnRH injection (CoSynch) may be an alternative for reproductive management of dairy herds where detection of estrus is less than optimal. The findings of this study demonstrate that the Ovsynch program could benefit dairy operations because it allows for timed artificial insemination of lactating cows without detection of estrus. There was, however, little or no significant improvement in pregnancy rates using Ovsynch over other programs.

Economics of Timed Insemination Programs

The economic value of the use of Ovsynch depends on the estrus detection rate of the herd. In those herds with high estrus detection rate the value of Ovsynch is lower. This concept was illustrated in a study that reported the value of a pregnancy based on insemination at detected estrus or Ovsynch in two herds (Tenhagen et al, 2004). One half of each herd was inseminated at detected estrus, the other half was inseminated with Ovsynch. In one herd with poor estrus detection, the cost of a pregnancy was reduced significantly with the use of Ovsynch compared to insemination at detected estrus. In the second herd, which had higher estrus detection rates, the cost of a pregnancy was slightly more for Ovsynch, despite improved reproductive performance. The greatest costs attributed to lower PR from insemination at detected estrus were higher culling rates and excessive days open.

A study conducted in Florida, modeled potential net returns per cow by comparing use of Ovsynch in winter and summer compared to insemination at detected estrus (Risco et al, 1998). The greatest impacts on net returns were obtained when

Ovsynch was used during summer compared to winter. This finding was attributed to lower estrus detection rates observed during the summer months. The authors concluded that use of a timed AI program such as Ovsynch is an economical alternative in reproductive management of dairy herds with poor estrus detection.

Embryonic Loss

An important consideration of low PR is embryonic loss before 40 days of gestation and can account for 15% to 25% of failed pregnancies (Roche, 1986). It was concluded by J. Santos and coworkers that lower fertility of lactating dairy cows appears to be due to both a lower conception rate and greater early embryonic (i.e., 28 d; 20%) and late embryonic losses (i.e., 24 to 42 d; 12.5%). Total losses from fertilization to birth are up to 60% with a final conception rate at birth of 28%. These total losses appear to be associated with lactation because similar rates are not seen in nonlactating heifers or multiparous cows that are nonlactating. However, milk production per se does not appear to be a risk factor for increased pregnancy losses. Higher producing herds may be better managed regarding nutrition, health, and reproduction such that milk production associations are difficult to detect. What appears to be associated with high milk production and lower fertility is that an increased milk yield is accompanied by an increase in both feed intake and overall metabolic rate, decreasing estradiol and progesterone concentrations in blood. These alterations in steroid balance are thought to reduce early embryonic development.

A study that evaluated factors affecting embryonic loss in dairy cattle indicated that 39% of cows pregnant on day 23 lost their embryo by day 27, and 18% of cows that were pregnant on day 27 or 28 were not pregnant on days 35 to 41 (Moore et al., 2005). The greatest risk identified for embryonic loss during both periods was insemination of pregnant cows, low progesterone concentration and cows with a linear somatic cell count > 4.5. The authors concluded that embryonic losses can be reduced by:

- Proper training of insemination technicians to improve accuracy of estrus detection. That is, to reduce the breeding of cows that are pregnant but incorrectly identified as being in estrus.
- Strive to reduce the incidence of both clinical and sub-clinical mastitis.
- Evaluate lactating cow nutrition to minimize postpartum negative energy balance and maximize postinsemination progesterone concentration. Administration of human chorionic gonadotropin (HCG) increases progesterone concentration (formation of accessory corpora lutea) and reduces pregnancy wastage (Santos et al, 2001). Treatment with 3,300 units of HCG, IM on day 5 after insemination resulted in multiple corpora lutea, higher progesterone concentration and higher conception rates on day 45.

Lameness and Reproductive Performance in Dairy Cows

A study conducted in Florida show that lameness delays resumption of cyclicity after calving and prolongs the calving to conception interval in dairy cows (Hernandez et al., 2001). In lame cows, the effect of lameness on time to conception is greater in cows with severe lameness, compared to cows with mild lameness (Hernandez et al., 2005) and application of a screening and hoof trimming procedure reduced the incidence of lameness during late lactation (Hernandez et al., 2007). These studies suggest that producers should adapt lameness prevention practices that include evaluation of locomotion scores for early detection and management of lame cows, to obviate the effect of lameness on reproduction.

Early Diagnosis of Open Cows

The basic economical factor that influences the value of early diagnosis of open cows is the premise that a pregnant cow is more economical than an open cow. The most common parameter used to express the value of a pregnant cow is the cost of a cow remaining open. Therefore, the value of early pregnancy diagnostic is finding an open cow earlier coupled with a successful re-breeding to reduce days not pregnant.

