CHARACTERIZATION OF PASTURE-BASED DAIRY FARMS IN FLORIDA AND GEORGIA

By

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To my parents

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LIST OF ABBREVIATIONS

AI	Artificial insemination
DMI	Dry matter intake
EAI	Estrus-based artificial insemination
NS	Natural service
SCC	Somatic cell count
SD	Standard deviation
TAI	Timed artificial insemination

Abstract of Thesis Presented to the Graduate School
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The management practices and results of pasture-based dairy farms in the Southeast appear to vary widely, and have not been described fully. The objective of this study was to characterize pasture-based dairy farms in Florida and Georgia.

An 18-page survey was designed and consisted of 62 questions covering 7 areas. Data were collected by personal interviews from September 2012 to March 2013. Respondents were asked to answer the questions in reference to summer 2011 through spring 2012. Twenty-three farms participated with 18 in Florida and 5 in Georgia. The dominant breed was pure bred Holstein on 17 farms, representing 71% of all cows. Milk production in the winter was 26.5 ± 6.6 kg/cow/day and in the summer 19.0 ± 6.8 kg/cow/day. Somatic cell counts were 249,826 ± 68,894 and 368,130 ± 79,085 cells/ml in the winter and summer, respectively.

Three farms employed 100% seasonal breeding. The greatest number of calvings were reported for October (11 farms) while 16 farms reported their fewest calvings during the summer. Non-breeding periods were reported by 17 farms. Summer breeding was avoided due to increased risk of calving problems (10 farms).

A total of 26 different grasses and forages were used. During the summer, all 23 farms grew warm-season perennial grasses. During the winter, 18 farms grew cool-season annual grasses. Oat and annual ryegrass were the most popular winter annual forages. The most popular summer perennial grasses were bermudagrass and bahiagrass.

For lactating cows the average total DMI was 17.7 ± 4.9 and 20.0 ± 4.0 kg/cow/day in the summer and winter, respectively.

In conclusion, management practices and production results varied greatly among farms but were similar to results for grazing dairy farms. Future studies may focus on describing the financial performance of pasture-based dairy farms and the association with management practices.

CHAPTER 1
INTRODUCTION

Grazing or pasture-based dairy farms are used successfully in many countries such as New Zealand, Australia, and western Europe. In the United States, grazing systems are gaining popularity in the east, midwest, and northwest regions of the U.S. where cool and moist climates are favorable to this type of dairy production. These regions allow for abundant grass growth during at least part of the year and heat stress is limited.

Traditionally, most dairy farms in the southeastern United States confine cows to barns or pasture lots year-round and feed stored forages and concentrated feeds (Fontaneli et al., 2005). Although cattle might be housed outside, often much of the feed is purchased. However, the cost of purchased feed and fuel has risen rapidly in the last 5 years (USDA-NASS, 2011). In addition, a significant amount of capital is tied up in buildings, machinery, and manure management systems on the farms. Moreover, a boost in demand for “green”, “natural”, and organic milk has led to an increased interest in grazing systems (Gillespie et al., 2009).

For these reasons, many dairy farmers have shown an interest in or started transitioning to pasture-based dairy systems (Ricks and Hardee, 2012). The management practices and production results of pasture-based dairy farms in the Southeast appear to vary widely, however (Macoon et al., 2011) and have not been described. Characterization of pasture-based dairy farms in the Southeast may be useful to aid farm advisors and to illicit profitable and sustainable practices.

The objective of this study was to characterize pasture-based dairy farms in Florida and Georgia with regards to production indices such as milk production, reproduction, facilities, nutrition, and pasture management.

The layout of this thesis is as follows. Chapter 2 is a review of the literature regarding the characterization of pasture-based dairy farms in Florida and Georgia. Chapter 3 describes the materials and methods of a survey that was conducted among pasture-based dairy farms in Florida and Georgia. In Chapter 4, the results of the survey regarding milk production, reproduction, and facilities are described. Chapter 5 continues the description of the results with a focus on pasture management and nutrition. Chapters 6 and 7 present the discussion and conclusions, respectively.

The study is part of the Southeast Sustainable Dairy Farms Project, which is funded by Sustainable Agriculture Research and Education (SARE) as LS11-243 Improving the Welfare of Southeastern Dairy Families Through the Adoption of Sustainable Production Systems (principal investigator R. C. Lacy, University of Georgia).

CHAPTER 2
LITERATURE REVIEW

Currently, there are approximately 119,000 dairy cows and 70,000 dairy cows, respectively in Florida and Georgia (USDA-NASS, 2012). These cows are kept on 130 dairy farms in Florida and twice that many in Georgia. The National Animal Health Monitoring System (USDA-NAHMS, 2007) reports grazing as the primary method of operation in over 3% of U.S. dairy operations. It is not clear how many of the dairy farms in Florida and Georgia house and feed cows on pasture and to what extent. Production practices regarding milk production, reproduction, nutrition, facilities and pasture management appear to vary widely. The objective of this review is to describe important characteristics of pasture-based dairy farms as found in the literature and describe voids in the description of the characteristics of pasture based dairy farms in Florida and Georgia.

2.1 Definition of Pasture-based Dairy Farms

A pasture is a forage crop delimited by fencing (Y. C. Newman, personal communication). Alternatively, pasture is defined as an area covered with grass or other plants used or suitable to grazing by livestock (Dictionary.com). It is difficult to find a clear consensus on a specific definition of pasture-based dairying in the literature, however. Taylor and Foltz (2006) defined pasture-based dairy farms as either farms using a “rotational grazing system” (also known as “management intensive grazing”) or “mixed feed” operations. Rotational grazing operations use pasture as the primary forage source during the grazing period whereas mixed feed operations obtain part of their dietary forage from pasture but rely primarily on stored forages.

In selecting a sample of Pennsylvania dairy farms for a survey of grazers, Hanson et al. (1998) required that the animals obtain 40% of their forage needs during the summer months from pasture.

Dartt et al. (1999) defined rotational grazing system as one where 1) at least 25% of the annual forage requirement comes from the pasture and 2) the animals graze for at least 4 months every year. Smith and Ely (1997) defined pasture housing as one in which cows are housed outside and obtain a portion of their feed by grazing.

Collectively, one can conclude that grazing refers to cows actively harvesting and feeding on grasses and herbage. In addition, dairy cattle can be housed on pasture but most of their forage intake can be from stored feed. Thus in this thesis, pasture-based refers to farms that at least partially, or temporarily, house (some of) their dairy cattle on pastures.

The opposite of pasture-based dairy farms is confinement-based dairy farming, which is characterized by feeding stored feeds to dairy cattle and housing cattle inside in barns or dry lots.

2.2 Motivation for Pasture-Based Dairy Farming

Keeping lactating dairy cows on pasture is not a new method. Prior to the 1940s and before rural electrification, the vast majority of dairy farms in the United States used grazing management systems (Gay, 2012). Grazing has been advocated, abandoned, and now is being advanced again as an alternative feeding system, particularly in the northeastern United States (Hanson et al., 1998). During the 1980s, the rising expenses of machinery and housing, and reduced profitability (Parker et al., 1992) began to make pasture systems appear to be more attractive.

Purchased feed costs have increased significantly in the last 7 years. USDA-ERS (2013) reported feed cost for dairy farms in Florida of $19.78/100 kg of milk in 2006 and $30.13/100 kg of milk in 2012. Because of this increase in feed cost, more farms consider growing more of their own feed, including grass for cows to graze. In addition, as the consumer desires more “healthy” food, the demand for “green”, “natural” and organic milk has increased. Many farmers have shown an interest in, or started to return to, pasture-based dairy farming as a means to gain economic efficiencies (Gillespie et al., 2009). More farmers in many temperate and subtropical regions of the world have shown an interest in, or started to return to, pasture-based dairy management systems as an alternative to confined systems (Macdonald et al., 2008) because of 1) reductions in milk price, 2) increments in production costs (Dillon et al., 2005) and 3) perceived environmental and animal welfare concerns associated with intensive (confined) dairying (Dillon 2006). Fontaneli et al. (2005) listed several reasons for an increasing interest in grazing 20 years ago in Florida including 1) lower cost of feed, equipment and labor, potentially resulting in greater profitability per cow, 2) easier management of manure nutrients and fertilizer and less potential environment hazards, 3) reported improvements in animal health and reproduction (less culling), and 4) improved quality-of-life for owners and managers (less stress, more leisure time, etc.)

Pasture-based dairy systems often are promoted as a socially and environmentally sustainable production model for North American dairy farms (USDA-NRCS, 2007). Moreover, this system has the potential to improve profitability of dairy operations of all sizes by maximizing the utilization of fresh pasture and focusing on reducing production costs (Paine, 2013).

Grazing or pasture-based systems have been utilized very successfully in many countries such as New Zealand, Australia, Ireland, the Netherlands, and the United Kingdom. In the United States, grazing systems have become more common again in the eastern, midwestern, and northwestern Pacific Coast regions of the country where climates are favorable to this type of production system due to abundant grass growth at least part of the season, and moderate climates, although the favorable grazing seasons are not the same in the North as in the South (Gay, 2012). In the 2000 and 2005 dairy versions of the Agricultural Resource Management Survey, farmers were asked, “Did this operation use pasture or cropland to graze dairy cattle during the prior year?” In 2000 and 2005, 68.5 and 64.5% of farmers, respectively, indicated such use (Gillespie et al., 2009). In fact, grazing made up about 3% of all U.S. dairy operations. Combination grazing and confinement operations represented an additional 31.1% of U.S. dairies (USDA-APHIS, 2007 and NAHMS, 2007)

Grazing is not a feasible practice year-round in many places due to the harsh winters, summers, or the limitations to the grass-growing season. Therefore, many farmers use a combination system and apply grazing while the grass is available and feeding total mixed rations or silage and balage during the non-grazing season.

The climate of the southeastern United States is typical of a humid, subtropical climate. Especially in areas along the Gulf of Mexico and southern Atlantic coast, the summers are hot, of long duration and are normally the period of greatest rainfall. Summer heat stress has been recognized as reducing both the productivity and reproductive efficiency of dairy cattle in the southeastern and southwestern portions of the United States (Jordan, 2003). In the other hand, the shorter cool season also allows for extended time of growth of forages and grasses. In short, the seasonal effects of heat stress have a large impact on pasture-based dairying in Florida and Georgia.

2.3 Milk Production and Dry Matter Intake

According to the Florida livestock dairy and poultry summary (USDA-NASS, 2011), the national average milk production in 2011 was 9,702 kg/cow/year with 3.71% milk fat. In Florida, the average milk production was 8,667 kg/cow with 3.67% milk fat; in Georgia, the average milk production was 8,343 kg/cow/year with 3.71% milk fat (USDA-NASS, 2012). These averages contain both pasture-based and conventional dairy farms.

In Florida and Georgia, milk production shows a significant seasonal pattern. From May to September, milk production declines as air temperatures rise (Figure 2-1) (Tao and Dahl, 2013).These results are in agreement with the data from USDA-NASS (2011). USDA-NASS (2011) reported that the least productive month in Florida was September (Table 2-1). In 2011 the lowest production was 591 kg/cow in September, and the highest production was 846 kg/cow in March. These results agree with Figure 2-2 which shows 12 months of milk production of all milk cows in the Dairy Records Management Systems (DRMS, 2013) dataset. Milk yield per cow decreased from May to September. The lowest milk production per cow was in September, only 24.7 kg/day. There was large difference between milk production in the cooler winter compared to the hot and humid summer.

Hahn and Osburn (1969) calculated that cows producing 32 kg of milk per day and living below a line drawn approximately through mid-Missouri, diagonally through Tennessee, and northern Georgia would lose approximately 180 kg of production from

June 1 to September 30, increasing gradually to 270 kg moving south to Florida and southern Alabama.

Extended periods of high ambient temperature and relative humidity decrease the appetite of cows and then reduce the foraging and dry matter intake (DMI), (Hansen and Aréchiga, 1999). Various studies have shown that there is a significant negative correlation between temperature-humidity index (THI), a measure of heat stress, and DMI for cows in the southeastern United States (Holter et al., 1996; Holter et al., 1997). Heat stress occurs when THI is greater than approximately 72 (West, 2003). West (2003) reported that milk yield for Holsteins declined 0.88 kg per THI unit increase, and DMI declined 0.85 kg for each degree (℃) increase in the mean air temperature. Ingraham et al. (1979) estimated that milk declined by 0.2 kg per unit increase in THI when THI exceeded 72. Secondly, different breeds show different effects of heat stress on milk yield (Bianca, 1965). In short, heat stress has been observed to cause reductions in milk production up to 25% (Thatcher et al., 1974; Roman-Ponce et al., 1977).

Milk production in pasture-based dairy farms is on average lower than in conventional dairy farms. The overall rolling herd average among all breeds on grazing dairy farms in Wisconsin was 7,005 kg/cow/year (Paine, 2013). A survey of 90 grazing dairy farms located primarily in the eastern U.S. indicated that the mean milk yield was 21.3 ± 5.1 kg/cow/day (Gay, 2012). Both are significantly below the national average.

Cows in free-stall housing produced 19% more milk (29.8 vs. 25.1 kg/day) over the duration of a 259-day study than cows managed on pasture (Fontaneli et al, 2005) in Florida. During a 4-week experimental period in Pennsylvania, Kolver and Muller

(1998) reported that cows consuming an all-pasture diet produced 33% less milk than cows feed a total mixed rations (29.6 vs. 44.1 kg/day), and had a milk protein concentration that was 0.19 percentage units lower. Fike et al. (1997) reported a large decrease (10 to 15 kg/day) in milk yield for cows moved from a confined housing system to Bermuda grass or rhizome peanut (*Arachis glabrata Benth.*) pasture in Florida in midsummer. White et al. (2001) reported that Holsteins produced more milk in confinement management (36.7 vs. 27.5 kg), but Jerseys produced more milk on pasture (24.8 vs. 23.6 kg) in North Carolina between confinement and pasture-based dairy cows. Because pasture-based dairy farms are less able to cool cows while they graze, the seasonality of milk production is expected to be greater than on conventional farms. However, other than the experimental data shown, no data or studies were found that describe the milk production and the seasonality of milk production on pasture-based dairy farms in the Southeast especially in Florida and Georgia.

2.4 Milk Quality

Milk Somatic cell count (SCC) is a long-established measure of milk quality (Eberhart et at., 1982). Norman et al. (2001) reported that SCC in Dairy Herd Improvement herds during 1996 and 1997 was lower during October through January than during July and August. There was a negative relationship between milk yield and SCC throughout the year (Figure 2-3). The average SCC in the United States in 2012 was 200,000 cells/ml whereas in Florida and Georgia the mean SCC was 267,000 cells/ml and 280,000 cells/ml, respectively (Norman et al., 2013).

In Gay's (2012) survey results of grazing dairy farms in the U.S., the SCC was on average 237,320 ± 141,050 cells/ml in the summer, and 233,420 ± 108,190 cells/ml in the winter. The mean SCC was 236,850 ± 125,030 cells/ml.

In the White et al. (2001) study in North Carolina, the SCC was always higher on pasture than in confinement both for Holsteins and Jerseys (Holsteins 453,100 vs. 71,000 cells/ml; Jerseys 276,000 vs. 132,800 cells/ml). In Florida, the mean SCC was greater in cows kept on pasture 24 hours per day compared to those moved on 2 different pastures only at night (654,000 vs. 223,000 and 364,000) (Fontaneli et al., 2005). Fike et al (2002) reported that the SCC is higher in continuous pasture-based systems than in pasture-based systems where cows are housed at night.

It is not clear what the current milk quality is on pasture-based farms in Florida and Georgia.

2.5 Reproduction

Several studies have shown that reproductive performance in dairy herds has declined since the 1950s in the United States. Washburn et al. (2002b) found an increase in days to first service from 84 to 100 between 1985 and 1999 in Holstein herds in 10 Southeastern states that were on continuous DHIA test during that period. De Vries and Risco (2005) also found that days to first service increased from a low of 84 days in 1983 to 104 days in 2001 in Florida and Georgia. In Kentucky, conception rates in herds enrolled in DHIA decreased from 62% in 1972 to 34% in 1996 (Silvia, 1998).

Annual pregnancy rates for 71 to 364 d since last calving decreased from 21.6% in 1977 to 1979, to 12% in 2000 to 2002 in Florida and Georgia (De Vries and Risco, 2005). Pregnancy rates were lower during summer (9.0%) than that during winter (17.9%) (De Vries and Risco, 2005). Al-Katanani et al. (1999) also reported significant seasonality in reproductive performance in the southeastern United States. Oseni et al. (2003) showed that days open increased during summer in most U.S. states, include

Florida and Georgia. In heat stressed cows, the duration and intensity of estrus is reduced (Gwazdauskas et al., 1981; Younas et al., 1993). In summer, the conception rates can decrease by 15% to 20% compared to the winter (Hansen, 2008). Cartmill et al. (2001) reported that whenever the THI was ≥ 72, fewer cows were detected in estrus and conception rate was lower. Similarly, Ingraham et al (1976) reported that conception rate declined from 66% to 35% when THI increased from 68 to 72 before breeding. All these studies showed that heat stress during the summer affects conception rate and causes poor fertility. However, reproductive performance in pasture-based dairy farms in Florida and Georgia is unclear.