Palpation is effective after day 33 to 35 and ultrasonography around day 28 to diagnose pregnancy. Pregnancy – specific protein B (PSPB) is present in cells of the developing trophoblast as early as day 21 of pregnancy in cows (Humblot et al., 1988). Detection of this protein in blood is a very good indicator of pregnancy as early as 30 days of gestation. Because of its long half-life, it remains in circulation for several months after parturition. Cows diagnosed for pregnancy less than 70 days, residual PSPB causes false positive results. Currently, blood samples for cows that are greater than 90 days in milk and 30 days post AI are shipped to the laboratory for analysis (BioPRYN®; Ag Health, Sunnyside, Wa., www.aghealth.com). The utility of this protein at the farm level will improve when on-the-farm diagnostic kits are developed and implemented for early diagnosis of open cows to manage reproduction.

Sexed Semen

A review on what is new in reproduction would be incomplete if the technology of sexed semen is not discussed. Increasing the number of heifers calves born would be a great advantage to the dairy industry. The bovine X chromosome – bearing sperm contain 3.8% more DNA than do Y chromosome -bearing sperm, allowing their separation after being stained with a fluorescent dye and sorted through fluorescent - activated cell sorter (Johnson, 1995). Because the female always contributes an X chromosome bearing egg, cattle AI with an X chromosome bearing sperm will result in a female calf with 95% reliability. At the present moment, there are two major drawbacks for used of sexed semen. The first is cost due to the labor and expense in producing sexed semen straws for AI. The second is the lower conception rates (35% vs. 55%) when compared to unsexed semen in virgin heifers.

Because of the low conception rates sexed semen is recommended in heifers AI at detected estrus. A recommended strategy is to use sexed semen to first service followed with unsexed semen in repeat breeding (Moore and Thatcher, 2006). This method results in $\geq$ 62.2 % female offspring at first calving. More heifers being born on the farm is a fast way to grow a herd internally, while maintaining biosecurity. Additionally, heifer calves are usually easier to deliver than bulls, so calving ease is another benefit. However, while each pregnancy is important, so is genetic progress. Each calf born should be genetically superior to her dam. This applies to sexed semen as well as conventional semen. Don't buy sexed semen just for the fact that it's sexed, because you may not get the best quality of genetics.

Conclusions

The premise for the observed decline in reproductive performance in dairy cows is that genetic improvement for high milk yield has created a sub-fertile animal experiencing lower pregnancy rates and high embryo mortality. To combat this problem, research has focused on the cow, her environment and ovulation synchronization protocols. However, application of this new research or technology must be coordinated with sound management practices that optimize cow health to allow the opportunity for conception and pregnancy maintenance. Producers must also endeavor with their managers to assure compliance of these reproductive management strategies on a daily basis.

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Notes

Housing and Management in the Dry Period

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Introduction

Traditionally, management of cows during the dry period was minimal. Approximately 60 days before calving, milking would cease and cows were treated with long lasting antibiotic in an attempt to clear up any lingering subclinical mastitis and prevent new infections. Cows were typically removed from the milking herd, given reduced feed, and often exposed to pasture and allowed to "rest" prior to parturition. In the last 10-15 years, however, this low input approach has shifted as numerous studies suggested that aggressive nutritional management during the dry period could reduce the incidence of metabolic disease and improve the transition into lactation. Improved understanding of the roles of dietary energy density, cation-anion balance, and fat metabolism have led to new nutritional recommendations for dry cows to improve subsequent lactational performance (Drackley, 1999). Similar to nutrition, there is a growing body of evidence to suggest that appropriate management of housing during the dry period can also yield dividends in the subsequent lactation, and that is the topic of this paper.

Photoperiod Management

Controlling the duration of light a cow is exposed to daily has dramatic influence on milk production during lactation (Dahl et al., 2000). Long days, light for 16 to 18 hours each day interrupted by a 6 to 8 hour period of darkness, increase milk yield 5 lbs/day at all stages of lactation. In addition, exposing growing heifers to long days accelerates lean growth and results in higher milk yields in the first lactation relative to shorter durations of light, i.e. short days (Rius et al., 2005; Rius and Dahl, 2006). However, recent studies suggest that exposure to short days during the dry period improves cow health and mammary growth before calving, eases the transition into lactation and ultimately results in greater milk production compared with cows on long days when dry (Dahl and Petitclerc, 2003).

The first study to show a response to short days in dry cows compared 60 days of short days to long days; essentially exposing cows to either photoperiod for the entire dry period (Miller et al., 2000). Subsequent studies have confirmed not only an improvement of milk yield following a dry period of short day exposure, but also evidence of more robust immune function and health (Auchtung et al., 2004, 2005). Dry cows on short days had fewer quarters infected with mastitis in early lactation and the incidence of metritis was reduced (Auchtung et al., 2004).

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Physiologically, the impact of photoperiod management is attributed to shifts in the secretion of certain hormones that are critical to lactation and health. Under short days, secretion of prolactin is lower relative to cows on long days (Dahl et al., 2000). Prolactin acts through a specific receptor that is present in many tissues, notably the mammary gland and numerous cells of the immune system including lymphocytes and neutrophils (Auchtung and Dahl, 2004). Those prolactin receptors are then responsible for transducing the signal when the hormone binds to them. In contrast to prolactin itself, the number of prolactin receptors increases under short days compared with long days, thus, the signal intensity may increase (Auchtung and Dahl, 2004). There is strong evidence then that the inverse relationship between prolactin and its receptor drives photoperiod related shifts in milk yield and health, with a reduction in prolactin being desirable during the dry period.

Cooling

In lactating cows, heat stress abatement is critical to maintain dry matter intake and milk yield during the summer months and even year round in some areas of the US (Collier et al., 2006). Because dry cows typically consume less feed and intake is limited relative to lactating cows, heat stress may have been overlooked during the dry period. However, previous reports indicate that provision of shade and other heat stress abatement improves calf health and production in the next lactation (Collier et al., 1982). More recently, Urdaz et al. (2006) showed that cooling dry cows late in the dry period improved intake and subsequent milk yield.

But heat stress effects on dry matter intake may explain only a portion of the improvements that occur when dry cows are cooled. Heat stress also produces an increase in circulating prolactin, a similar response to that of long day photoperiod exposure. This led to a test of the hypothesis that prolactin responsive gene expression in the liver was negatively affected by heat stress during the dry period, and that led to lower milk yield. The objective of the study was to evaluate the effects of heat stress prepartum under controlled photoperiod on lactation performance and hepatic metabolic gene expression of periparturient Holstein cows. Cows were dried off 46 d before expected calving date and assigned to treatments by mature equivalent milk production. The treatments were: 1) Heat stress (HT) and 2) Cooling (CL). Both treatments had a photoperiod of (14L:10D). After calving, cows were housed in a free stall barn with cooling, and milk yield was recorded daily up to 42 DIM. Daily DMI was measured from -35 to 42 d relative to calving. Liver biopsies were collected at dry off, -20, +2, and +20 d relative to calving for cows on HT and CL to measure mRNA expression of prolactin responsive genes. HT cows had greater afternoon rectal temperatures (39.2 vs. 38.8^{o}C) and decreased DMI prepartum (26.5 vs. 31.1 lbs/d) and milk yield postpartum (63.5 vs. 76.7 lbs/d) compared with CL cows. Relative to CL cows, hepatic mRNA expression of *suppressors of cytokine signaling* -2 (*SOCS2)* and *IGFBP5* was down-regulated in HT cows. Expression of *ACADVL* was up-regulated in CL cows at d +2 but down-regulated at d +20 relative to HT cows. These results suggest that heat stress abatement in the dry period improves subsequent lactation, possibly through SOCS-2 and its regulation of hepatic lipid metabolism (do Amaral et al., 2008).

Stocking Density

The preceding discussion suggests that dedicated facilities, especially those that feature controlled lighting and cooling, may be used to improve dry cow management and subsequent lactational performance. Yet for facilities to yield a maximal return on the investment of capital, they must be designed and used to maximize the efficiency of cow flows over time. Although dairy cows are not seasonal breeders, there are seasonal spikes in calving that dictate fluctuations in dry cow numbers. That means that overstocking of dry cows is likely to occur even in a dedicated facility.

Stocking density is a critical component of overall cow comfort, yet the impact of overstocking during the dry period is unknown. And, the relative contribution of limiting feed access versus stall access to stocking density effects is unknown. To determine if reduced freestall availability during the dry period had an impact on subsequent milk yield and performance, we used 40 Holstein cows dried off approximately 60 d before calving and assigned to 70% stall availability (overstocked) or 100% stall availability (control) for the entire dry period. All cows were fed individually using a Calan gate system and dry matter intake (DMI) was recorded during the dry period. Treatments ended at calving when all cows were managed in a commercial facility throughout lactation. Cows were milked three times per day; milk production was recorded until 150 d in milk. There was no difference between groups in days dry, DMI, BCS or milk production. When dry, overstocked cows consumed 33.7 lbs/d DM compared with 32.9 lbs/d for cows with full stall access. BCS did not differ between treatments and score averaged 3.2 for overstocked versus 3.1 for control cows. Milk production was 97 lbs/d for 100SA and 96 lbs/d for 70SA. These results suggest that dry cows can adapt to substantial reductions in stall availability during the dry period if adequate access to feed is maintained, and not experience a reduction in subsequent milk yield (Velasco et al., 2007).