Artificial insemination (AI) and natural service bulls (NS) are both widely used in the U.S. (NAHMS, 2007). To overcome problems associated with estrus detection, many dairy farms use bulls, either immediately after the voluntary waiting period, or after an unsuccessful AI period. According to De Vries et al. (2005), in Florida and Georgia, 47.3% of the 488 herds reported the consistent use of one type of breeding system between 1994 and 2002: 11.1% reported AI, 20.1% reported NS, and 16.2% reported a combination of both (mixed). The remaining 52.7% of herds reported changes in breeding systems between 1994 and 2002. The reproductive performances were different among the three types of breeding systems in summer and winter. During the summer, pregnancy rate for AI herds was slightly less than that for mixed and NS herds. During the winter, pregnancy rates for AI herds did not differ from that for mixed and NS herds. Bela et al. (1995) reported that cows on pastures have fewer services per conception and shorter calving intervals. Breeding systems used on pasture-based dairy farms in Florida and Georgia are not characterized, however.

Summer heat stress likely leads to seasonal calving pattern in the Southeast. It is not clear to which extend dairy farmers in Florida and Georgia attempt to inseminate cattle year round, or are aiming to have a seasonal calving pattern deliberately, for example by not inseminating cattle during part of the year.

2.6 Cattle Breeds on Pasture-Based Dairy Farms

Holsteins are the predominant dairy breed in the U.S. (NAHMS, 2007). Approximately 95% percent of operations with dairy cows had at least one Holstein cow, and Holsteins represented around 90% of all cows. Although 18% of operations reported having Jerseys on-hand, only 5.3% of all cows were Jerseys. Other breeds, which also included cross-breed cattle, were present on 21% of operations (NAHMS, 2007).

In Gay's (2012) survey of pasture-based dairy farms, he reported that Holstein was the dominant breed in respondents' herds with 70% of all herds reporting at least some Holstein genetics. The second most dominant breed was Jersey, which was present on 69% of the surveyed farms (Gay, 2012). The Cornell Dairy Farm Business Summary (DFBS, 2008) for intensive grazing farms indicated that Holstein was the most common breed with 11 out of 26 farms in New York having ≥ 95% Holsteins. The second most common was crossbreeds (DFBS, 2008). In a dairy grazing practices survey in Wisconsin, 62% were Holstein-based herds with Jerseys-based herds comprising 12% of all grazing herds. Cross-breeds were 17% of all herds (Paine, 2013).

Regarding the reasons for predominance of Holsteins, Washburn et al. (2002b) reported that the Holstein had a much better milk yield compared with Jersey. In the White et al. (2001) study of confinement and pasture-based dairy cows in North

Carolina, Holsteins had a much greater milk yield both in confinement and pasture systems than Jerseys.

Another factor is the tolerance to heat stress. At a temperature of 29˚C and 40% relative humidity, the milk yield of Holstein, Jersey and Brown Swiss cows was 97, 93, and 98% of normal; but when the relative humidity was increased to 90%, the milk yields were 69, 75, and 83% of normal (Bianca, 1965). Thus, Holsteins appeared to be the least heat tolerant although they also produced the most milk.

Another factor is differences in reproductive performance. Washburn et al (2002a) reported that Jerseys had higher conception rates and higher percentages of cows pregnant in 75 days than Holstein. Vibart et al. (2012) reported that Holstein x Jersey crossbreeds has the greatest first service conception rate and percent pregnant by 90 days after calving among Holstein and Jerseys. The ideal cow will not be the same for all pasture-based dairy farms (Probert, 2013). The most important trait considered by pasture-based dairy farmers is reproductive efficiency. Other traits considered by many pasture-based producers were body size, udder health, productive life, feet and legs (Probert, 2013). Gay (2012) reported that the most desired traits for grazing dairy farmers, from highest to low, were productive life, udder composite, feet and leg composite, and fat percentage. Also, he found that the actual selection habits, from highest to low, were udder composite, productive life, feet and leg composite, and calving ability. He reported that the actual importance of SCC drastically dropped when compared to the desired importance in a grazing environment because grazing dairy farmers already have a low SCC.

Approximately 34% of all cows are culled each year (De Vries et al., 2009). They reported that in the eastern U.S. 12% of all culls were for “low production” and 18% were for “reproduction problems”. In another study (Pinedo et al., 2010) culling reasons were died (20.6%), reproduction (17.7%), injury or other (14.3%), mastitis (12.1%) and low production (12.1%). In Gay (2012)’s survey, the top 5 culling reasons among grazing and non-grazing dairy farm were fertility, high SCC, low production, feet and legs problems, and old age.

2.7 Forage and Feed

The subtropical climate is a double edged sword for forages in Florida and Georgia. It provides a longer growth period for grasses. On the other hand, it affects the quality of forages.

In intensive pasture-based dairy management systems, cows are out on pasture almost year round and are given little grain concentrate supplement. The U.S. grazing season ranges from 4 to 5 months in Wisconsin to year-round in the Southeast (Gillespie et al. 2009). In Florida and Georgia, forage growth is the highest in the summer and the lowest in spring and fall (Staples et al., 1994). Often cool season annual grasses (ryegrasses or small grains) are grown in the winter. Even after using different forages throughout the year, pasture-based dairy farms in Florida and Georgia cannot keep up with the forage requirements for cows. There is still a 45 to 90 day gap in the late fall or early winter season when perennial grass yields are low and the ryegrass or small grain production has not started yet (Staples et al., 1994). Stored or purchased forage or feed is necessary at that time.

For the Southeast, Fike (1999) reported that Bermuda grass is one of the most extensively grown improved, perennial, warm-season forages. Bermuda grasses occupy more than half of the pasture acreage in the southern U.S. (Adams, 1992). There are many other grasses and legumes which can be grown on pastures in the Southeast also, such as warm season perennial Bahia grass (*Paspalum notatum*), warm season annual pearl millet (*Pennisetum glaucum*), and cool season annual oat (*Avena sativa*). In a survey of Florida dairy farmers, Staples et al. (1997) reported that 8 out of 48 dairy farmers stated that they were interested in trying new forages in the near future, such as Tifton 78 bermudagrass was mentioned the most often in their survey. Staples et al. (1997) also indicated that the most common forages were small grains, Callie Bermuda, and Pearl Millet at that moment. Fontaneli et al. (2001) reported that rye (*Secale cereal L*.), annual ryegrass (*Lolium multiflorum Lam.*), and clovers (*Trifolium sp.*) are valuable forages for winter pasture programs in northern Florida. However, the forage species currently used by dairy farms in Florida and Georgia are not characterized.

The perennial, warm-season forages adapted to the Southeast are typically of lower nutritive value than either cool-season perennials or warm-season annuals (Hoveland, 1996). Minson and McLeod (1970) reported that tropical grasses were an average 13% less digestible than temperate grasses. But the main factor, which determines the level of animal production from pasture is the amount of digestible nutrients consumed per day. Thus, the high amounts of indigestible fiber on tropical grasses leads to a low daily intake of feed and lower animal production (Stobbs, 1975).

In addition, the availability and accessibility of leaf is one of the major factors influencing the quality and quantity of feed consumed by grazing cattle (Stobbs, 1975). Young forage usually contains sufficient protein and minerals to meet the requirements of the animals. Production is limited by the digestible nutrients, which is affected by the fiber content of the feed. As the pasture matures, the fiber content will increase, resulting in a decrease in digestibility and intake (Stobbs, 1975). Also, the protein and mineral content in mature pasture will decrease. When cows graze on poor quality tropical pastures, they have to draw heavily from the body reserves and lose weight, which affects milk production. Every grazing dairy farmer recognizes the effect of pasture maturity on milk production. Thus, as far as practical, dairy farmers attempted to feed young forage (Stobbs, 1972). This principle also influences the grazing sequence: fresh cows and milking cows go before dry cows on the same pasture.

Because so many factors influence the grass and nutrient quality, proper DMI can be a problem for grazing cows or pasture-based dairy farm. Cows need approximately 6 to 9 hours a day to graze. The number of hours grazed and biting rate is affected by the condition of the pasture (Staples et al., 1994). The relationship was measured using cows grazing ryegrass pastures during the growing season in Scotland (Phillips and Leaver, 1987). Their study results indicated that in the spring, when forage was lush, cows averaged 60 bites per minute. The grazing time was 8 hours per day and the total intake was about 14.4 kg (31.7 lbs) dry matter per day. In the fall, when pasture growth was lower, cows took more bites per minute with on average 66 bites. The grazing time was about 9 hours a day and the total intake was about 19.6 kg (43.2 lbs) dry matter per day. That means either extra grain supplements or concentrates must be added to reach the required amount of dry matter intake.

Stocking rate also influences forage intake. Forage intake decreased with increasing herd size in one unit area in Wisconsin (Paine, 2013). Forage intake decreased when supplements were fed with forages which have greater nutritive value (Holmes and Jones, 1964; Golding et al., 1976; Arriaga-Jordan and Homes, 1986). But the quality of pasture and supplement, the amounts of pasture and supplement fed may affect the response of intake to supplement. Waldo (1986) expressed that total dietary DMI is affected very little by forage quality when diets contained a very large (≥ 80% of dry matter) level of concentrate.

Feeding of supplements is a common practice, but not all farms apply this efficiently. Supplementation induced a significant increase in milk yield, fat, and protein content and reduced the butter fat level (Delaby and Peyraud, 1997). Many studies have clarified that typical responses were approximately 0.3 to 0.4 kg of milk per kg of supplement fed to cows grazing an adequate, temperate pasture (Leaver et al., 1968; Journet and Demarquilly, 1979; Meijs and Hoekstra, 1984). When cows grazed tropical pasture, a similar response (0.34 kg of milk per kg of supplement) was reported (Combellas et at., 1979). Davison et al. (1991) stated similar results but indicated that cows were not adapted to high amounts of supplement (8 kg of dry matter/day) and abundant herbage resulted in greater than normal substitution effects.

These responses varied between different lactating periods. With complete lactation studies, Jennings and Holmes (1984) found the range of response to supplement was 0.1 to 1.80 kg of milk/kg of supplement, with an average response of 0.82 kg of milk/kg of supplement. Several long-term studies (≥ 250 days) have shown a linear milk yield increase in response to an increasing supplement rate (Cowan et al., 1976; Davison et al., 1991). But some others reported a curvilinear response (Coulon and Remond, 1991; Delaby and Peyraud, 1997).

Current studies that characterized feeding management on pasture-based dairy farms in Florida and Georgia were not found.

2.8 Cost of Production and Profitability of Pasture-Based Dairy Farms

Little information is available about the cost of production and profitability of pasture-based dairy farms. Table 2-2 compares the financial performance of non-rotational grazing systems, and rotational grazing systems from the 2007 Ag Census (USDA-Ag census, 2007). Cost of milk production on the rotational grazing system farms was lower at $ 2,730 per cow per year than on the non- rotational grazing system farms, which was $ 3,116 per cow per year. Feed cost, labor cost and equipment cost were all lower on rotational grazing system farms than non- rotational grazing system farms. However, revenues and profitability were not given.

However, the pasture-based dairy farm may not be preferred in some cases. Elbehri and Ford (1995) simulated production systems for a 60-cow Pennsylvania dairy farm and found that intensive grazing pasture-based systems were more profitable than conventional systems if milk production was equal. The study also showed that if milk yields for the pasture-based system decreased by only 4% to 6%, the intensive grazing system would no longer be preferred.

Tucker et al. (2001) evaluated dairy cow performance and profitability on a total mixed rations diet versus rotational grazing of annual ryegrass during March to May in Mississippi. Daily milk production declined on the ryegrass diet, but milk income over feed costs was higher.

White et al. (2002) conducted a four-year experiment with conventional and pasture-based systems in North Carolina. The authors concluded that a pasture-based system had the potential to be economically competitive since significant differences in return over feed costs between the systems were not found.

The literature review suggests that pasture-based dairy farming can be profitable and be competitive with conventional dairy farms. The financial performance of pasture-based dairy farms in Florida and Georgia is not documented, however.

Table 2-1. Monthly milk production per cow in Florida (USDA-NASS, 2011)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Monthly production per cow	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
2002	640	606	688	661	658	611	568	540	474	479	499	574	6998
2003	617	586	651	642	629	586	552	508	463	502	536	615	6887
2004	651	642	704	688	692	633	608	556	465	529	568	658	7396
2005	690	670	745	713	720	654	597	561	502	515	554	617	7536
2006	674	647	745	699	690	642	613	536	504	538	565	631	7484
2007	667	642	735	722	720	667	636	558	531	527	563	640	7609
2008	704	695	751	712	738	654	624	563	527	556	599	690	7812
2009	754	699	799	776	772	697	658	602	536	558	617	701	8170
2010	733	724	826	804	772	726	695	606	570	606	665	754	8481
2011	806	767	847	790	783	740	690	636	590	613	663	740	8665
2012	808	781	847	817	804	735	690	640	568	595	663	717	8665

Table 2-2. Production costs for rotational grazing system and non- rotational grazing system dairy farms reported in the 2007 Census of Agriculture (Paine, 2013)

Cost category	MiG[1] dairy farms	Non-MiG[2] dairy farms	Percent MiG: Non
Hired labor	$439	$635	0.69
Feed cost	$626	$732	0.86
Equipment rent	$114	$129	0.88
Custom work	$128	$144	0.89
Chemical cost	$89	$99	0.90
Land & facilities rent	$178	$194	0.91
Depreciation	$415	$444	0.93
Fuel cost	$158	$163	0.97
Repairs cost	$301	$304	0.99
Fertilizer cost	$180	$172	1.04
Utilities cost	$104	$98	1.06
Total	$2730	$3116	0.88

[1]MiG = rotational grazing systems as known as management intensive grazing
[2]Non-MiG = non- rotational grazing systems

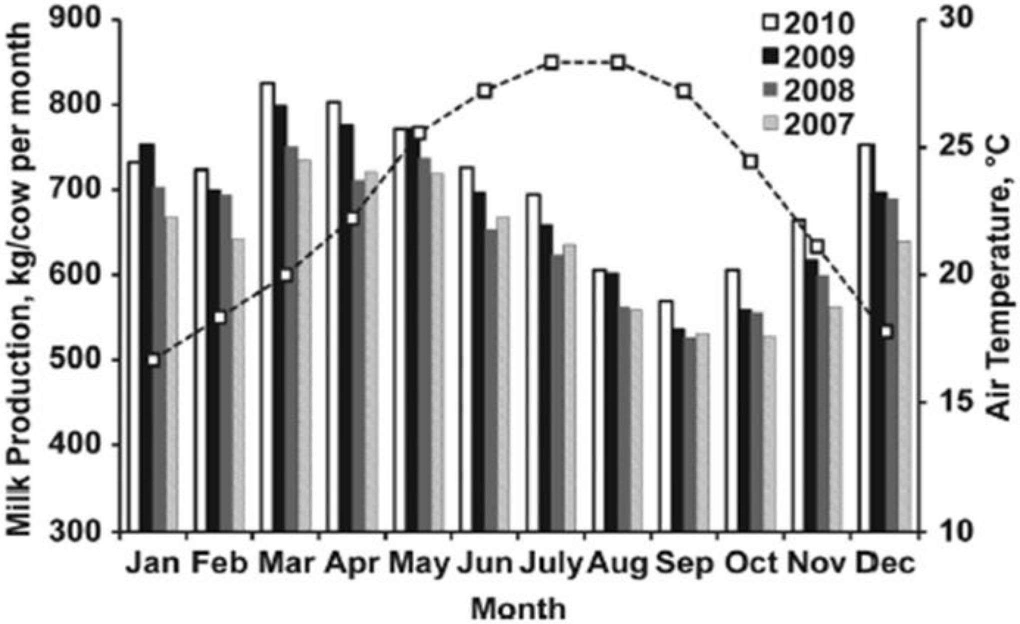

Figure 2-1. Monthly milk production in Florida (figure from Tao and Dahl, 2013)

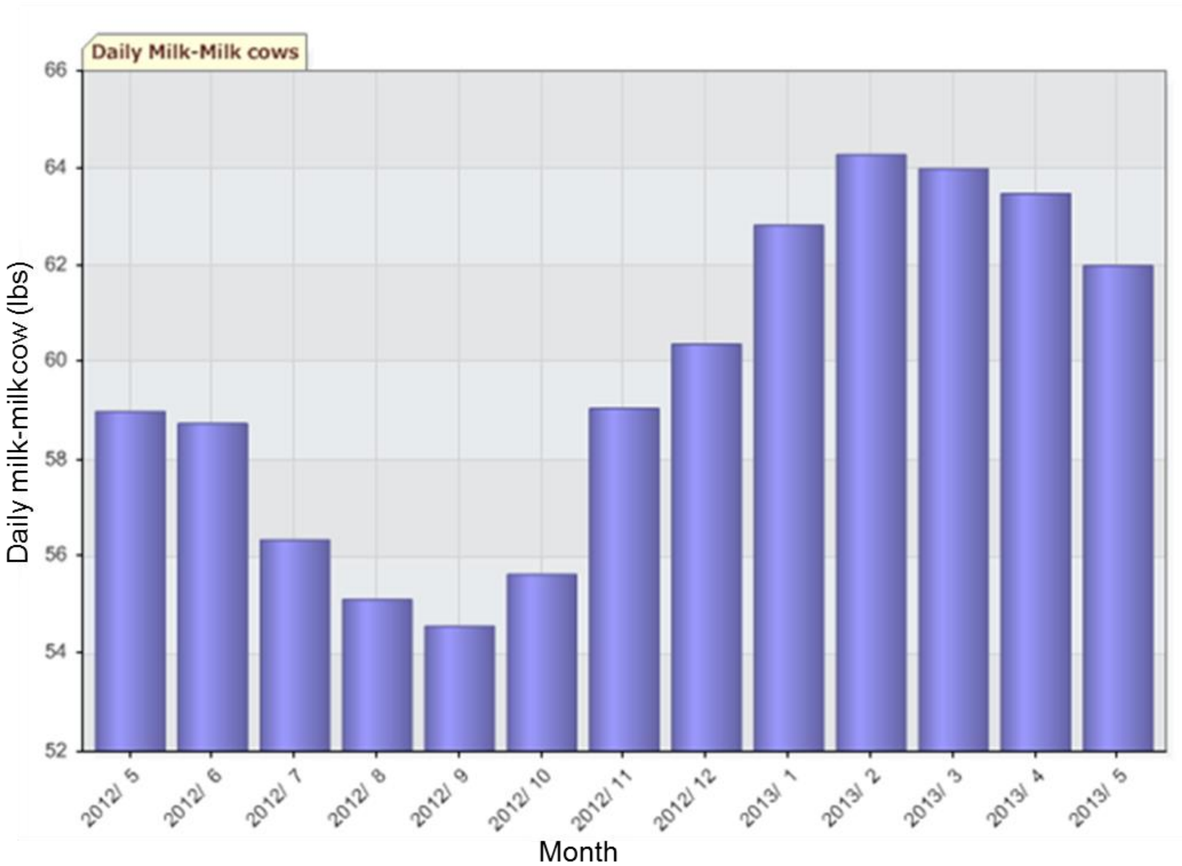

Figure 2-2. Daily milk production (lbs) in Dairy Herd Improvement herds per lactating cow in Florida and Georgia (figure from DRMS, 2013)