While determining the actual incidence of disease requires a tremendous number of cows, there are certain indicators of immune function that can be used to compare immune competence and potential disease resistance. In 20 cows of the study, short-term treatment effects on neutrophil phagocytosis and chemotaxis and lymphocyte proliferation were measured 4 and 24 h after assignment to either overstocked or control conditions. Lymphocyte proliferation was measured again at 2 and 5 wk post-treatment. Locomotor scores and postpartum disease prevalence were also recorded for these 20 cows and the second cohort of 20 cows subjected to the same treatments. In the short-term, immune cell activity was enhanced among cows on the 70SA treatment compared with cows on 100SA. Lymphocyte proliferation, a measure of immune competence, increased in response to ConA and tended to increase in response to PHA, suggesting an increased responsiveness of T-cells. The percentage of neutrophils engulfing 1 or more fluorescent marker beads was greater among 70SA cows than the 100SA cows. Long-term there was a tendency for cows in the 70SA treatment to have increased LPS-induced B-cell proliferation compared to 100SA cows. Postpartum disease prevalence was similar for cows on both treatments. There were interactions between treatment and cohort and week and cohort on locomotor score. Locomotor score did not change over time for cohort 1 cows or for the 100SA cows in cohort 2, but it worsened over time for the 70SA cows in cohort 2. A moderate reduction in freestall access in dry cow facilities should not adversely affect immune function, but it may negatively impact hoof health (Gressley et al., 2007).

Summary

In addition to appropriate nutritional management during the dry period, the studies described above support the concept that housing management can affect dry cow health and production in the next lactation. Exposure to short days improves milk yield and health, as does heat stress abatement for the entire dry period. There is evidence accumulating that suggests a common linkage through effects on prolactin responsive genes. Whereas increased stocking density causes subtle changes in immune function relative to 1:1 cow to stall ratio, there was little evidence of a subsequent depression of milk yield or performance, as long as feed access was not altered. These lead to the recommendations that dry cows be housed in limited light situations, be well cooled, and have ample feedbunk space even if stall availability is limited.

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Notes

Feeding Management: Do's and Don'ts

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Feed represents the greatest proportion of the total cost of producing milk. Over the past eighteen months feed ingredients prices have increased greatly! This increase is due in part to the increased demand for corn and soybeans to produce ethanol and biodiesel and world demand. At the same time the cost of all inputs required for growing forage (fuel, fertilize, seed, chemicals, etc.) has increased because of higher oil prices. The Southeast continues to suffer from an extended drought that has reduced forage supplies and increased the cost of locally produced forage. All of these factors have significantly increased feed cost which makes it even more important than ever before to have a sound feeding management program to control feed cost and maintain profitability.

There are many factors involved in feeding management that affects milk yield, cow health, and feed cost. The first factor involves the production of high quality forage and storage to maintain quality. Certainly rations must be balance to provide the nutrients required to support milk yield and keep animals healthy which controlling feed cost. Proper mixing of ingredients, timely feed delivery, and feed bunk management are important. Other items such as providing adequate amounts of clean water and cow comfort are an important aspect of management for the cow to take advantage of the nutrient supplied by the ration. This paper will discuss several components of feeding management that can be fine tuned to improve the nutrition of the cow which can support improved milk yield and cow health.

Feed Storage

Feeds lose some of their nutrient value after harvest. These losses are typically greatest for forages because of fermentation and spoilage. The more readily digestibility nutrients are frequently lost, so the digestibility of the remaining material is lower. The goal is to minimize nutrient losses beginning at harvest and throughout storage. Researchers at the University of Maryland recently reported the results of a trial measuring the effect of plastic liners for silo walls (Table 1). The silage closest to the wall contained less DM (was wetter) and more NDF. Typically the silage closest to the wall is not packed as tightly and undergoes fermentation longer because of high initial oxygen concentrations. This is supported by the higher pH and concentrations of butyric acid (indicates poor fermentation) and lower concentrations of lactic acid. This would suggest that a large proportion of the digestible nutrients had been degraded during fermentation. When fed to growing heifers or lactating cows, the higher fiber content would limit DMI and prevent animals from achieving optimum growth or milk

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yield. The amount of silage that is potentially negatively impacted is considerable. For example, the outside two feet of a 40 ft by 155 ft bunker silo with silage pilled 12 ft high represents 10% of the total feed without counting any losses on top. We also know from previous research that DM and nutrient losses are over 30% higher if the silo is not covered.

Table 1. Effect of covering type on nutrient content and fermentation of corn silage.

	8[1]		16		24	
	A[2]	B	A	B	A	B
DM, %	19.77[e]	29.01[abc]	23.52[d]	29.13[ab]	27.80[bc]	30.33[a]
NDF, %	62.29[a]	46.07[cde]	54.86[b]	46.44[cd]	47.87[c]	43.00[e]
pH	5.20[a]	3.97[bc]	4.22[b]	3.76[c]	4.04[bc]	3.74[c]
Lactic acid, %	0.39[e]	1.67[cd]	1.09[d]	2.21[abc]	2.44[ab]	2.76[a]
Butyric acid, %	0.22[b]	0.07[d]	0.39[a]	0.02[d]	0.21[bc]	0.08[d]

[abcde]Means in rows with unlike superscripts differ ($P < 0.05$).

[1]Distance from the silo wall, inches

[2]A = 6 mil black/white polyethylene plastic weighted with split-tires; B = triple co-extruded film (1.77 mm) with low permeability to oxygen, protective tarpaulin, and weighted down with reusable bags filled with pea-gravel. This treatment also included a layer of extruded film along the length of the sidewall prior to filling.

Source: McDonell et al., 2007. J. Dairy Sci. 85 (Suppl. 1):180. (Abstr.)

Almost all silos have a layer of soiled silage on top, even when covered with plastic. The amount of spoilage varies and data are limited on the impact of feeding this material to dairy cattle. Kansas State University researchers conducted a trial in which they fed different amounts of the spoiled silage to beef steers (Table 2). As the proportion of spoiled silage in the diet increased from 0 to 16%, dry matter intake (DMI) decreased. Along with the decrease in DMI, nutrient digestibility decreased significantly. With normally diets, nutrient digestibility increased when DMI is limited or decreased. The lower intake and nutrient digestibility would reduce the total amount of nutrient available to support growth of heifers or milk production in lactating cows.

Preventing spoilage of feeds, especially wet feeds, and keeping them out of the ration is a very important aspect of feeding management. To prevent spoilage, forage should be stored properly. Hay should be stored in a barn or covered to minimize mold formation and spoilage. For silage this begins with packing the entire silo aggressively to remove all air from the silage so it ferments quickly. Based on the research summarized in Table 1, the use of plastic on the sidewalls plus a good cover on the top of the silo is a practice worth incorporating to maintain silage quality even better than just covering with plastic. When opening the silo, do not uncover anymore silage than can be fed in two days. Oxygen can penetrate into the silage up to three feet stimulating any yeast or aerobic bacteria to start nutrient breakdown. Any spoiled silage on top of the silo should be discarded to maintain DMI and nutrient content of the diet. These practices will preserve the nutrients in forage and maintain palatability.

Table 2. Effect of feeding spoiled silage to steers on intake and nutrient digestibility.

	% of spoiled silage in the diet			
	0	5.4	10.7	16.0
DMI, lb/d	17.5[a]	16.2[a]	15.3[bc]	14.7[c]
	--------------------	Digestibility, %	--------------------	
Organic Matter	75.6[a]	70.6[b]	69.0[b]	67.8[b]
Crude Protein	74.6[a]	70.5[b]	68.0[b]	62.8[c]
NDF	63.2[a]	56.0[b]	52.5[b]	52.3[b]
ADF	56.1[a]	46.2[b]	41.3[b]	40.5[b]

[abc]Means in the same row with unlike superscripts differ ($P < 0.05$).

Source: Whitlock, et al., 2000.

Monitoring Dry Matter Content of Feedstuffs

The dry matter content (DM) of wet feeds changes, sometimes daily. These changes affect the composition of the ration unless the amounts included in the mix are adjusted for the change in DM. An example of the changes that can occur in wet feeds is illustrated in Figure 1. This example comes from a research trial we recently conducted in Tifton. Both the corn and ryegrass silage were harvested from one field on a single day and were stored in bags which should reduce the daily variation in DM. There was not much daily variation in the DM content of the corn silage, but the DM content of the ryegrass varied much more. The variation in the ryegrass most likely represents differences in the moisture content of the forage in one area of the field at harvest. The wet brewers' grain was stored on a concrete pad with loads received every five days. It is easy to spot when some of the new loads of wet brewers' grain were received and when drier brewers' grains were sampled from the pile.