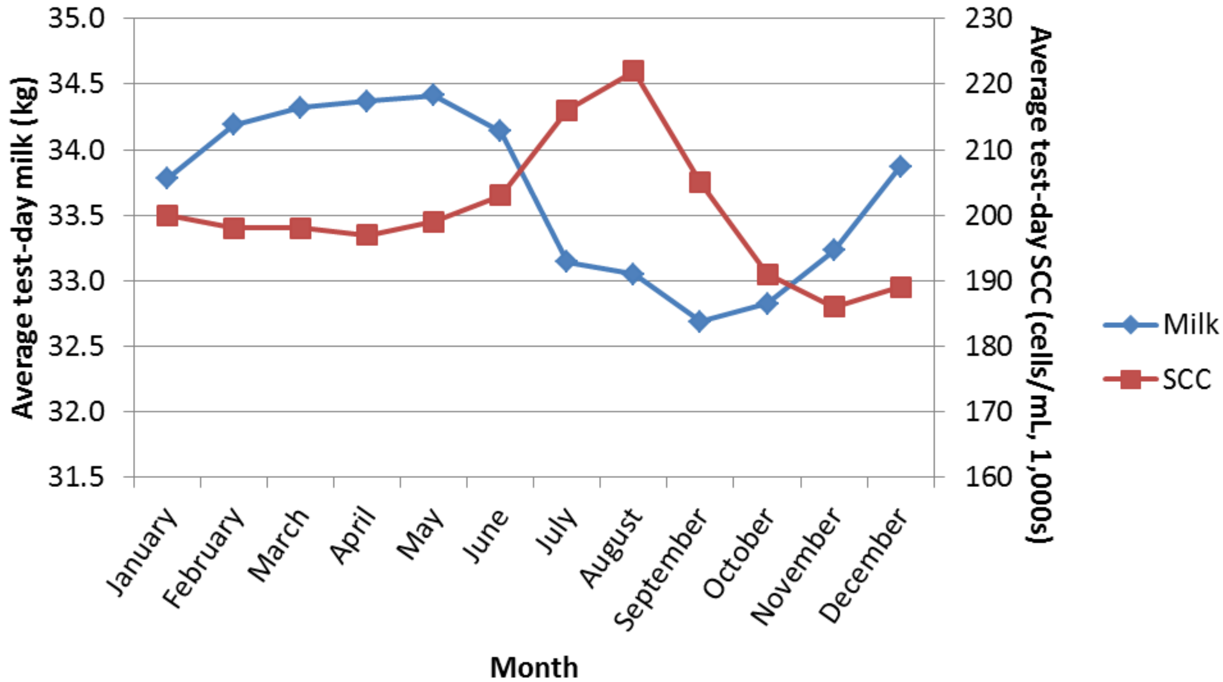

Figure 2-3. Average test-day milk yield and SCC from Dairy Herd Improvement herds during 2012 by month (Norman et al., 2013)

CHAPTER 3
MATERIALS AND METHODS

3.1 Survey Design and Data Collection

An 18-page survey was designed and consisted of 62 questions which included 26 short-answer questions, 17 multiple-answer questions, 17 fill-in-the-blank questions and 2 questions for which respondents were asked to give their top 3 reasons (see Appendix). The survey covered 7 areas which included farm business structure, young stock management, milking herd management, pasture and crop management, feeding management, manure and nutrient management, and environment and sustainability. The survey focused on pasture-based dairy farms where pasture-based refers to farms that at least partially, or temporarily, house some or all of their dairy cattle on pastures.

The survey form was designed to be filled out by interviewers who were vising the participating dairy farms. Reasons for personal visits were that a higher survey completion rate was expected given the small number of pasture-based dairy farms in Florida and Georgia, and the pasture-based management practices could be best captured through a dialogue with the respondent.

Pasture-based dairy farmers in Florida and Georgia were invited in the summer and fall of 2012 by mail, telephone calls, emails, and general announcements in newsletters to participate in the survey. An opportunity to complete the survey was offered at the 2013 Georgia Dairy Conference. Two Florida dairy Extension agents provided a list of 42 dairy farms to be targeted for participation. One hundred dollars was awarded to each farm for completing the survey.

Based on these lists, a total of 40 survey invitations were mailed at the end of September, 2012 and these farms were called to set up appointments if they were interested to participate. In addition, 8 farms initiated contact and said they were interested to participate. A total of 24 farms of those that were contacted did not participate because either wrong telephone numbers were given or the farms did not return the phone calls. One farm volunteered to fill out the survey by mail but did not return the form. Finally, the survey was conducted for 23 dairy farms by 20 different interviewees.

Data were collected by personal interviews from September 2012 to March 2013. Respondents were asked to answer the questions in reference to summer 2011 through spring 2012. The target interviewees of the survey were those responsible for most of the business or who made most decisions on the farm. Of the 23 respondents, 5 were farm managers and 18 were owners. Of the 20 interviewees, 1 reported for 3 farms and 1 reported 2 farms. Three interviewees owned more than one farm, but because these farms were managed the same but at a different location, they reported as one whole farm. The survey form was slightly edited after the first 3 interviews to clarify some questions.

3.2 Statistical Analysis

Data were entered into and summarized by Microsoft Excel 2010 using counts, averages and standard deviations (SD). Three regions were defined: farms in Georgia, farms in Florida north of Gainesville, and farms in Florida south of Gainesville based on the natural clustering of participating farms.

The following associations were analyzed with procedure GLM in SAS (Cary, NC) to determine a region effect: 1) number of employees = region, 2) number of cows = region, and 3) number of heifers = region. Two seasons were defined: summer and winter. The following associations were analyzed to determine a season effect using procedure Mixed in SAS: 1) daily milk yield = season, 2) somatic cell count = season. Farm was assumed random in the last two models. Least square means for region and season were compared with the Tukey-Kramer Adjustment for multiple comparisons and the pdiff option. Pearson correlation coefficients were calculated with procedures Corr in SAS. Significance was declared if the $P < 0.05$ and a trend was declared if $P < 0.10$.

To compare milk production from cows by providing cooling inside vs. no cooling or access to a cooling pond vs. other outside cooling methods, the following associations were analyzed with the procedure Mixed in SAS: 1) milk = season + cooling + , season*cooling, 2) milk = season + cooling pond + season*cooling pond. Farm was assumed random in the last two models, the other explanatory variables were fixed. Least square means for cooling methods were compared with the pdiff option.

CHAPTER 4
CHARACTERIZATION OF FARM STRUCTURE, MILK PRODUCTION, REPRODUCTION AND FACILITIES

4.1 Dairy Farms Business Structure

The number of surveyed dairy farms and their business structures are presented in Table 4-1. This survey was conducted on 23 dairy farms: 4 in Georgia, 13 in north Florida, and 6 in south Florida. Of the 23 farms, there were 6 corporations, 9 limited liability companies, 1 S-corporation, 3 sole proprietorships and 4 partnerships. The average number of full time employees was 16.2 ± 33.4 and tended to be different among the different regions ($P = 0.06$). The average number ± SD of full time employees were 5.1 ± 1.4, 7.1 ± 4.2, and 43.2 ± 60.6 in Georgia, north Florida, and south Florida, respectively.

The total number of heifers and cows owned by the 23 farms were 17,288 and 28,768, respectively. The average herd size in Georgia was 588 ± 63 cows and 363 ± 25 heifers which were similar to the herd size in north Florida. In south Florida, the average herd size was much larger at 3,169 ± 3,397 cows and 1,976 ± 3,439 heifers. Regions differed in average number of cows per herd of cows ($P = 0.020$) but not in average number of heifers per herd ($P = 0.158$). The total number of cows in north Florida was smaller ($P = 0.019$) than the number in south Florida.

Of the 23 farms, 18 would maintain ownership of their heifers from birth to calving. Of these, 16 farms raised their own young stock and 2 farms contracted with another party to raise their heifers. Five farms sold their heifers but 2 would buy their own back later; 3 of the 5 would buy other heifers. One farm in south Florida did not have any heifers when surveyed which caused the average number of heifers per farm for that region to have a large SD. Of the 16 farms they raised their own heifers, the average of heifer to cow ratio was 63% (min = 25% and max = 107%).

4.2 Description of Dairy Breed, Replacement and Genetic Selection Goals

The distribution of cows among the different breeds is shown in Table 4-2. The dominant purebred was Holstein with 20,328 cows on 17 farms, representing 71% of all cows in the survey. Of the 23 farms, 17 farms (74%) had at least one Holstein. On 3 farms, purebred Holsteins were less than 25% of all cows while on 9 farms more than 75% of all cows were Holsteins. Of all cows in the survey, purebreds made up 75% of all cows and crossbreds the remainder 25%. After Holsteins, the second most common cow breed was the Jersey x Holstein cross with 4,464 head distributed across 10 dairy farms. The purebred Jersey and the Holstein x Jersey cross made up 1,257 and 608 head respectively. The unspecified crossbreeds and other unspecified cows mostly came from local herd dealers. When asked about future breeding plans, 6 farms indicated they would like to expand their cross-breeding program whereas 2 farms would like to reduce the crossbreeding on their farms.

The interviewees were asked to rank at most 3 genetic selection goals by level of importance (Table 4-3). Twenty-two farms responded. Eleven farms indicated that reproduction and longevity were important goals, with 9 and 5 farms responding that it was their first priority, respectively. Secondly, milk volume and udder composition were mentioned by 9 and 8 farms, respectively. Udder composition and feet and legs were mostly mentioned as the second or third goals.

Of the 19 farms that had crossbreeds, 12 farms had the same genetic selection goals for the multiple (cross) breeds on their farms. Seven farms reported different genetic selection goals depending on the specific (cross) breed, however. Three farms decided on the breed of the service sire based upon the size of the cow; that is small cows were bred to Holstein sires and large cows were bred to Jersey sires.

The annual cull rate of the 23 farms was 22 ± 9%. The annual cull rate varied greatly between farms and (cross) breeds (Table 4-2). The pure breed Holstein and unspecified cross breed had the highest average annual cull rate, which were 28% ± 10% and 27% ± 10%, respectively. The lowest annual cull rate was for the Jersey x Milking Shorthorn cross. The average annual cull rate of Brown Swiss, Norwegian Red x Holstein, and Jersey x Holstein x Swedish Red were below 20%, being 14% ± 10%, 17%, and 16% respectively.

Nineteen farms reported that failure to get pregnant was an important culling reason, with 9 farms reporting it as their primary reason and 6 farms reporting it as their secondary reason (Table 4-4). Low milk production and mastitis were the other 2 culling reasons most often mentioned. Bad udder composition and feet and leg problems were both reported by 8 farms respectively and were mostly mentioned as second and third reasons. Death was reported on 5 of the 23 farms to be within the top 3 culling reasons.

4.3 Milk Production and Procedures

The milk production was dissimilar among the 23 farms (Figure 4-1). Milk production in the winter (26.5 ± 6.6 kg/cow/day) was greater ($P < 0.001$) than in the summer (19.0 ± 6.8 kg/cow/day). All 23 farms reported a lower milk yield in the summer compared to the winter. In the winter, the highest reported milk yield was 38.1 kg/cow/day and lowest milk yield was only 6.3 kg/cow/day. On the same 23 farms, the highest milk yield in the summer was 33.6 kg/cow/day and lowest was only 4.5 kg/cow/day. The summer/winter milk yield ratio (summer milk yield divided by winter milk yield, an indicator of seasonality) ranged from 0.42 to 0.90. The average summer/winter milk yield ratio was 0.71 ± 0.14. The average annual rolling (moving average) herd milk yield reported was 7,671 ± 1,614 kg/cow/year on 19 farms. Four farms could not report their annual rolling herd milk yield.

SCC were greater (P < 0.001) in the summer than in the winter on all 23 farms (Figure 4-2). The averages of the SCC were 249,826 ± 68,894 cells/ml and 368,130 ± 79,085 cells/ml in the winter and summer, respectively. The highest and lowest SCC in the winter were 396,000 and 150,000 cells/ml. In the summer, the highest and lowest SCC were 540,000 and 200,000 cells/ml, respectively. The summer/winter SCC ratio (summer SCC divided by winter SCC) varied between 2.29 and 1.07 with an average of 1.52 ± 0.33 cells/ml. The correlation between summer/winter ratio of SCC and summer/winter ratio of milk yield was 0.27 (P = 0.207).

Only 11 farms participated in a Dairy Herd Improvement Association (DHIA) program. Seven farms participated with monthly milk testing while 1 farm only tested a few times during the summer and 1farm tested quarterly. The remaining 2 farms used DHIA only for records keeping. However, not all farms that tested measured milk yield, fat, protein, and SSC. Only 2 farms tested for fat, protein, and SCC in addition to milk yield. Two farms tested for milk yield and SSC but not for milk components. One farm tested for milk yield monthly but tested for fat, protein, and SCC only 3 times per year. In addition, one farm tested for milk only and another farm tested for milk monthly and for SSC as needed.

Twenty farms milked cows twice per day year-round. One farm milked only once per day. One farm milked 3 times per day and another farm milked 4 times per day year-round.

Milking procedures are reported in Table 4-5. The milking procedures varied across the 22 farms that answered this question. The most common milking procedure (7 farms) was to not wash udders but to strip, and pre-dip, wipe, and post-dip. Four farms only pre-dipped, wiped, and post-dipped. Udder washing was not done on 15 farms whereas stripping was not done on 11 farms. Pre-dipping and wiping udders were both not done on 1 farm each. All 22 farms reported to use post-milking teat dipping. Three farms pre-dipped and wiped only when it was raining and the cows were dirty. Only 7 farms used automatic removal of the milking machine whereas the other 14 farms used manual removal of the milking machine.

4.4 Reproduction Programs

Age at first calving was 24.0 ± 1.6 months with a range from 20 months to 28 months among the 22 reporting farms. One farm did not know the age at first calving because they purchased heifers without knowing the age of heifers.

Figure 4-3 is a pattern of the intensity of calving of heifers during the year on the 23 farms. Farm 1 only provided the time when most heifers calved (June and July). Farm 2, 3 and 4 were 100% seasonal breeding farms such that all their heifers calved only in a narrow window of a few months. Farm 11 had a minimal number of calvings in July and August, while farm 12 had calving minimal number of calvings in the summer. An all-year calving pattern was applied on 8 farms, which implies that 15 farms had one or more months without barely any calvings. Five of the 8 year-round calving farms still reported a seasonal calving pattern.

Several reasons were given for these heifer-calving patterns. Most of farms tried to avoid calving in the hot summer. However, 3 out of 23 farms planned for calving in summer to fill the need for milk sales caused by the lack of cow calving during the summer. Moreover, interviewees believed that heifers, especially crossbreeds, could better handle the heat stress and had fewer problems during calving in the summer compared with mature cows. Two farms mentioned the availability of grass as a reason for a heifer calving pattern concentrated in either the fall or spring.

The cows' calving pattern (Figure 4-4) was similar to the heifers' calving pattern. Farm 1 only reported their most intensive calving months for cows, but not the least intensive. All other farms, except one farm (farm 21) which had a similar number of calvings each month, had their heaviest calving season in the fall or winter with the least amount of calvings occurring in the summer. Also, farms 2, 3 and 4 were strictly seasonal breeding farms such that all their cows calved only in a narrow window of a few months, the same as their heifers' calving pattern.

Ten of the 23 farms reported that their cow-calving pattern was similar to their heifer-calving pattern. Three farms (farms 1, 5, and 11) managed their heifers to calve earlier in the calendar year than their cows. One farm (farm 8) indicated that they managed their cows to calve earlier in the year than their heifers. Seven farms (farms 5, 9, 10, 13, 17, 18, and 21) applied an all-year-round calving pattern for cows as well as for their heifers. Only 1 farm (farm 14) had an all-year round calving pattern for heifers but had a seasonal calving pattern for their cows. Six cow calving year-round farms (farms 5, 9, 10, 13, 17, 18) and five heifer calving year-round farms (farms 5, 9, 14, 18, 21) had months with the most calvings.

April to August was the least common period for cows to calve. Twelve of the 23 farms, which include the 100% seasonal farms, reported that their cows did not calve in July and August. All farms preferred their cows to calve mostly in either fall or winter.