Identifying the changes in DM content of all wet ingredients and adjusting the ration to account for these changes should be part of the feeding management protocols. The DM content of feeds can be easily determined using a Koster tester or microwave oven. The key is to actually run the analysis routinely rather than assume that there are no changes. If the results of the analysis seem to be out of line, a second sample should be run to verify that the DM actually changed and rule out a mistake. This is especially true for microwave readings because of greater the potential for error with this method. Once the DM content of the ingredient has been measured, the rations should be changed to reflect the correct DM content of the ingredient. Failure to adjust rations results in rations that are different from those formulated. Depending on the actual change in DM content, the final ration could have higher or lower concentrations of nutrients which may explain the variation in daily milk yield on most dairies.

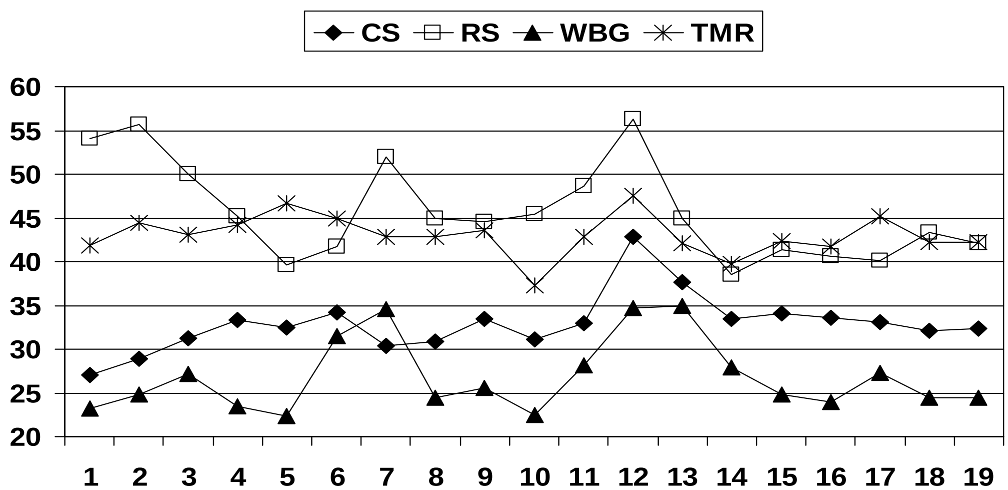

Figure 1. Change in dry matter content of corn silage (CS), ryegrass silage (RS), wet brewers grains (WBG) and the resulting TMR ration used in a 2007 research trial at the UGA Dairy Research Center in Tifton, GA.

Mixing the Correct Ration

A common expression used by nutritionist is that there are four rations on most farms. The one provided by the nutritionist, the one given to the feeder, the one the feeder actually mixes, and the one the cow consumes. All four rations should be the same, but often there are differences that occur in each step so that the ration the cow receives and eats is quite different from that formulated. The following items should be incorporated into the normal feed management protocol.

- Check all rations to ensure that the ration formulated is the same as that used by the feeder for mixing.
- Make sure all feed ingredients are labeled and the feeder knows the differences in the ingredients.

- Add ingredients to the mixer in the order recommended by the manufactor. This information can be found in the owner's manual and differs according to the type of mixing system.
- Use scales to add ingredients to the mixer and strive to put the correct amount in the mix, no more or no less. Do not estimate the amount of an ingredient by volume.
- Check the mixer scales for accuracy routinely when the mixer is empty and full.
- Follow the mixing times recommended by the manufactor to avoid over mixing.
- Check the particle size of the final mix to determine if the mixing times need to be adjusted.
- Consider grind grass hay before mixing to improve uniformity of the TMR, especially if the mixer is not designed to process hay.
- If the mix is dry, consider adding water so that the smaller particles will stick to the larger particles.
- Premix any ingredients used in small amounts to improve the accuracy of mixing and reduce labor requirements. If necessary, purchase a small scale.
- Perform routine maintenance to prevent breakdowns. Replace knives as needed and clean magnets daily.

Feed Bunk Management

Feed bunk management is important for getting the cows to consume the ration that has been formulated and mixed in amounts necessary to support growth and milk yield. The following items should be reviewed to identify any factors that may limit intake.

- Fresh feed should be available immediately after milking. Cows typically eat more after milking and this also keeps them from laying down so that the teat sphincter muscles have time to close.
- The only time a feed bunk should be empty is just after it has been cleaned each day. Target refusals at 4 - 5% of the amount offered for fresh and high producing cows and 2 - 3% for lower producing cows.
- Calculate daily dry matter intake based on the amount of TMR offered, the amount of TMR refused, and the DM content of the ration. Plot the daily values for each group along with milk yield to monitor any changes.
- Evaluate the ration in the feed bunk immediately after feed deliver to make sure it was properly mixed.
- Use 100% of the feed bunk space for feed delivery. Offer more at the ends of the bunk and near waterers.
- Provide a minimum of 18 to 30 inches of feed bunk space per cow. Fresh cows should have more space than lower producing cows. Multiple feed deliveries should be made when the amount of bunk space is limited to less than 24 inches per cow.
- Evaluate the ration approximately 4 to 6 hours after feeding and before the bunk is cleaned to determine if the cows are sorting the ration.

- Push feed at least 4 to 6 times each day, depending on the number of feeding, to keep feed in easy reach of the cows.
- Feed approximately 65% of the ration during the cooler parts of the day during the periods of heat stress and increase the number of feedings.
- If feed in the bunk is heating, add an organic acid or mold inhibitor to prevent secondary fermentation.
- If bunks are pitted, consider refitting with a plastic liner or resurfacing the surface. This will encourage higher intake and reduce spoilage.
- Design feed bunks properly. Dry matter intake is better when the cow eats with her head down as in grazing, curb heights are no higher than 21 inches, and neck rails are 46 to 48 inches above the floor and provide the cow room to reach feed on the outside of the feed bunk.

Water

Dairy cattle require plenty of fresh, clean water with the ration. Water availability and quality is frequently not considered when troubleshooting problems, but it should be one of the areas we routinely monitor. Water constitutes 60 to 70% of an animal=s body and milk is 86% or more water, any reduction in water consumption decreases growth and performance. Water intake ranges from 2 gallon/day for young calves to more than 35 gallon/day for high producing lactating cows. To meet these needs lactating cows should have water available as they leave the milking parlor as well as adequate water space in the free stall barn, dry lot, or pasture.

Water troughs should be checked daily to ensure that they are working properly. All water troughs should be cleaned every week to prevent growth of algae and buildup of solids. When cleaning, be careful not to leave any concentrated chorine or other sanitizers in the water trough as this may kill of the bacteria in the rumen resulting in animals going off feed.

Summary

Good habits related to feeding management will provide positive results and all employees should be encouraged to follow protocols. This not only impacts growth and production, but animal health as well. Given the fact that feed represents the primary cost of raising replacements or producing milk, feeding management is also very important for maintaining profitability.

Notes

Manure to Money??? Carbon and Renewable Energy Credits

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Introduction

When earth life was created, a balance between atmospheric oxygen (O_2) and carbon dioxide (CO_2) was formed. Animals breathe air and extract oxygen for their body cells to properly function, returning carbon dioxide into the atmosphere as waste. Plants uptake carbon dioxide and through the process of photosynthesis produce their cellular energy source, glucose, and resulting waste product – oxygen. This natural system worked beautifully until the industrial revolution started putting more carbon compounds into the air than the ever-lowering plant population had a chance to remove.

Now news reports tell us global warming is melting glaciers and polar ice caps and, if left unchecked, will eventually put most of Florida under water. One contributing cause of global warming is the increasing amounts of industrial greenhouse gas emissions, predominately carbon dioxide and methane (CH_4), but including nitrous oxide, sulfur hexafluoride, hydrofluorocarbons and perfluorocarbons (Davidson, 2008).

Carbon dioxide is emitted by our lungs when exhaling, vehicles when driven or flown, and any fossil fuel (including coal) powered factory or electricity generator when the fuel is converted to energy. Methane, which is belched by cattle and bubbled up from lagoon bottoms, is considered 21% more harmful than carbon dioxide in its warming effect (Davidson, 2008).

To counteract global warming, green power (electricity or fuels supplied from renewable energy sources, such as wind, solar, geothermal, hydropower and various forms of biomass) has become the popular answer. In the world of business, popular answers still must be economically feasible or forced. Recognizing this, the United Nations began talks which were agreed upon in 1997 and entered into force in February 2005, which became known as the Kyoto (Japan) Protocol. It is an amendment to the United Nations Framework Convention on Climate Change with the objective of achieving stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human caused) interference with the climate system (Anonymous, 2008a).

As of November 2007, 175 parties had ratified the Kyoto Protocol. The United States is not among them. The thirty-six developed countries (plus the European Union as a party in its own right) who signed are required to reduce greenhouse gas emissions to the levels specified for each of them in the treaty. (Each developed

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country has its own specified cap.) Between 2008 and 2012, developed countries have to reduce greenhouse gas emissions by a collective average of 5% below their 1990 levels (for the European Union countries, this corresponds to some 15% below their expected greenhouse emissions in 2008). One hundred thirty-seven developing countries have ratified the protocol, including Brazil, China and India, but have no obligation beyond monitoring and reporting emissions (Anonymous, 2008a).