Figure 4-5 shows the seasonal insemination patterns on the 23 farms. These patterns followed the calving patterns with the main insemination season starting approximately 2 months after the main calving season. The months with the most inseminations were primarily in the winter. A primary insemination period was reported by 22 farms. Twelve farms reported a specific time as the primary insemination period, but 9 farms reported an insemination period, no matter the intensity. Others had similar numbers of inseminations in each month.

The most common primary insemination period was January to March. Only 6 farms inseminated their cows year round but 4 of them still reported a seasonal insemination period. Six farms inseminated many cows or heifers in the summer. They either bred the heifers or selected the younger cows to inseminate in the summer. To manage their calving pattern, 18 of the 23 farms they had a specific none-insemination period (Figure 4-5). Excluding the 6 all-year-round-calving farms, the other 17 farms had a do-not-breed period. The most common months of the do-not-breed period were October and November. One farm that claimed to calve year round indicated that animals were not inseminated for several weeks from late October to Thanksgiving. Six farms reported no breeding in the summer.

Table 4-6 summarizes the main reasons for a reduced or limited insemination period. The most popular reason given by 10 of the 23 farms for having a non-breeding period was to avoid calving, and thereby calving problems, in the summer. The next important reason was the lower pregnancy rate in the summer, reported by 7 of the 23 farms. Quality and quantity of grass, labor availability, and maintaining the seasonality of milk production was mentioned by 4 farms each. The effect of summer heat stress on animals was reported as a reason by 3 farms. One farm mentioned that feed availability was a reason for not breeding. None of the 23 farms indicated that time off or vacation was a reason for not breeding.

Table 4-7 lists the main insemination methods used on the 23 farms. The sequence of insemination methods in this list starts with the first method followed by the next method and so on. There were 9 different combinations. Among the 23 farms, 6 farms only used natural service bulls (NS) for inseminations. Five farms applied estrus-based artificial insemination (EAI) first and then continued with NS. Four farms applied timed artificial insemination (TAI) for the first insemination, followed by NS. TAI followed by EAI was applied on 2 farms. A mixture of TAI and EAI applied at the same time followed by NS was applied on 2 farms as well. The 4 remaining farms applied combinations of EAI, TAI, and NS. Natural service bulls were used widely on the farms, which may explain why 10 farms had incomplete records of reproduction performance because inseminations were not recorded.

Sexed semen was used on 7 of the 23 farms. All 7 farms used sexed semen on their heifers at least once, and all of them applied it in the cooler winter months. One farm also used sexed semen on their higher producing Jersey cows and Brown Swiss cows. None of the farms employed embryo transfer.

Reproductive performance which included 21-day insemination rate, conception rate and 21-day pregnancy rate was not well measured by many farms. Ten farms had no idea about their reproductive performance, including 6 farms where NS was the main breeding method. Only 8 farms reported the 21-day insemination rate during their main insemination period. The 21-day insemination rate during the main insemination season averaged 58 ± 17%. The conception rate during the main insemination season was reported by 14 farms with an average of 44% ± 12%. Outside the main insemination period, the insemination rate was reported by 5 only farms with an average of 51 ± 18%. Outside the main insemination period, the conception rate provided by these farms was on average 22% ± 13%.

4.5 Facilities and Time Budgets

Sixteen farms reported a time budget for cows that totaled 24 hours. The other 7 farms merged locations, such as cooling pond on grazing paddocks or cooling pond and feeding barn on the grazing paddocks and trees on the grazing paddocks, so that they could not be determine how many hours the lactating cows spent in each location.

For lactating cows, 12 farms out of 16 put the lactating cows on grazing paddocks for an average of 17.5 ± 5.4 hours and 16.0 ± 6.4 hours in winter and summer, respectively (Table 4-8). Dirt lots were used more in winter (12.0 ± 8.5 hours) than summer (9.6 ± 7.6 hours). In summer, lactating cows spent more time in a feeding barn than in winter (8.1 ± 4.5 hours vs. 3.5 ± 2.1 hours, respectively).

Within the 16 farms, 3 farms did not have any dry cows in winter because calving was very seasonal. Dry cows from the other 13 farms spent more than half of the day either on dirt lots or on grazing paddocks. Two farms had their dry cows spend 2 hours every day in the holding areas for health checks. Compared with lactating cows, more farms put their dry cows under trees instead of on dirt lots or grazing paddocks with a cooling pond.

A variety of cooling systems were applied on the farms (Table 4-9). In winter, 7 out of 23 farms did not use any cooling system for lactating cows, 6 farms used cooling ponds, 5 farms used trees, 3 farms applied irrigation and cooling water through a center pivot, 3 farms used shade cloth, 1 farm set sprinklers outside, 1 farms provided a shade barn and 1 farm kept their lactating cows in a shade barn with fans and sprinklers to reduce heat stress. Five farms used 2 cooling methods. Only one farm kept their lactating cows most of time inside and only one hour per day on the dirt lots.

In the summer, 2 farms kept their lactating cows under a shade barn most of time and only spent less than 4 hours on dirt lots. Eight of the farms provided the cooling ponds for their lactating cows, 7 farms let their cows graze under the center pivot with irrigation water, 5 farms used trees, and 3 farms applied shade cloth. Three farms used sprinklers, a shade barn, and a shade barn with fans and sprinklers, respectively. Five farms used more than one cooling method. One farm did not use any cooling system.

The outside cooling systems for dry cows are presented in Table 4-9. More than half of the 23 farms used trees to help reduce the heat stress on dry cows in both the winter and the summer. Five farms in the winter and 1 farm in the summer reported that no outside cooling system was used. Cooling ponds were mentioned as the cooling method by 4 farms in winter and 6 farms in summer. Center pivots with irrigation water was used on a 5 farms in both the winter and the summer. A total of 6 farms used shade cloth as the cooling method in winter and summer for dry cows. Moreover, 1 farm housed cows inside a barn without access to the outside, and 1 farm reported that a shade barn was employed on the farm.

Inside cooling systems for lactating and dry cows in summer and winter are presented in Table 4-9. Although most of the 23 farms were pasture-based, some of them also applied a cooling system in the feeding barn or exit lane. Eleven farms never put lactating cows in a feeding barn, either in winter or summer. Every farm provided at least one additional cooling method, such as fans or sprinklers, for their lactating cows if they put them in a feeding barn in summer. In the winter, 3 farms did not use any cooling system. Fans and sprinklers were applied on 6 farms in winter and on 10 farms in summer for lactating cows. Showers in the exit lane were reported by 1 farm in both during the winter and summer. Fans only were applied on 6 farms for lactating cows in both seasons. In addition, in both winter and summer, 3 farms used another cooling system such as tunnel ventilation, misters and soakers, and mister only. For dry cows, only one farm put their dry cows in a barn and applied fans with sprinklers in both the winter and summer.

The cooling systems used in the holding area and milking parlor are listed in Table 4-10. In the holding area in the winter, 4 farms used no cooling system 9 farms applied fans with sprinklers, and the other farms either applied showers, fans or misters in the exit lane. In the summer, only one farm did not use a cooling system in the holding area. Thirteen farms applied fans with sprinklers. Showers, fans only and misters were employed in the exit lane on 5, 4 and 5 farms, respectively.

Cows outside with access to cooling pond during the summer produced on average more milk (LS means = +4.7 kg/cow/day, $P = 0.042$) than cows outside without access to a cooling pond. In the winter, the cows outside with access to cooling pond produced on average numerically more milk (LS means = +2.7 kg/cow/day, $P = 0.267$) than the cows outside without access to a cooling pond.

Cows with access to inside cooling during the summer tended to produce on average more milk (LS mean = +3.6 kg/cow/day, $P = 0.071$) than cows without access to inside cooling. But in the winter, cows with access to inside cooling produced on average numerically more milk (LS mean = +2.7 kg/cow/day, $P = 0.207$) than cows without access to inside cooling.

Cooling systems were used in the milking parlor in different ways as well (Table 4-10). In the winter, 10 farms did not use any cooling system. Fans with sprinklers or showers in the exit lane were applied on 4 farms. Another 9 farms employed fans only. In the summer, 7 farms did not use any cooling system and 13 farms applied fans only. Others used fans with sprinklers or showers in the exit lane.

Table 4-1. Business structure of the 23 surveyed dairy farms in three regions

Characteristic	Georgia	North Florida	South Florida	Total
# of farms	4	13	6	23
Corporation	0	3	3	6
Limited liability company (LLC)	3	5	1	9
S-corporation	0	0	1	1
Sole proprietorship	0	2	1	3
Partnership	1	3	0	4
# of full time employees per farm	5.1 ± 1.4	7.1 ± 4.2	43.2 ± 60.6	371.5
# of heifers per farm	363 ± 25	306 ± 274	1976 ± 3439	17,288
# of cows per farm	588 ± 63	569 ± 589	3169 ± 3397	28,768

Table 4-2. Description of adult dairy cattle breeds and cull rates

Breed or cross[1]	% of the total herd			Total # farms	# cows	Annual cull rate (%)
	<25%	25-75%	>75%			
Brown Swiss	4	0	0	4	11	14 ± 10
Holstein	3	5	9	17	20,328	28 ± 10
Jersey	5	1	0	6	1,257	24 ± 6
Holstein x Jersey	3	3	0	6	608	21 ± 2
Jersey x Holstein	2	7	1	10	4,464	22 ± 12
Montbeliard x H	1	0	0	1	20	20
Norwegian Red x H	1	0	0	1	30	17
Jersey x Milking Shorthorn	0	0	1	1	31	5
Unspecified crossbreed	1	1	0	2	296	27 ± 10
H x J x Swedish Red	1	0	0	1	6	22
J x H x Swedish Red	0	1	0	1	125	16
J x H x S/M/A	0	2	0	2	300	25 ± 0
Other unspecified	1	0	1	2	570	20 ± 0

[1]H = Holstein, J = Jersey, M = Milking Shorthorn, A = Ayrshire, S = Swedish Red

Table 4-3. Genetic selection goals

Breeding goals[1]	# of farms	Importance		
		# as top 1	# as top 2	# as top 3
Reproduction	11	9	1	1
Longevity	11	5	2	4
Milk volume	9	4	3	2
Udder composition	8	0	2	6
Feet and legs	6	0	3	3
Calving ability	5	1	4	0
Net merit dollars	2	2	0	0
Fluid merit dollars	2	0	2	0
Body capacity	3	0	3	0
Strength	1	1	0	0
Fat and protein	1	0	0	1
Functional type	1	0	0	1
Once per day milking	1	0	0	1

[1]Each farm reported up to 3 goals

Table 4-4. Primary culling reasons

Cull reasons[1]	# of farms	Importance		
		# as top 1	# as top 2	# as top 3
Failure to get pregnant	19	9	6	4
Low milk production	14	5	5	4
Mastitis	11	4	3	4
Bad udder composition	8	2	4	2
Feet and leg problems	8	2	3	3
Death	5	0	2	3
Disease	3	0	0	3
Temperament	1	1	0	0

[1]Each farm reported up to 3 goals

Table 4-5. Milking procedures

Wash udders	Strip	Pre-dip	Wipe	Post-dip	# of farms
No	Yes	Yes	Yes	Yes	7
Yes	Yes	Yes	Yes	Yes	4
No	No	Yes	Yes	Yes	4
No	No	Yes[1]	Yes[2]	Yes	3
Yes	No	Yes	Yes	Yes	2
Yes	No	No	Yes	Yes	1
No	No	Yes	No	Yes	1

[1]On fresh cows or during raining weather only
[2]When dirty

Table 4-6. Reasons for a reduced or limited insemination period

Reasons	# of farms
Calving problems in the summer	10
Failure to get cows pregnant	7
Matching quality and quantity of grass	4
Labor availability	4
Maintain the seasonality of milk production	4
Heat stress	3
Feed availability	1
Time off or vacation	0

Table 4-7. Insemination methods

Sequence[1]	# of farms
NS	6
EAI + NS	5
TAI + NS	4
TAI + EAI	2
MIX + NS	2
NS + TAI + NS	1
EAI	1
TAI + EAI +NS	1
MIX	1

[1]NS = natural service
EAI = estrus followed by artificial insemination (only)
TAI = time artificial insemination (only)
MIX = estrus followed by artificial insemination and timed artificial insemination

Table 4-8. Time budget for lactating cows in each location

Locations	Summer (hours)	# farms	Winter (hours)	# farms
Dirt lot	9.6 ± 7.6	5	12.0 ± 8.5	6
Grazing paddocks	16.0 ± 6.4	12	17.5 ± 5.4	12
Feeding barn	8.1 ± 4.5	7	3.5 ± 2.1	5
Free stall	19.0	1	19.0	1
Holding area + milking parlor	3.6 ± 1.2	16	3.6 ± 1.2	16
Cooling pond	9.0	1	11.0	1
Under trees	0	0	0	0

Table 4-9. Cooling systems used on pasture and while cows are grouped for milking and supplementation

Cooling system	# of farms			
	Winter		Summer	
	Lactating	Dry	Lactating	Dry
Cows do not go outside	1	1	2	1
Outside cooling system:				
No cooling system	7	5	1	1
Cooling pond	6	4	8	6
Under center pivot	3	1	7	4
Under shade cloth	3	2	3	4
Under trees	5	13	5	14
Others[1]	3	1	3	1
Cows do not go inside	11	22	11	22
Inside cooling system				
No cooling system	3	0	0	0
Fans with sprinklers	6	1	10	1
Showers in the exit lane	1	0	1	0
Fans only	2	0	4	0
Others[2]	3	0	3	0

[1]Includes only cows under sprinklers outside
[2]Includes tunnel vent, misters and soakers

Table 4-10. Cooling system at holding area and milking parlor

Cooling locations and methods	# of farms	
	Winter	Summer
In holding area		
No cooling	4	1
Fans with sprinklers	9	13
Showers in the exit lane	3	5
Fans only	4	4
Misters	4	5
In milking parlor		
No cooling	10	7
Fans with sprinklers	3	3
Showers in the exit lane	1	2
Fans only	9	13