One of the "flexible mechanisms" which allows developed countries under the Protocol to meet their greenhouse gas emission reductions is by purchase (trade) of greenhouse emission reductions from elsewhere (usually developing countries who are encouraged to build "green industries")(Anonymous, 2007). Kyoto established a Bonn, Germany, based Clean Development Mechanism Executive Board to assess and approve projects prior to awarding Certified Emission Reductions (CER). A Certified Emission Reduction is equal to a ton of carbon dioxide removed from the air. Certified Emission Reductions can be purchased from financial exchanges, from certified projects which reduce emissions, or from other developed countries with excess reductions (Anonymous, 2007).

Carbon Credits

Although the United States did not enter into the Kyoto Protocol, it has not stopped entrepreneurs from starting up a voluntary carbon credit system. Like the UN Certified Emission Reductions, any carbon credit or carbon offset is equal to a ton of carbon dioxide removed from the air. Since no "authorized" certification method has been federally approved, it has been difficult verify carbon credits to date. In late February the United States released guidelines advising companies and individuals to only purchase Certified Emission Reductions to avoid buying worthless credits (Harvey, 2008).

I n 2007, the United States carbon credit market more than doubled to between $150 million and $200 million, according to research firm Ecosystem Marketplace. Comparatively, in Europe, under Kyoto Protocol, the Certified Emission Reductions market hit $10 billion last year (Davidson, 2008).

Even now, with voluntary conditions in the United States, individuals and companies are looking for verifiable carbon credits or offsets. Dairy producers with methane-producing, covered lagoons or the ability to convert their manure into methane or other biofuels in an anaerobic digester, can then either utilize the methane to generate electricity, heat water, or just burn it off to convert the methane into more environmentally friendly carbon dioxide. All of these things reduce the amount of greenhouse gas emissions that would otherwise be going into the atmosphere and are "certifiable emission reductions."

An example dairy from Florida, of 3500 cows, which hypothetically converted its manure to methane to electricity, had modeled annual carbon credit revenue of between $56,000 in 2009, to $70,000 in 2011, to $84,000 in 2014, to $98,000 in 2017, by

Terrapass, a private company which sells carbon credits on-line to individuals who wish to balance their carbon impact. Interesting, they would not calculate carbon credits for a herd of 700 because of the high cost of getting the credits validated by a third party (Freed, 2008).

There is anticipation that Congress will approve a federal cap on greenhouse gas emissions, which could potentially expand the carbon credit market incredibly. Hedge funds and investment banks are starting to trade carbon credits like stocks and bonds already, betting their value could soar if greenhouse gas caps are imposed (Davidson, 2008).

Renewable Energy Credits (RECs) (also Known as Green Tags, Renewable Energy Certificates, or Tradable Renewable Certificates)

A Renewable Energy Credit is a tradable environmental commodity that represents proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource. These credits can be sold and traded (in 2006 from $5 to $90 per MWh, median about $20) (Anonymous, 2007), but not "double-dipped" as a carbon credit too ((Anonymous, 2008b).

While Carbon Credits promote low carbon technologies, Renewable Energy Credits can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources : solar, wind, geothermal, low impact hydropower (small-run-of-the-river facilities, not dams), biomass, biodiesel, and fuel cells powered only by hydrogen produced by one of the previous methods) (Anonymous, 2008b).

In states which have a Renewable Energy Credits program (Florida does not), a green energy provider (a wind farm or dairy with methane-propelled electrical generator, for instance) is credited with one REC for every 1,000 kWh or 1 MWh of electricity it produces. A certifying agency gives each REC a unique identification number to ensure it does not become double-counted. The green energy is then fed into the electrical grid (by mandate) and the accompanying REC can then be sold on the open market (Anonymous, 2008b).

Florida and Georgia dairy producers, who convert methane into electricity, may have the option of using that electricity on the farm or selling it to the electrical grid as "green energy." Florida, Georgia and federal future legislation may give dairy green-electricity producers more options. It is not outside the realm of possibility that both non-profit and for-profit organizations will help fund new renewable energy credit projects.

Bottom Line

Dairy producers should seriously consider their options, potentially band together to form an aggregate group to sell collective carbon credits, and pay attention to legislation (particularly state Renewable Portfolio Standards, national carbon capping and the next round of Kyoto talks which will determine what happens after 2012, when the current round comes to an end). Stay informed for your financial future well-being. Sale of Carbon Credits or Renewable Energy Credits could potentially add significantly to a dairy's bottom line.

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Notes

Agent Update

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