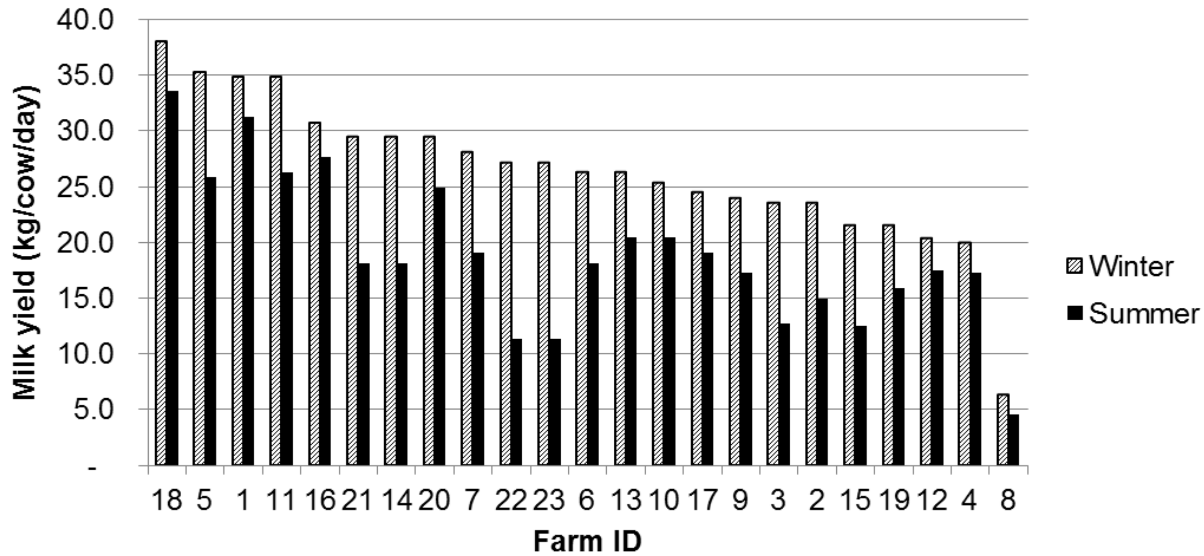

Figure 4-1. Average daily milk production in the winter and summer seasons

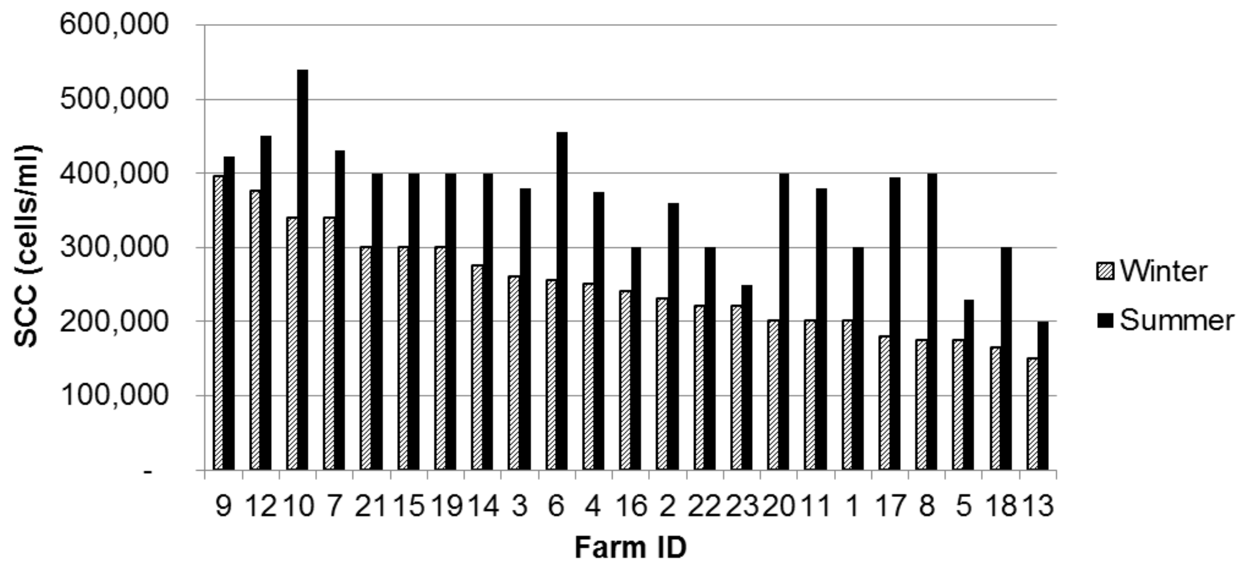

Figure 4-2. Somatic cell counts in the winter and summer seasons

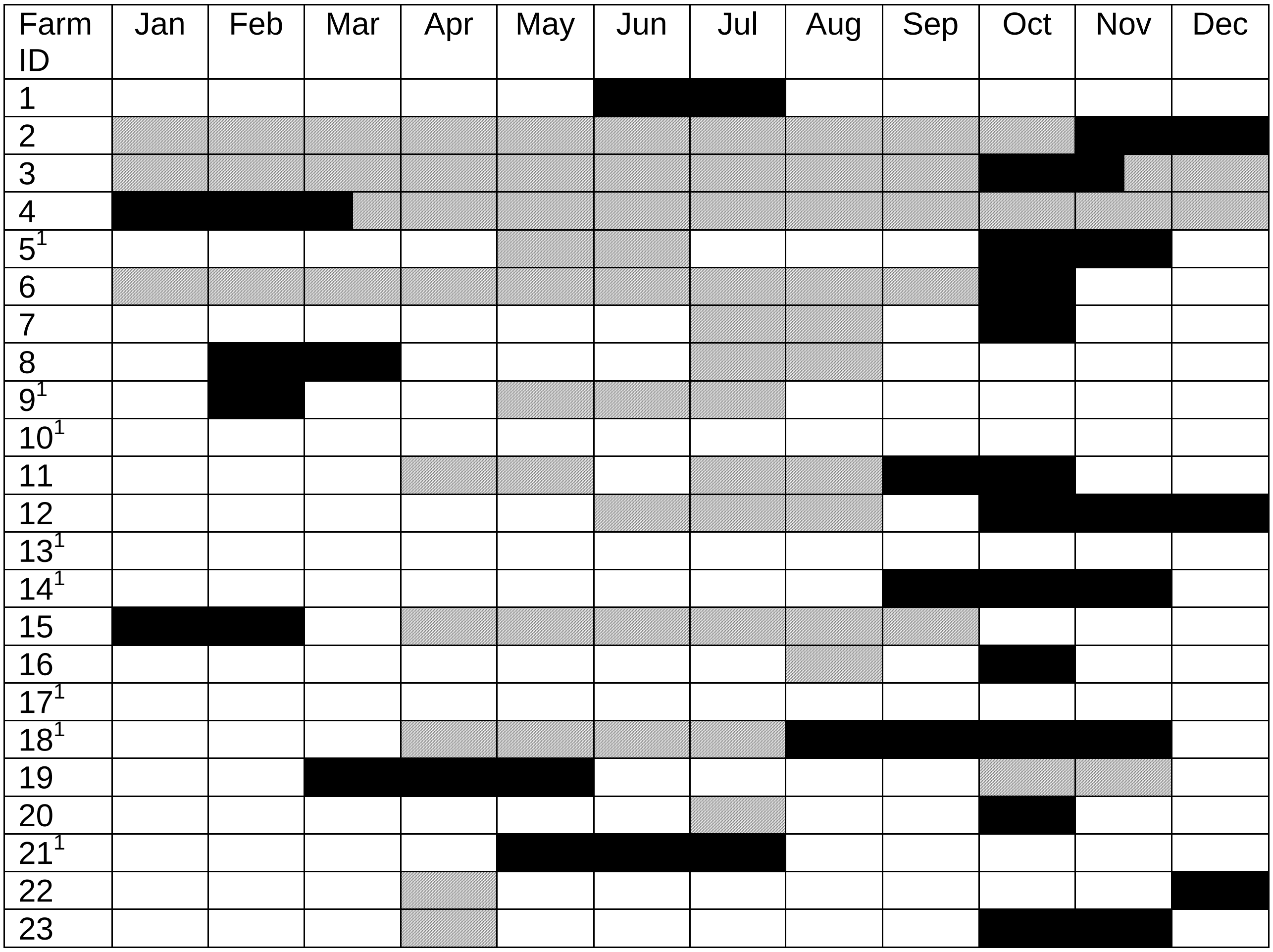

Figure 4-3. Heifers calving pattern. █ = months with most heifer calvings, ▨ = months with minimal number or no heifer calvings. ☐ = months with a regular amount of heifer calvings. [1]Farms calve all year round.

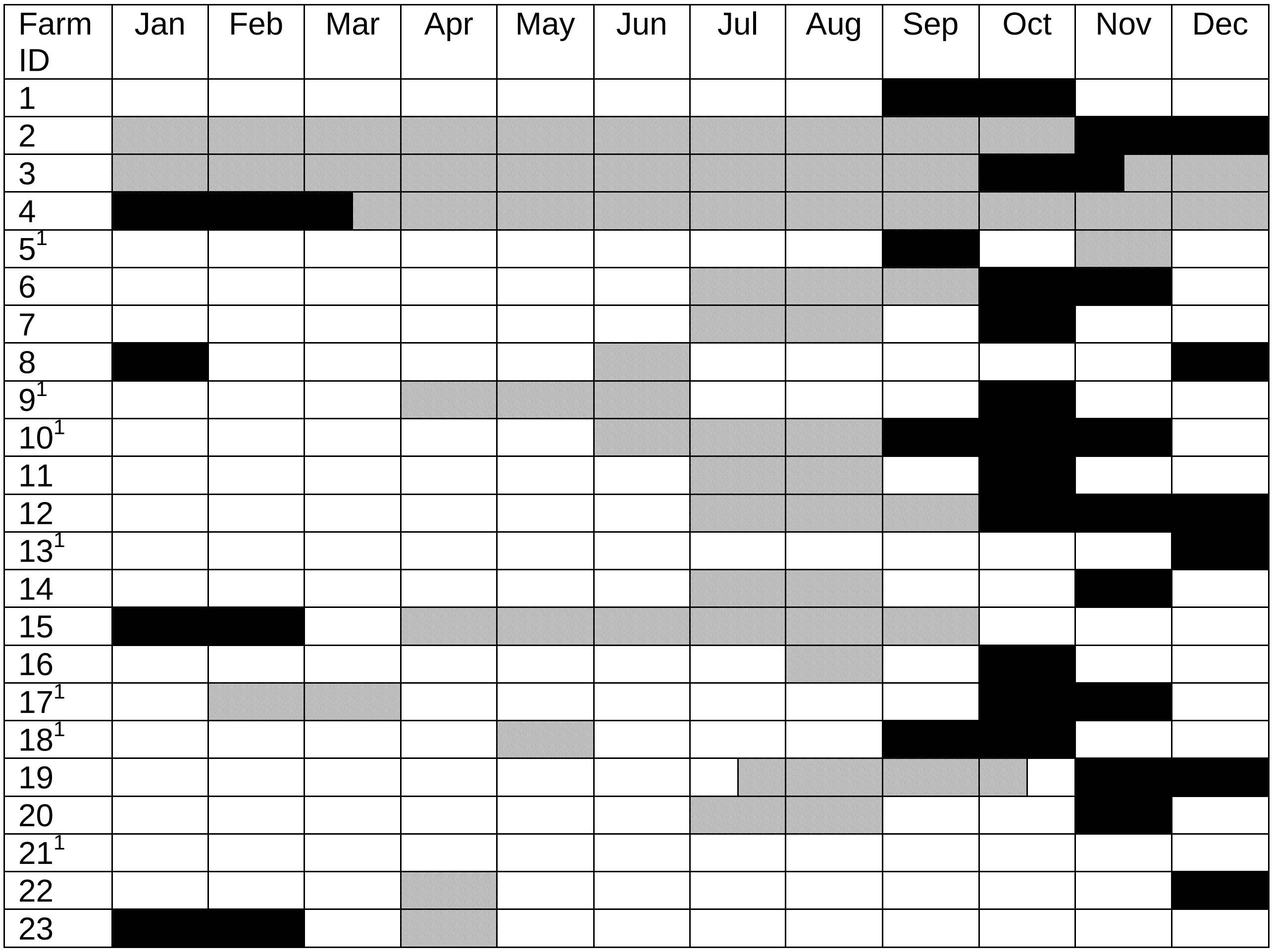

Figure 4-4. Cows calving pattern. ■ = months with most cow calvings, ▨ = months with minimal number or no cow calvings. □ = months with regular cow calvings. [1]Farms calve all year round.

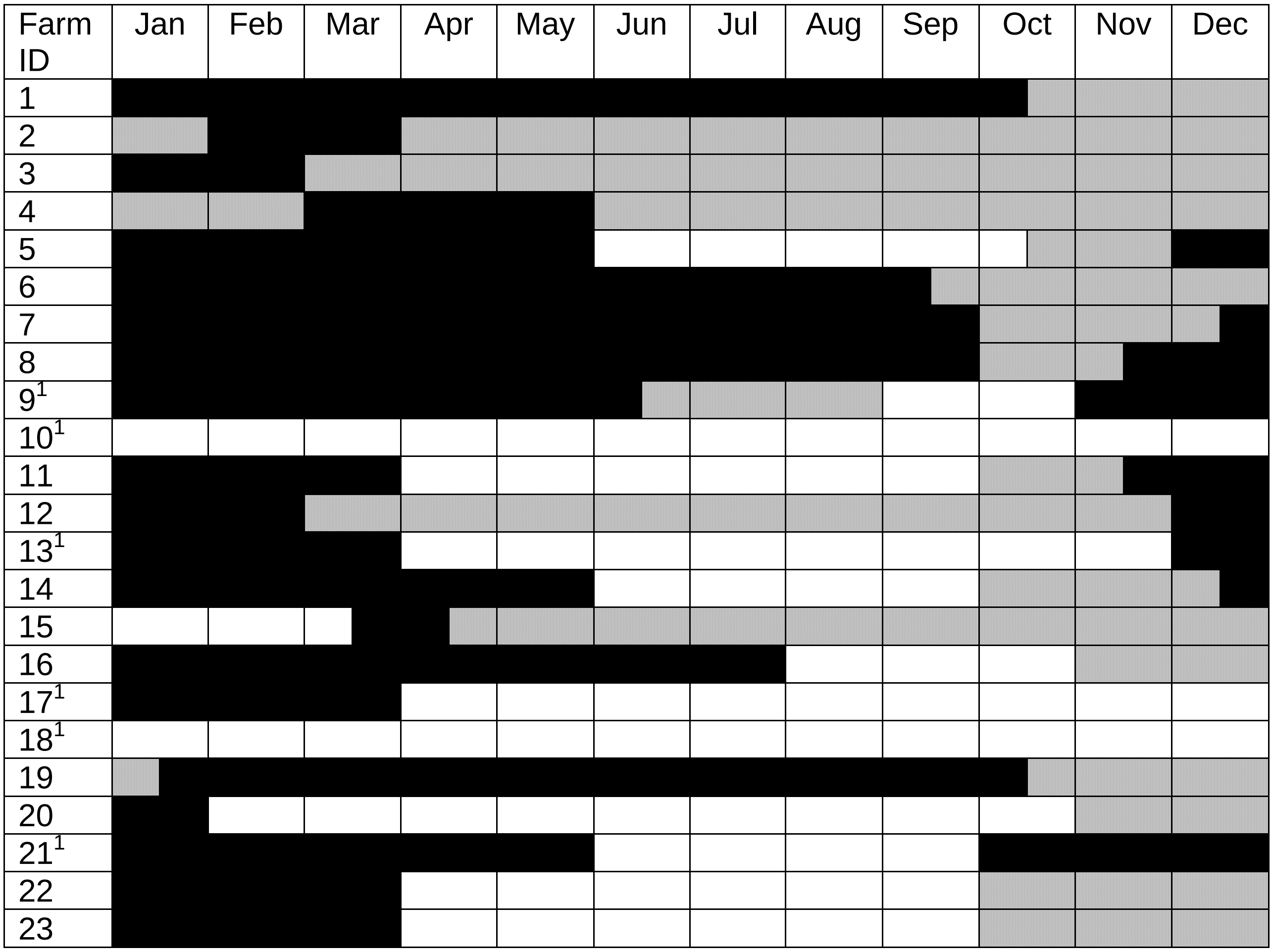

Figure 4-5. Cows insemination pattern. = months with most cow inseminations, = months with minimal number or no cow inseminations. = months with regular amount of cow inseminations. [1] Farms calve all year round.

CHAPTER 5
CHARACTERIZATION OF PASTURE AND FEEDING MANAGEMENT

5.1 Land Use

The total hectares per farm ranged from 23 to 1,395 among the surveyed 23 farms (Figure 5-1). Improved grass paddocks were used on 17 farms. The presence of unimproved grass paddocks were reported by 8 farms. Dirt lots were reported on 9 farms and 1 farm did not specify their field type.

The total area of the grazing paddocks per farm was 181 ± 277 hectares. Except for the 3 farms that did not provide useful data, 20 of the 23 farms had less than 225 hectares, which was 14 to 100% of their total land area, dedicated to grazing. The average percentage for grazing land of their total farm size was 93% ± 39%. The average size of a grazing paddock for milking cows was 6.4 ± 8.3 hectares; and the average size of a grazing paddock for dry cows was 13.3 ± 15.4 hectares. Permanent paddocks were used on 16 farms with on average 38 ± 53 paddocks with a range from 8 to 200 paddocks.

Paddocks were laid out in 4 different ways as is shown in Table 5-1. The most popular way was fixed sized lots only. These lots had constant sizes due to permanent fencing. One farm laid out the fixed sized lots as a traditional pie chart shape. Another 5 farms applied a center pivot with a traditional pie chart for both their lactating cows and dry cows. Only 2 farms reported that they used fixed sized lots with a center pivot and laid the lots out as traditional pie chart for lactating cows. Center pivots with a double circle of pie chart laid-out paddocks was used on 1 farm for both their lactating cows and dry cows. Finally, 1 farm did not let their lactating cows go outside and another farm did not put their dry cows outside.

5.2 Pasture Utilization

The number of lactating cows on each hectare of paddock in the summer was reported by 17 farms (Figure 5-2). The average stocking density of lactating cows was 19 ± 21 cows per hectare. In the winter, the stocking density of lactating cows was reported by 15 farms with the average of 19 ± 22 cows per hectare. For dry cows, the stocking density was reported by 13 farms with on average 6 ± 5 cows and 8 ± 12 cows per hectare in summer and winter, respectively.

The time cows spent on each pasture before the pasture was given a rest time to regrow grass was widely different. For lactating cows, 13 farms reported this pasture utilization period. In the summer, the longest pasture utilization period was 60 days and the shortest was 0.5 day, and the average of the pasture utilization period was 6 ± 17 days. In the winter, the pasture utilization period was very similar, with on average 6 ± 18 days as reported by 11 farms with the longest 60 days and shortest 0.5 day. For dry cows, the pasture utilization period was provided by 8 farms in the summer and by 7 farms in the winter with the average 109 ± 175 days and the range from 1 day to 365 days in both summer and winter.

In addition to a large variation in the time cows spent on a pasture, the rest time for each pasture was very different between farms as well. Rest time was reported by 14 farms in the summer and by 13 farms in the winter for lactating cows (Figure 5-2). For lactating cows, the shortest time was 4 days in both summer and winter while the longest time was 180 days in both summer and winter. The average rest time was 37 ± 64 days and 49 ± 62 days in summer and winter, respectively. Farms with high stocking density did not use their paddocks as grazing pasture. According to the Figure 5-2, there was no relationship between the stocking density and rest days per one day in the pasture.

For dry cows, the rest time for each pasture was reported by 4 farms with the average 15 ± 13 days in the summer and 43 ± 40 days in the winter. The time range was from 1 to 30 days in the summer and 1 to 90 days in the winter.

For pasture management, the height of the grass was estimated by 15 farms, with 10 farms estimating the height visually; 3 farms used visual observation plus pasture plate measurements. One farm estimated grass height by using a pasture stick and the other farm estimated height by using a pasture plate meter. Grass height was estimated daily by 7 farms, weekly by 2 farms, twice monthly by 1 farm, and monthly by 2 farms. One farm estimated grass height only during the winter.

Only one farm measured the height of the grass to decide on the rest time of the paddock for lactating cows. This farm set 41 to 46 centimeter as the move-in grazing target and set 10centimeter as the move-out target for lactating cows and no target for the dry cows. All other farms counted time since the cows moved in or out of the pasture and estimated grass height visually to decide when to move cows in or out of a paddock. Time varied based on rain and grass growth.

The grazing plans varied among the 23 farms as well. The first grazing model, used by 3 farms, was that dry cows followed lactating cows after the lactating cows had left the paddocks. Secondly, dry cows were always kept on the same paddock on 2 farms. Thirdly, 5 farms arranged for the high milk yield cows to get the freshest grass first which then were followed by lower milk yield cows. Another 2 farms forced the cows that were later lactation to eat more grass and fresh cows had less time to eat grass, but the fresh cows were allowed more time in the feed barn. The others farms did not make special arrangements that depended on the group.

Information on whether the purchased feed price affected grazing management was provided by 20 farms. Thirteen farms indicated that the purchased feed price affected their grazing plans. First, as the feed price increased, they tried to use more grass and reduced the amount of concentrates fed. Secondly, some of farms tried to grow more of their own feed. Thirdly, some of the farms stored more feed when the price was low and less when the price was high. One farm reported that they also picked out the fat cows and gave them less concentrates. But in general, as the feed price increased, farms cut down on the amount of concentrate fed and tried to use more grass.

All but 2 farms had water piped to the paddocks to provide water for grazing animals. The 2 farms did not provide water in the paddocks. Three farms also used center pivots to provide water to their herds and 2 farms had natural water sources on their grazing paddocks.

5.3 Grass and Forage Species Grown on Farms

A total 26 different grasses and forages species were planted among the 23 farms (Table 5-2). Eight species were cool-season annual plants, 10 species were warm-season perennial grasses, 4 species were warm-season annual grasses, 2 species were cool-season perennials, 1 specie was native perennial and 1 specie was unspecified.

During the warm season, all 23 farms grew warm-season perennial grasses such as bahiagrass or bermudagrass species. During the cool-season, 18 farms grew cool-season annual grasses. For the grasses, 15 farms reported that they made balage or hay or silage to help control the grass quality and preserve the grasses. Animals could graze on grass in 17 farms out of 23 farms. Both corn and sorghum were planted on 6 farms, 2 farms only planted corn and 1 farm only planted sorghum as warm annual grasses. All the corn and sorghum grown on farms was made into silage.

The total area of warm-season perennial grassland was 5,012 hectares, with mixed-species pastures occupying 2,630 ha (52%) and non-mixed pastures occupying the remaining 2,382 hectares. Of the non-mixed grass pastures, 878 hectares (37%) was bermudagrass (*Cynodon spp.*) which included Tifton 85, common bermudagrass, Florakirk bermudagrass and coastal bermudagrass; 1,114 hectares (47%) was stargrass (*Cynodon nlemfuensis*); 100 hectares (4%) was limpograss (*Hemarthria altissima*); and 289 hectares (12%) was bahiagrass (*Paspalum notatum*), including Pensacola, Tifton 9 and Argentine.

The total area of cool-season annual grasses was 1,475 hectares, with mixed cool-season annual grasses on 878 hectares (59%) and non-mixed cool-season annual grasses on 678 hectares (41%). Of the non-mixed grasses, oat (*Avena sativa*) was the most common (482 hectares, 71%), followed by triticale (x*Triticosecale spp.)* on 144 hectares (21%) and annual ryegrass (*Lolium multiflorum*) on 52 hectares (8%). The most popular mixture of cool-season grasses was annual ryegrass and oat, established on 374 hectares (43%).

Warm-season annual grasses were established on 2,358 hectares, with corn (*Zea mays*) on 938 hectares (40%), sorghum (*Sorghum bicolor*) on 850 hectares (36%), crabgrass (*Digitaria sanguinalis*) on 400 hectares (17%) and pearl millet (*Pennisetum glaucum*) on 168 hectares (7%).

Oat and annual ryegrass as the most popular cool-season annual forages were planted on 13 and 11 farms, respectively. Annual rye grass mixed with other grasses was reported by 7 farms with the average mixture at 55 ± 16%. An unknown mixture based on annual ryegrass was reported by 2 farms. Two farms reported to grow annual ryegrass without an additional mixture. Oat was planted as mix grass on 5 farms with the average mixture at 43 ± 7% oat. Further, pure oat was planted on 6 farms, and with an unknown mixture planted on 2 farms.

Many different warm-season perennial grasses were used. The most popular were Coastal bermudagrass, common bermudagrass, Argentine bahiagrass and Tifton 85 bermudagrass. The use of Coastal bermudagrass was reported by 11 farms with an average mixture of 50 ± 26% on 8 farms and without mixture on 3 farms. Common bermudagrass was planted on 9 farms with an average mixture of 43 ± 25% on 4 farms, an unknown mixture on 4 farms and without mixture on 1 farm. Tifton 85 bermudagrass was used on 8 farms with an average mixture of 43 ± 11% on 2 farms, an unknown mixture or not mixed on 3 farms each. The use of Argentine bahiagrass was reported by 8 farms with an average mixture at 32 ± 21% on 6 farms and non-mixture on 2 farms.

A total of 13 out of 18 farms growing winter season grasses or forages over- or reseeded their oat and ryegrass on existing growth. The other 5 farms reported that they always grew winter season grasses or forages on a new bed.

The annual sequence in which crops were grown varied among farms (Table 5-3). The most common sequence was corn, followed by sorghum or corn, and cool-season annual grasses. For example, the first planting was corn, then sorghum, then oat. In addition, a sequence of cool-season annuals, warm-season annuals and cool-season annuals was also applied. Specifically, 3 farms grew a sequence of corn, sorghum, and oat on a total of 244 hectares; 2 farms grew corn followed by sorghum on 364 hectares. Eight different farms grew eight other sequences.

5.4 Insect and Weed Control, and Fertilization

For insect control in paddocks, 1 farm used poultry (chickens and turkeys) as a biological control for pasture caterpillars (armyworm and looper), which are the most common targets of insect control. Insecticide was applied by 13 farms for caterpillar control and 9 farms did not use any insect control.

For weed control, 2 farms did not use anything, 5 farms only used herbicide, 10 farms applied herbicides and machine mowing, 3 farms used hand harvesting only, 2 farms used manual and machine control, and 1 farm employed herbicide and manual control.

When farms were asked how they determined the nutrient profile of grass paddocks, 8 farms replied that they used nothing as the cues to estimate the nutrient of grass paddocks. Among the 23 reporting farms, 9 farms indicated the historic sample analysis, 4 farms indicated current sample analysis and 4 mentioned book values of forages as the cue for determining the nutrient profile of grass paddock. In addition, 1 interviewee mentioned that she personally tasted the grass as the cue to help determine the nutrient profile. One farm reported looking at the cows' condition and 1 farm reported they might chop and sample the grass to help determine the nutrient profile.

Ten farms reported that they did not use any manure or commercial fertilizer on paddocks. Solid manure was applied by 6 farms, with 2 farms applying solid manure daily, 3 farms applying it monthly, and 1 farm applying it once every 3 year. Liquid manure was used by 10 farms. The frequency was from daily to once every 6 years.

Commercial fertilizer was used on 11 farms with widely different application plans from monthly to one time per 10 to 18 years.

On cropland, 10 farms reported that they did not use any manure or commercial fertilizer. The application frequency was higher than on paddocks and more complicated among farms. Solid manure was used by 12 farms. The highest frequency was daily and the lowest frequency was yearly. Other frequencies used were from once per 3 days to once a year. Liquid manure application was reported by 13 farms. The highest frequency was daily and the lowest frequency was 2 times per year. Others frequencies that were used ranged from once per 3 days to monthly. The use of commercial fertilizer on crop land was reported by 10 farms. The use frequencies mostly depended on the type of plants growing. The frequency of application ranged from twice per year to 8 times per year.

Among the total 23 farms, 16 farms kept written records of where, when and how much manure was applied. Seventeen farms had a certified nutrient management plan certified by an outside agency.

The irrigation methods used by the 23 farms are shown in Table 5-4. One farm did not use any irrigation at all and 2 farms did not use any irrigation on paddocks. Most farms employed center pivots or travelling guns on their paddocks and cropland. Effluent was delivered through the center pivot on 4 farms to their paddocks and on 5 farms to their cropland. Fresh water was delivered by a center pivot on 9 farms to paddocks and on 7 farms to cropland. By using a travelling gun, 4 farms delivered effluent to their paddocks and 6 farms delivered it to their cropland. Similarly, 1 farm used a travelling gun to deliver fresh water on paddocks and 3 farms used them on cropland. Others irrigation methods included the use of sprinklers to deliver fresh water on paddocks and a dry separator to deliver effluent on paddocks.

5.5 Dairy Cows Nutrition and Feed Intake

The DMI were reported by 21 farms for lactating cows and dry cows. One farm had no idea about how much dry matter they fed because they used buckets to measure feed quantities. One farm just applied a total mixed ration and did not provide DMI. In the winter for lactating cows, 2 farms let their cows graze ad libitum and did not know how much dry matter the cows ate. One farm offered ad libitum amounts of balage and silage. In the summer, 3 farms allowed for ad libitum fresh grass intake and 1 farm provided ad libitum balage and silage but they could not report the dry matter intake. For dry cows, 4 farms offered ad libitum grazing, 1 farm offered ad libitum silage and 1 farm offered ad libitum hay in the summer. In the winter, 2 farms offered ad libitum grazing and 2 farms offered ad libitum hay to the dry cows.

None of the farms reported the amount of DMI from ad libitum fed feeds. Therefore, we used the average weight of each category to estimate the DMI for the ad libitum fed cows.

A large variation in sources and DMI was observed among farms (Figure 5-3). For lactating cows in winter, the average DMI was 20.0 ± 4.0 kg/cow/day. The average DMI from grazing was 2.9 ± 1.9 kg/cow/day among 14 farms. Here 2 farms provided ad libitum fresh grass to graze, also, they could not report the dry matter intake. Hay was provided by 7 farms with the average DMI from hay estimated at 4.7 ± 2.8 kg/cow/day. Balage and silage were used on 10 farms with the average DMI at 3.4 ± 1.2 kg/cow/day and 6.2 ± 2.0 kg/cow/day, respectively. One farm indicated that they provide balage and silage ad libitum. The average DMI from concentrate was 12.1 ± 4.6 kg/cow/day among the 21 farms. One farm indicated they provided 0.9 kg of dry matter from molasses.

For dry cows in the winter, the reported DMI also varied widely. The average DMI was 11.4 ± 3.7 kg/cow/day among 18 farms. Close to calving, 3 farms reported that they decreased DMI from grazing from 7.7 kg/cow/day to 1.8 kg/cow/day, increased DMI to 9.1 kg/cow/day from balage as grass intake decreased and also provided 1.8 kg/cow/day dry matter from concentrate. In addition to those 3 farms, grass was provided ad libitum on 2 farms and hay was also provided ad libitum on 2 farms. In general, fresh grass was provided on 13 farms with the average DMI of 6.5 ± 3.2 kg/cow/day, hay was fed on 10 farms with the average of 7.1 ± 4.0 kg/cow/day, balage was fed on 6 farms with an average of 2.9 ± 3.3 kg/cow/day, silage and concentrate were fed on 4 and 17 farms with an average of 2.1 ± 2.0 kg/cow/day and 4.8 ± 2.2 kg/cow/day, respectively.

The reported summer DMI for lactating cows among 21 farms are shown in Figure 5-4. The pattern was similar to that reported for the winter. Three farms fed ad libitum grass for grazing and 1 farm provided ad libitum balage and silage. For lactating cows in the summer, the total DMI was 17.7 ± 4.9 kg/cow/day. In total, 15 farms provided their lactating cows fresh grass by grazing with the average DMI reported at 6.4 ± 3.8 kg/cow/day. One farm applied green chop with 3.2 kg/cow/day DMI. Hay was provided by 5 farms with the average DMI at 2.8 ± 0.9 kg/cows/day. Balage was used on only 3 farms with the average DMI at 2.5 ± 1.2 kg/cow/day. The DMI from concentrate was about 9.8 ± 4.3 kg/cow/day among the 21farms. Silage was provided on 9 farms with the DMI at 6.3 ± 2.1 kg/cow/day.

In the summer for dry cows, a total of 20 farms reported the DMI with an average of 10.5 ± 4.8 kg/cow/day. Two farms only provided fresh grass ad libitum and 1 farm used silage ad libitum only. Four farms fed fresh grass ad libitum. Fourteen farms fed fresh grass by grazing with an average DMI of 8.4 ± 1.9 kg/cow/day, 4 farms fed hay with an average of 2.3 ± 1.0 kg/cow/day, 3 farms fed balage with an average of 6.3 ± 0.9 kg/cow/day, 5 farms fed silage with an average of 4.3 ± 2.2 kg/cow/day. Only 11 farms fed a concentrate with 3.2 ± 2.0 kg/cow/day.

Seventeen farms consulted a nutritionist for review and rebalancing of their feed rations at least once per year. Five farms reviewed rations less than monthly while 1 farm reviewed them quarterly. Eleven farms reviewed rations at least monthly.

Twenty two farms indicated that when they balanced their feed rations they considered at least one of the following areas: soil analysis, forage analysis, pasture intake, season of the year and price of feed stuffs. Details about the considerations by each farm are shown in Table 5-5. The price of feed stuffs was the most common consideration by farms, which was mentioned by 17 farms. Season of the year and forage analysis were also important when balancing feed rations as was indicated by 16 farms. In addition, 9 farms mentioned pasture intake and 5 farms reported soil analysis to be considered when balancing feed rations. The soil analysis influenced the farmers' decisions of what plants to grow.

5.6 Electricity Use and Future Outlook

The electricity use was often different between the summer and winter But 5 farms reported that electricity use was similar in the summer and winter. Fourteen farms reported that they used more electricity in the summer. Specifically, 9 farms reported that more than 30% more electricity was used in the summer; 5 farms indicated that less than 30% more electricity was used in the summer. On the other hand, 4 farms indicated that they used less electricity in the summer. To be specific, 1 farm reported that they used more than 30% less electricity in the summer compared to the winter and 3 farms reported that in the summer they used less than 30% less than in the winter.

There were limitations for growth on 22 farms. The reported major limitations are shown in Table 5-6. Only 1 farm indicated they were still growing and did not see any major limitations. The average number of reported limitations for each farm was 3 ± 2. The most important limitations were high purchased feed price, low milk price and land availability. A limited customer base was a limiting factor on one farm, which marketed their milk by themself. Simply no desire to grow was reported by one farm. That pasture-based dairy farming was too much work or low reproductive performance were not reported by any farm.

Among the 23 farms, 5 farms indicated that they planned to obtain more cows and improve efficiency. An additional 5 farms said they were not sure about expansion with one respondent reporting that if they expanded they would go to a more confined system. Moreover, 7 farms reported a desire to keep the same pasture-based model, with 2 of them indicating that they will decrease cow numbers but will maximize the use of grass, and improve the quality of grass. In addition, 2 farms wanted to purchase more land if possible. The other farms just wanted to survive and make a living.

Due to the currently high feed prices, 7 farms indicated that they wanted to use more grass and to make a higher quality of balage in the next several years. Another 7 farms expressed that they will keep the same pasture use and try to maximize the benefits from pasture. An additional 1 farm reported that because of the long distance to the milking parlor, they would keep the same pasture use. Finally, 5 farms wanted to use less grass since they were limited on acreage were thinking of using more confinement in the future.

Table 5-1. Ways the paddocks were laid out

Characterizations	# farms for lactating cows	# farms for dry cows
Fixed size lots only	14	16
Center pivot + traditional pie chart	5	5
Fixed + center pivot + traditional pie chart	2	0
Center pivot double circle	1	1
Does not apply	1	1

Table 5-2. Types of grasses and forages used on farms

Type	Grass/forage	# farms			Total (Hectares)	
		Mixture (%)[7]	Pure[8]	Unknown[9]	Irrigated	Non-irrigated
		Cool season annuals				
CA[1]	Annual ryegrass	7 (55 ± 16)	2	2	747	206
CA[1]	Arrow leaf clover	1 (7.5)	0	0	25	6
CA[1]	Cereal rye	1 (50)	0	0	141	20
CA[1]	Crimson clover	0	0	2	202	0
CA[1]	Oat	5 (43 ± 7)	6	2	793	174
CA[1]	Rye	0	2	0	20	26
CA[1]	Triticale	0	1	0	145	0
CA[1]	Wheat	0	1	0	42	48
		Cool season perennials				
CP[5]	Red clover	1 (7.5)	0	0	25	6
CP[5]	White clover	1 (33)	0	0	0	53
		Warm season annuals				
WA[3]	Corn	0	8	0	947	0
WA[3]	Crab grass	0	0	4	356	11
WA[3]	Pearl millet	0	3	0	153	16
WA[3]	Sorghum	0	7	0	661	218
		Warm season perennials				
WP[2]	Argentine bahiagrass	6 (32 ± 21)	2	0	38	1,436
WP[2]	Coastal bermudagrass	8 (50 ± 29)	3	0	240	385
WP[2]	Common bermudagrass	4 (43 ± 25)	1	4	413	1,804
WP[2]	Florakirk bermudagrass	0	1	0	48	22
WP[2]	Jiggs bermudagrass	1 (50)	0	1	222	808
WP[2]	Limpograss	0	1	1	222	747
WP[2]	Pensacola bahiagrass	4 (27 ± 9)	2	0	210	145
WP[2]	Stargrass	3 (57 ± 35)	2	1	250	2,947
WP[2]	Tifton 85 bermudagrass	2 (43 ± 11)	3	3	540	78
WP[2]	Tifton 9 bermudagrass	0	1	0	12	47
		Native perennials				
NP[4]	Panicum	0	0	3	251	0
		Unspecified				
UNS[6]	Smut grass	1(25)	0	0	0	1,042

[1]CA = cool season annuals
[2]WP = warm season perennials
[3]WA = warm season annuals
[4]native perennials
[5]cool season perennials
[6]unspecified
[7]grown with other grass or grasses with a known mixture rate
[8]grown one kind of grass only
[9]grown with other grass or grasses with an unknown mixture rate

Table 5-3. Crop sequence applied on farms

Crop sequence	# farms	# total hectares
Corn, sorghum, oats	3	244
Corn, sorghum	2	364
Corn, corn, pearl millet	1	32
Corn, corn, rye	1	51
Corn, pearl millet	1	81
Annual ryegrass, corn, sorghum, wheat	1	42
Annual ryegrass, sorghum, wheat	1	48
Annual ryegrass/oats, pearl millet, annual ryegrass/oats	1	36
Rye, pearl millet	1	20
Oats, sorghum	1	31

Table 5-4. Irrigation methods

Irrigation methods	Paddocks (# farms)		Cropland (# farms)	
	Effluent	Fresh water	Effluent	Fresh water
Center pivot	4	9	5	7
Stationary gun	1	0	0	0
Travelling gun	4	1	6	3
Hand hose	1	0	1	1
Moving line	0	1	0	0
Others	1	1	0	0

Table 5-5. Considerations for balancing feed rations

Considerations	# farms
Forage analysis, season of the year and price of feed stuffs	5
Soil analysis, forage analysis, pasture intake, season of the year and price of feed stuffs	4
Season of the year and price of feed stuffs	3
Forage analysis, and price of feed stuffs	2
Forage analysis only	2
Forage analysis, pasture intake, season of the year, and price of feed stuffs	2
Soil analysis, pasture intake, season of the year, and price of feed stuffs	1
Forage analysis, and pasture intake	1
Pasture intake and season of the year	1
Price of feed stuffs only	1
None	1

Table 5-6. Major limitations for growth of the farm

Growth limitations	# farms
High purchased feed price	13
Low milk price	10
Land availability	10
Do not want to borrow any more money	6
Lack of borrowing capacity	5
Environment regulations	4
Grass quality	2
Lack of owned capital	2
No desire to grow the farm	1
Low milk production	1
No successor	1
Hard to find experience employees	1
Limited customer base	1
Too much work	0
Low reproductive performance	0

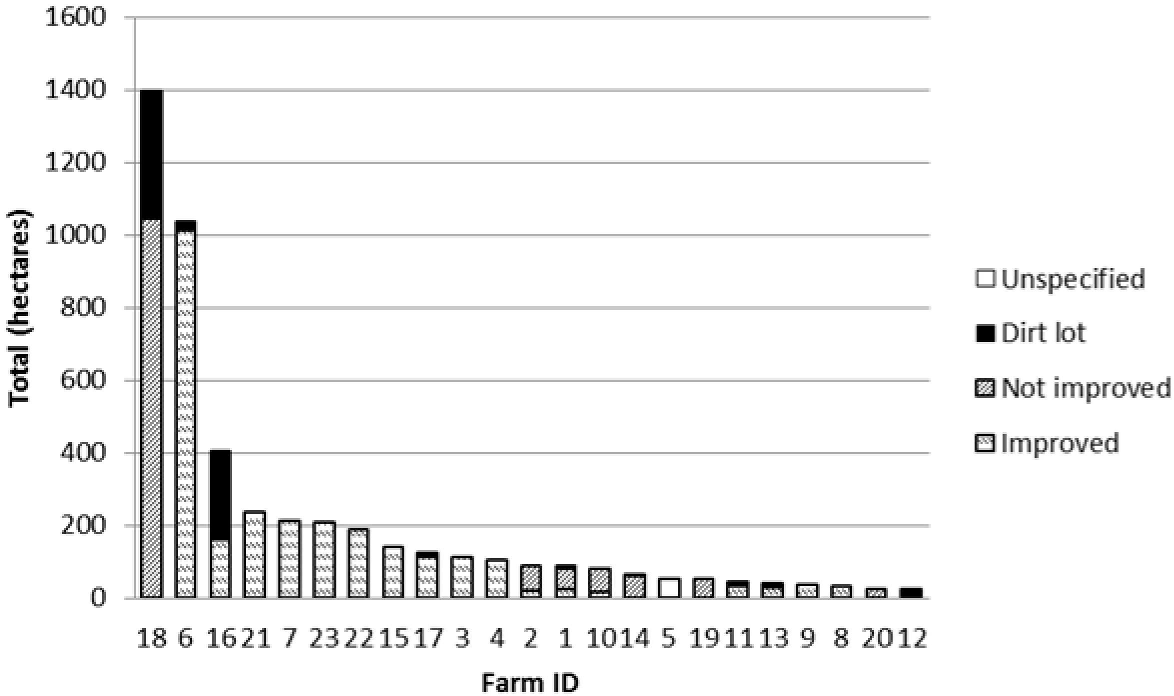

Figure 5-1. Land usage in each farm

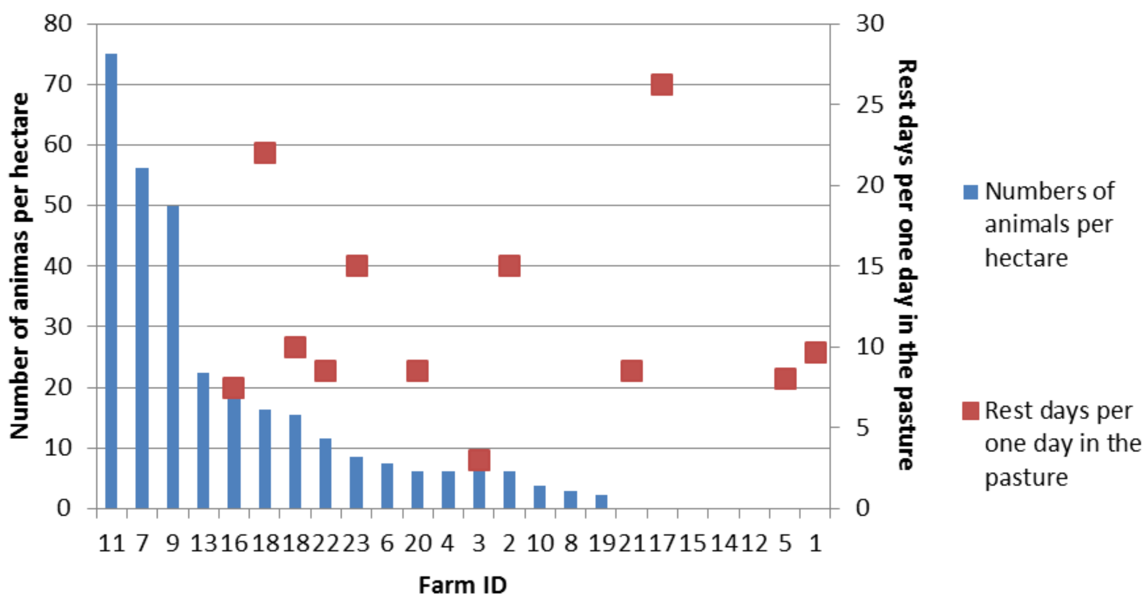

Figure 5-2. Stocking density and pasture rest period (days)

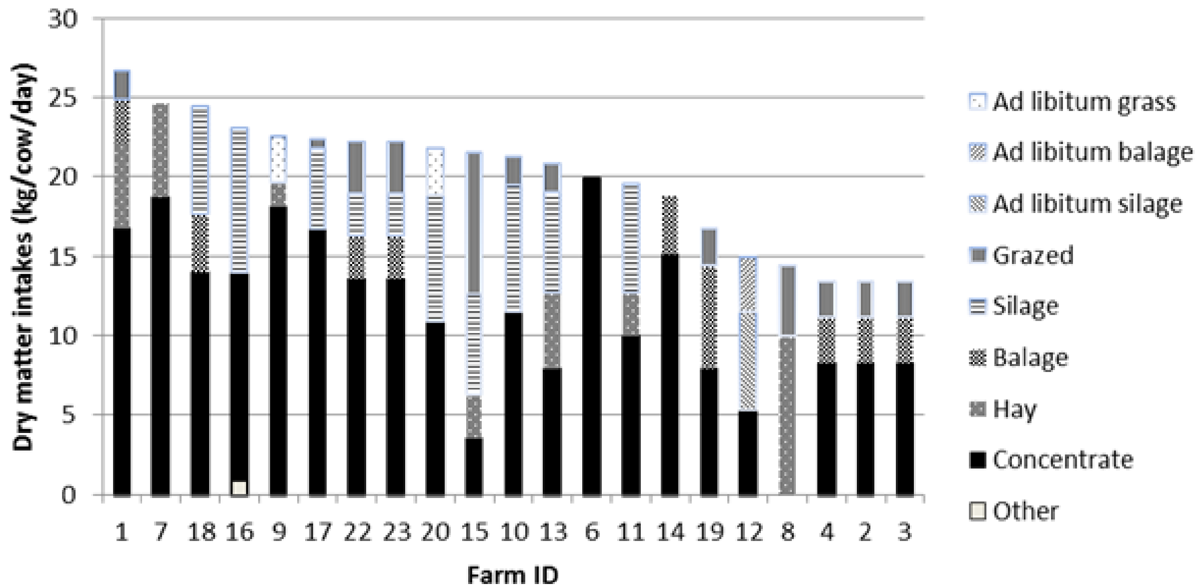

Figure 5-3. Total dry matter intake for lactating cows in winter

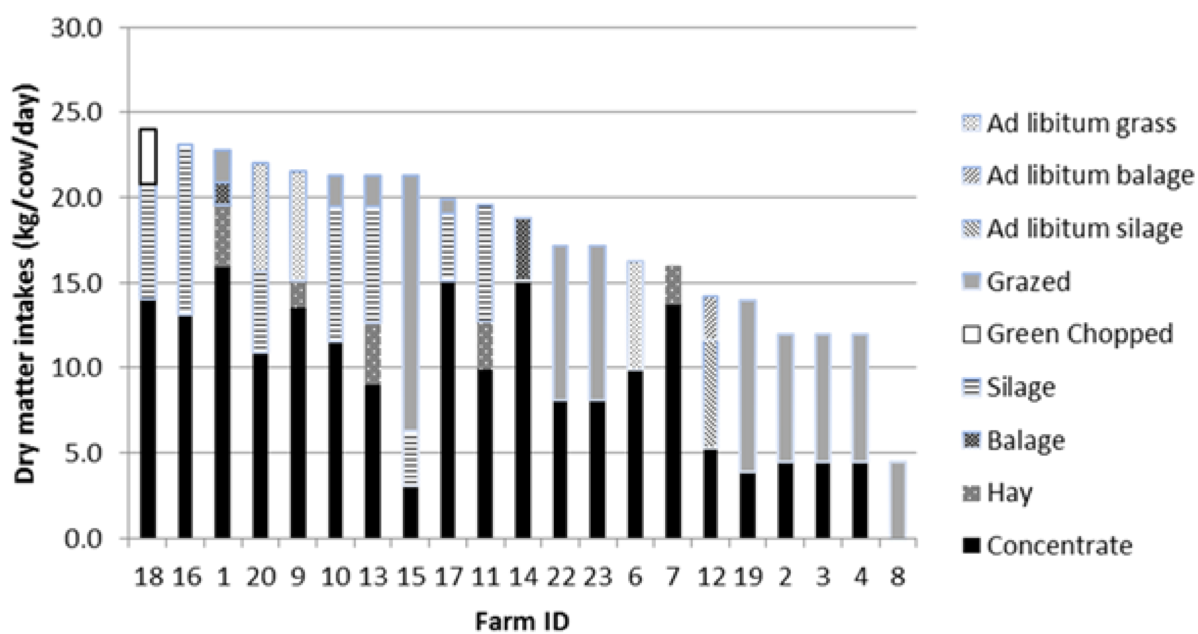

Figure 5-4. Total dry matter in take for lactating cows in the summer

CHAPTER 6
DISCUSSION

6.1 Survey Participation

The objective of the study was to characterize pasture-based dairy farms in Florida and Georgia with regards to milk production, reproduction, facilities, cattle breeds, cow nutrition, and pasture management. A survey form was developed with the intent to conduct personal interviews via farm visits to obtain the greatest participation and clarify questions and answers. Each interview lasted approximately 1.5 hours and participants were offered $100 for a completed survey.

Farmers were less willing to participate than expected due to numerous time constraints. In the end, survey results were obtained from 23 farms: 18 from Florida and 5 from Georgia. The survey covered a total of 28,768 cows; which represented about 15% of the total number of cows in Florida and Georgia. Some participants from Florida reported as a single farm in the survey, although this “single farm” was actually a group of similar farms with similar management practices and the same owner or upper management but at different locations. Therefore more than 23 locations were included. Given lists obtained from the Florida Extension personnel, approximately 50% of the pasture-based farms in Florida were likely included. The participation rate for Georgia was much lower. Therefore, the survey results may not be as accurate a representation of pasture-based dairy farms in Georgia. On the other hand, no major differences in the characteristics of pasture based dairy farms in Florida and Georgia are expected.

Low participation in DHIA and lack of concrete knowledge about production measures, such as reproductive performance, illustrates the perception that record keeping at pasture-based dairy farms is not a priority. As a result, many farms either could not report production measures, or gave rough estimates.

6.2 Cattle Breeds, Genetic Selection, and Culling

The survey results on cattle breeds were in agreement with the literature on grazing farms. Approximately 95% of dairy operations in the U.S. had at least one Holstein cow (NAHMS, 2007). Our survey results showed that 74% (17 farms) had at least one Holstein cow which number is lower.

In the NAHMS (2007) report, Holsteins represented around 90% of all cows. In our study, 71% of all cows (n = 20,328) on the 23 farms were Holstein. In our survey, 93% of all cows reported some Holstein genetics. Gay (2012) only reported that 70% of all farms included in his grazing survey reported at least some Holstein genetics. Both NAHMS (2007) and Gay (2012) reported the second largest breed was Jerseys. The results from a dairy grazing practice survey in Wisconsin (Paine, 2013) stated that the largest group was pure breed Holsteins (62%), but the second largest group was cross-breeds (27%) Among the 23 farms in Florida and Georgia, the pure breed Holstein was the largest group and represented 71% of the total cows included in the survey. The second largest group was cross-breeds and the third one was Jersey. It was similar to the results from Paine et al. (2013).

Probert (2013) reported that the most important trait of genetic selection considered by pasture-based producers was reproduction, followed by body size, udder health, longevity and feet and legs respectively. Gay (2012) ranked traits considered by grazing producers from most to least important, as longevity, udder composition, and feet and leg. Reproduction ranked 6th.But the results from our survey showed that farmers preferred reproduction and longevity first, followed by milk volume, udder composition and feet and legs. Thus, selection criteria differed from the literature.

The annual cull rate varied greatly between farms and (cross) breeds in in our study. The annual cull rate for each breed was lower than the average annual cull rate of 34% as reported by De Vries (2009) for all Florida farms participating in DHIA. The average annual cull rate regardless of breed was 22% which is higher than Gay's (2012) was average cull rate of 18%. Pasture-based dairy farms appear to have lower cull rates than confined dairy farms.

De Vries (2009) further reported that reproduction problems was the most often cited culling reason for herds participating in the DHIA program. Additionally, Pinedo et al (2010) indicated that death, reproduction, injury or other, mastitis, and low production were the top 5 reasons for culling in a similar data set. Also, Gay (2012) reported that the top culling reasons in grazing farms were fertility, high somatic cell count, low production, and feet and legs problem. Although, Smith et al. (2000) reported death losses were high in South, the death losses in our study were not high. Reproduction or failure to get pregnant has been frequently reported as a primary reason for culling, followed by low milk production, udder composition, and feet and leg problems in our study. These results were very similar to national results from Gay (2012).

6.3 Milk Production and Milk Quality

Results for milk production and milk quality were generally in agreement with the literature on grazing farms. The rolling herd average milk yield among the 19 farms that reported results was 7,671 kg/cow, which was lower than the reported nationwide milk production of 9,702 kg/cow, and lower than the Florida average milk production of 8,667 kg/cow, and lower than the average Georgia milk production of 8,343 kg/cow (USDA-

NASS, 2011). But out result was higher than the milk yield among all breeds on grazing dairy farms in Wisconsin, which was 7,005 kg/cow/year (Paine, 2013). The average milk yield per cow per day in the study was 22.1 kg which is similar to Gay's (2012) result of 21.3 kg/cow/day

The average reported SCC in the summer and winter among the surveyed farms was 368,130 cells/ml and 249,826 cells/ml, respectively, which were higher than the 237,320 cells/ml in summer, and 233,420 cells/ml in winter as reported by Gay (2012). Especially milk quality in the summer was worse. This result is likely caused by the more humid and hotter weather in Southeast.

The mean SCC of the surveyed farms, regardless of season, was 308,978 cells/ml, which was higher than either the Florida mean SCC (267,000 cells/ml) or the Georgia mean SCC (280,000 cells/ml), and much higher than the national average SCC (200,000 cells/ml) (Norman, et al., 2013).

6.4 Reproduction

Most pasture-based dairy farms calved seasonally with an emphasis on late fall calving. Most of them had a no breeding time so these farms were deliberately seasonal. The calving problems in the summer and failure to get cows pregnant were the most common reasons not to inseminate. In addition, some farms targeted the calving pattern to match grass availability by matching peak milk production with grass growth in the spring and summer.

The major breeding method was NS. Many farms used a bull, either immediately after the voluntary waiting period, or after an unsuccessful AI period. This strategy was also reported by Washburn et al. (2002b) for grazing farms. One farm began using a bull before 80 days after calving in our study.

Reproductive performance of the surveyed herds during the main breeding season was on average good as could be expected for farms that use pasture to graze cows. Conception rate in the primary insemination season was 58 ± 17% in our study,). Results for the Wisconsin grazing study were not available. Following to the average insemination rate (44%) and conception rate in the primary insemination season, the pregnancy rate can be calculated at 25% from our study. This result is much higher than the winter pregnant rate, of 18% in Florida and Georgia DHIA in 2002 (De Vries and Risco, 2005).

6.5 Feed Intake

There were large variations in the objectives for their pastures among the survey farms. It appeared from the farm visits that several farms used the paddock primarily as a holding area and just put the cows on it for several hours per day. Grass intake was not a goal for these farms. Other farms managed grass really well and applied a grazing rotation management. Cows on these farms spent most of the time on the pastures. These farms provided concentrate based on grass availability.

In our study, 12 farms allowed lactating cows to graze on pasture in both the summer and winter. All farms made their own balage and silage. Grazed grass was often not a major feed source, however. For lactating cows, 71 ± 28% of the dry matter intake came from stored feed in the summer and 90 ± 11% came from stored feed in winter.

Farms were not clear enough about the how much their cows ate when they were on pasture. Dry matter intake might have been be estimated by farmers which could be far from the truth.

6.6 Electricity Consumption and Future Prospects

Annual patterns in electricity usage varied remarkably with some farms using significantly more and other farms using significantly less electricity in the summer. Some farms used more electricity in the winter because they had more cows to milk. Other farms used more electricity in the summer due to more irrigation and cooling.

The major limitations for future growth were high purchased feed costs and low milk price. Some farms wanted to expand with pasture-based farming where others looked into more confined systems. This survey highlighted the large variation that exists among pasture based farms in Florida and Georgia. It is unclear from this study if the variation in management practices resulted from a lack of knowledge or other constrains that prevented implementation of best pasture-base practices. Future research might investigate the greatest needs that pasture-based farms have regarding education and support. Future research might also determine the effect of various practices on profitability and lifestyle.

CHAPTER 7
CONCLUSIONS

Genetic selection, culling reason, milk production and reproduction, pasture management and utilization, grass varieties, fertilizer practices, feed management, all varied widely among pasture-based dairy farms in Florida and Georgia. However, average results regarding breeds, milk production and reproduction were in agreement with results for grazing-based dairy farms elsewhere in the U.S.

It is unclear from this study if the variation in management practices resulted from a lack of knowledge or other constrains that prevented implementation of best pasture-base practices. Survey results will help direct subsequent research and extension programs to gather more information, help promote sustainable agriculture and meet farmers' education needs through university Extension. Future studies should also focus on financial performance to describe the development potential of pasture-based dairy farms.

APPENDIX
SURVEY

Southeast Sustainable Dairy Farms Project: Practices Survey 2012

version 10/8/2012

This survey is being conducted by the University of Florida, University of Georgia, and Fort Valley State University to identify current production and grazing practices on dairy farms in the Southeast. Participation in the study is **voluntary**. All answers to questions in this survey will be kept **strictly confidential.** Your data will only be used in summarized results. Individual farm information will not be identified in any publication. **All producers who complete a survey will receive a $100 reward.** Thank you for participating. University of Florida, IRB Exemption of Protocol #2012-U-0206.

We welcome your comments and suggestions. Contact information:
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Dr. Mohammed Ibrahimm 478-825-6815 ibrahimm@fvsu.edu (Fort Valley State University)

ENUMERATOR:

DATE OF SURVEY: SURVEY STARTING TIME: SURVEY ENDING TIME:

FARM:

A. FARM BUSINESS STRUCTURE

A.1. What is the name and address of the farm?____

____

A.2. What is your name? ________________________

A.3. How are the areas of responsibility divided among management? For example, areas are herd management, pasture management, cow health, nutrition, record keeping, young stock, reproduction.

____

____

____

A.4. What is the farm's business structure?
☐ Partnership
☐ Sole proprietorship
☐ Corporation
☐ S Corporation
☐ Limited Liability Company (LLC)
☐ Other: ____________________

A.5. How many full time employees does the farm have? A full time employee works about 50 hours/week. Please add up your part-time employees. For example two employees that work each 25 hours/week equals one full time employee.

Number of full time employees: ____

B. YOUNG STOCK

B.1. How do you obtain your replacement heifers?

☐ We raise our own young stock
☐ A heifer grower raises our own young stock
☐ We sell our young stock and buy our own heifers back
☐ We sell our young stock and buy other heifers
☐ Other: ___________________

B.2. How many young stocks (calves and heifers) were on average on the farm in the past year? ______________

B.3. Describe any major changes in how young stock was raised or the number of young stock on the farm in the past year.

____

____

____

B.4. What is the average age at first calving of your heifers? ___________________

B.5. What is calving pattern of heifers (animals that calve for the first time)?

Month with most # calvings: __________ Month with least # calvings: ____________

Description of calving pattern: ____

____

____

B.6. What is the main reason(s) for this heifer calving pattern?

____

____

____

C. HERD MANAGEMENT

C.1. Describe how many purebred and crossbred dairy cattle are in your dairy herd and the annual cull rate of each of the breeds. (For example: Jersey, Holstein, Brown Swiss, Holstein male x Jersey female, or a three-way cross of Holstein, Jersey, and Swedish Red)

Breeds	Number	Annual cull rate

C.2. Describe any major changes in the number or breeds of cows in the past year?

____

____

____

C.3. What are your top 3 reasons for culling? Please rank them from 1 to 3 where 1 = most important and 3 = least important.

______ Disease
______ Low milk production
______ Failure to get pregnant
______ Death
______ Other: ______________________________
______ Mastitis
______ Feet and leg problems
______ Bad udder composition

C.4. How do these culling reasons vary for your breeds?

____

____

C.5. How many times are cows being milked per day? _________ times/day

C.6. Do you use the following in your milking procedures?

☐ Wash udders
☐ Pre dip
☐ Dry or wipe
☐ Automatic removal of machine
☐ Post dip
☐ Other: ______________________________

C.7. What is your average herd milk production and somatic cell count in the winter and summer? The winter is approximately from Dec. 21 to Mar. 20 and the summer is approximately from Jun. 21 to Sep. 20.

	Winter	**Summer**
Milk production (lbs/cow/day)		
Somatic cell count (cell/ml)		

C.8. What is your rolling herd average (lbs/cow/year): __________________________

C.9. What are your 3 most important breeding goals? Please rank them from 1 to 3 where 1 = most important and 3 = least important.

______ Milk volume
______ Fat
______ Protein
______ Reproduction
______ Calving ability
______ Feet and legs
______ Other: __________________
______ Body size
______ Udder composition
______ Longevity
______ Net merit dollars
______ Fluid merit dollars

C.10. How do the main breeding goals vary for your different (cross) breeds?

____

____

____

C.11. What is the calving pattern of cows (animals that calve for the second or greater time)?

Month with most # calvings: __________ Month with least # calvings: ____________

Description of calving pattern: ____

____

C.12. How does this calving pattern of cows compare to calving pattern of heifers? For example, heifers may start calving 1 month before cows start calving in the fall.

____

____

____

C.13. How does season affect your reproduction program?

The main insemination season is from ____________________ to ____________________

____

____

C.14. What is the reproductive performance of your cows? For example, 50% heat detection rate, 40% conception rate, and 20% 21-day pregnancy rate.

Main insemination season: ______________________________

Outside insemination season: ____________________________

	Main breeding season	**Outside breeding season**
21-day service rate = heat detection rate		
Conception rate		
21-day pregnancy rate		

C.15. Is there any time of the year you do not inseminate cattle?

☐ No

☐ Yes, during these times and for these reasons we do not inseminate cattle:

Reasons are for example:

> 1. Lower pregnancy rate; 2. Quality and quantity of grass 3. Feed availability; 4. Time off or vacation; 5. Labor availability; 6. To produce more milk in cool season; 7. Calving problems in the summer; 8. Other: ____________________

Time you do not breed cattle: ____

Reasons: ____

____

____

C.16. Please provide a breakdown of the reproductive management program that is used to inseminate your cows in each season. For example, estrus synchronization (**SYN**) and timed artificial insemination (**TAI**), 2nd service with heat detection and artificial insemination (**EAI**), and after that natural service bulls (**NS**).

Cows	**Reproduction management program**
Main insemination season	
Outside insemination season	

C.17. Do you use sexed semen and/or embryo transfer? If yes, how?

____

____

____

C.18. What kind of heat detection aids do you use on cows?

☐ None ☐ KMAR
☐ Tail paint/chalk ☐ Pedometers
☐ Other: ______________________________

C.19. Describe the time budget of cows in different seasons (hours/day).

	Lactating cows		**Dry cows**	
	Winter	**Summer**	**Winter**	**Summer**
Dirt lot				
Grazing paddocks				
Feeding barn				
Free stall				
Holding area + milking parlor				
Cooling pond				
Under trees				
*Other**				
Total	24 hours	24 hours	24 hours	24 hours

Other*: ____________________________

C.20. What types of <u>outside</u> cooling systems are in place for cows?

	Winter						**Summer**					
	No Cooling system	Cooling Pond	Under Center Pivot	Under Shade Cloth	Under Trees	Other* ———	No Cooling system	Cooling Pond	Under Center Pivot	Under Shade Cloth	Under Trees	Other* ———
Lact. cows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dry cows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Other*: ____________________________

C.21. What cooling system do you use <u>inside</u> the holding area, milking parlor and/or the barn? Winter is the cool season including parts of fall and spring, summer is the warm season including parts of spring and fall.

		Winter					Summer				
		No cooling	Fans with sprinkler	Showers in the exit lane	Fans only	Other* ____	No cooling	Fans with sprinkler	Showers in the exit lane	Fans only	Other* ____
Holding Area		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Milking Parlor		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inside barn	Dry cows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Lactating cows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Other*: ___________________________

C.22. Is the farm participating in a Dairy Herd Improvement Association (DHIA) program?

☐ No
☐ Yes, how often: ________________;
- ☐ Milk
- ☐ Fat
- ☐ Protein
- ☐ Somatic Cell Count

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D. PASTURE AND CROP MANAGEMENT

D.1. How many acres of the following areas does the farm have? Acres

Improved grass paddocks: grass selected and maintained. ___________

Not-improved grass paddocks: no selection of grass and used. ___________

Dirt lot: a lot with minimal grass growing. ___________

D.2. How much of the total acreage is for grazing paddocks? __________________ Acres

D.3. What is the average size of a paddock?

Milking cows: __________________ Acres

Dry cows: __________________ Acres

D.4. How many permanent paddocks (no moving fence line) are on the farm?

D.5. How many variable sized paddocks (with moving fence line) are on the farm?

D.6. How are the paddocks laid out?

	Fixed sized lots	**Center pivot + Traditional pie chart**	**Center pivot Double Circle**	**Other**
Lactating cows	☐	☐	☐	
Dry cows	☐	☐	☐	

Comments: ____

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D.7. What is your management plan for dry and milking cows on paddocks?

	Season	Numbers of animals per acres	Initial turn-in month for grazing	Time spent on each pasture per term (days)	Rest interval between each term (days)	Target turn in grazing height (inches)	Target move out grazing height (inches)	End month for grazing
Lactating cows	*Summer*							
	Winter							
Dry cows	*Summer*							
	Winter							

Comments:

____

____

____

D.8. If there are different management plans within groups of cows on paddocks, please describe them:

____

____

____

D.9. Does the price of purchased feed (concentrates) affect your management of cows in paddocks?

☐ No

☐ Yes, in this way:

____

____

____

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D.10. How do you estimate the height of the grass in the paddocks?

☐ None

☐ Visual estimate; how often: ____________

☐ Pasture stick; how often: ____________

☐ Pasture plate meter; how often: ____________

☐ Other: _________________________; how often: ____________

D.11. How do you provide access to water for grazing animals on paddocks?

☐ None - animals return to milking/housing facilities for water

☐ Use water wagon to transport water to pasture

☐ Water piped to pasture, permanent, year round system

☐ Natural water sources (creeks, springs, streams, ponds, etc.)

☐ Other: _____________________

D.12. Please provide the varieties of grasses and forages grown and how they are used. (I = Irrigated, N-I = Non-irrigated.).

Grass/forage	**Mixture %**	***Acreage***		**Grazed**		**Hay**		**Silage**		**Greenchop**	
		I	***N-I***	**I**	**N-I**	**I**	**N-I**	**I**	**N-I**	**I**	**N-I**
Coastal Bermuda											
Callie Bermuda											
Tifton 85 Bermuda											
Tifton 44 Bermuda											
Common Bermuda											
Stargrass											
Argentine Bahia											
Pensacola Bahia											
Limpograss											
Annual Ryegrass											
Oats											
Triticale											
Wheat											
White Clover											
Red Clover											
Corn Grain											
Corn Silage											
Sorghum											
Pearl Millet											
*Other**											
*Other***											

Other*: ______________________ Other**: __________________________

Comments:

____

____

____

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D.13. In which way and how often do you plant or reseed the winter grasses or forages?

	Types of grasses/forages	How often?
☐ Plant on new bed		
☐ Reseed on new bed		
☐ Over seed on existing growth		
☐ Over plant on existing growth		
☐ Other:		

D.14. What types of pest control are used on your paddocks?
- ☐ None
- ☐ Pesticide
- ☐ Other: ______________________

D.15. What types of weed control are used on your paddocks?
- ☐ None
- ☐ Herbicide
- ☐ Manual (cutting or pulling weeds)
- ☐ Machine (cutting or pulling weeds)
- ☐ Other: ______________________

D.16. Please describe the crop sequences (rotations) that you used on your farm last year from January to December. Then tell us how many acres you have in each crop sequence. (Use a slash (/) to separate main crop and cover crop at the same time. For example: corn, corn, winter rye/white clover)

Crop sequence 1: ____; _________acres

Crop sequence 2: ____; _________acres

Crop sequence 3: ____; _________acres

E. FEEDING MANAGEMENT

E.1. In this part of the survey, we will ask about your feeding management. What is the feed intake from different sources for each different group of cattle in different seasons. Feed intake as fed (AF), or as dry matter (DM).

Feed source from	**Lactating cows (lbs/animal/day)**		**Dry cows (lbs/animal/day)**	
	Winter	**Summer**	**Winter**	**Summer**
Grazed grass				
Green chopped grass				
Hay				
Balage				
Concentrates				
*Other**				

Other*: ____

E.2. How often do you consult an outside nutritionist for review and rebalancing?
________________ times/year

E.3. Which of the following do you consider when you balance your feed ration(s)?
☐ Soil analysis
☐ Forage analysis
☐ Pasture intake
☐ Season of the year
☐ Price of feed stuffs
☐ Other: ________________

E.4. Which of the following do you use for determining the nutrient profile of grass paddocks?
☐ None
☐ Book values
☐ Current sample analysis
☐ Historic sample analysis
☐ Other: ________________________

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F. MANURE AND NUTRIENT MANAGEMENT

F.1. Do you keep written records of where, when and how much manure was applied?

☐ Yes

☐ No

F.2. How often are the commercial fertilizer and/or manure from parlor and barn applied on grass paddocks and/or cropland?

	Paddocks		Cropland	
	Applied	**How often?**	**Applied**	**How often?**
Nothing	☐		☐	
Manure solids	☐		☐	
Manure liquid	☐		☐	
Commercial fertilizer	☐		☐	

F.3. Do you have a certified nutrient management plan, certified by an outside agency, which describes where, when and how manure is applied:

☐ No

☐ Yes, since: year: _______________ and certified by __________________

F.4. How many acres are under the following methods of irrigation?

Method	**Paddocks**		**Cropland**	
	Fresh water	**Effluent**	**Fresh water**	**Effluent**
Center pivot				
Stationary gun				
Travelling gun				
Hand hose				
Moving line				
*Other**				

Other*: ____

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G. Environment and Sustainability

G.1. How much more or less electricity do you use in the summer versus the winter? For example, the farm uses 50% more electricity in the summer.

____

G.2. What are the major limitations for growth of the farm?

☐ Low milk price
☐ Grass quality
☐ High purchased feed price
☐ Low milk production
☐ Low reproduction performance
☐ No desire to grow the farm
☐ Environment regulations
☐ Other: ______________________
☐ Land availability
☐ Too much work already
☐ Lack of owned capital
☐ Lack of borrowing capacity
☐ Do not want to borrow any more money
☐ No successor

G.3. How do farm's plans for next few years affect the way the farm is currently being operated? (Expansion, investments, production and practices, etc.)

____

____

____

____

G.4. Are you going to use more or less grass paddocks in the future? Why?

____

____

____

____

H. COMMENTS

H.1. Do you have any other comments about our survey that you would like to share with us?

____

____

____

____

Thank you!

All answers to questions in this survey will be kept strictly confidential, and the results will only be used to design policies and programs to help dairy farms in the region. Individual farm information will not be identified in any publication. Thank you very much for participation!

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BIOGRAPHICAL SKETCH

Fei Du was born in Beijing, China. In 2004, she entered the Beijing University of Agriculture for Bachelor's degree in Veterinary Science. During her course of study at Beijing University of Agriculture, she was awarded the Outstanding Students Leader Award (2004-2007) thrice, received a Professional Scholarship, and an American Pet Food Institute Scholarship. She also pursued a management and feeder internship (2005-2007) at the Beijing Zoo during the summer. Her senior project at Beijing University of Agriculture focused on developing experiments concerning immunity to astragalus polyose in dogs.

Three and half years later, she transferred to the University of Tennessee, Knoxville and got her B.S. in animal science Magna Cum Laude in 2010. During the time she studied at the University of Tennessee, Knoxville, she worked at the University Student Center as a student assistant for 3 years and got the Unsung Hero Award. Also, when she graduated, she received a Myron Taylor Myers Scholarship (2010), and was on the Dean's list (2009). After she graduated from the University of Tennessee, she worked for 6 months as a research assistant and focused on Alzheimer disease in the Pathobiology department, College of Veterinary Medicine, at the University of Tennessee, Knoxville.

In 2011, she moved to Gainesville, Florida and began her M.S. in animal sciences at the University of Florida. Upon graduation from her Master's degree, she considers working in the animal agriculture industry.