Early Weaning Performance and Health

John D. Arthington
Associate Professor and Center Director,
Range Cattle Research & Education Center
UF/IFAS
Ona, FL

Most of the research studying the effects of early weaning on cow and calf productivity has come from the mid-west and high-plains regions of the US. At the time of early weaning these producers are often without adequate pasture forage, therefore, their studies have focused on the use of dry lot feeding of the early-weaned calves. In tropical and subtropical regions the availability of forage may extend throughout the year. An opportunity to rear early-weaned calves on high-quality pasture forage should provide important value toward the costs of maintaining an early-weaned calf.

Producers may choose to market early-weaned calves immediately after weaning versus accepting the management of these young animals. In collaboration with agronomists at the University of Florida, we have been investigating the establishment of Calf Nurseries for the rearing of early-weaned calves. Each nursery has a small area (approximately ½ acre) of sod where water, feed, and mineral are offered. To prevent escape of the small, early-weaned calf, as well as exclude wildlife, we secure each nursery using woven-wire fencing. Over the past six years, we have grazed early-weaned calves at an average stocking rate of four to six calves/acre. This stocking rate has proven acceptable despite both dry and wet winters. Optimal stocking rate should be defined as the rate which best utilizes the available forage for maximum animal body weight gain. On non-irrigated land, this target rate is highly dependent upon the amount of effective precipitation received during pasture establishment. Over six consecutive years, we have found a great deal of variability among ryegrass yield (Figure 1) and calf performance (Table 1); however, a stocking rate of four to six calves per acre has proven to be acceptable to achieve rates of body weight gain similar to or greater than the gain achieved by non-weaned calves of a similar age. In each of the studies reported in Table 1, early-weaned calves were provided supplemental concentrate feed at a rate of 1% of body weight. We were not certain of the best rate of supplementation, so we continued to adhere to this level so that results could be compared over multiple years. At an average annual stocking rate of five calves/acre, Calf Nurseries use a minimum of dedicated land. For example, using an early weaning rate of 10% (lactating cows with the lowest body condition) a 500 head cowherd would early wean 50 calves, requiring only 10 acres of land dedicated to the Calf Nursery.

In our system, calves are born in the fall (October / November) and early weaned at the start of the breeding season in the first week of January, at an average age of 70 days. 'Jumbo' ryegrass is established in mid-November. We prefer Jumbo because tests have shown it grows later (approximately 30 days) into the spring compared to 'Gulf'. A complete fertilizer is applied at emergence and again approximately six weeks into grazing. We can expect about 100 days of grazing lasting into April (Figure 1). Ryegrass provides an excellent source of feed for early-weaned calves. In the first couple months of grazing, crude protein will be approximately 20% and *in vitro* organic matter digestibility will exceed 80% (Figure 2). Although ryegrass is rich in nutrients, we have found it essential to provide a concentrate supplement to the early-weaned calves. In the first four years of investigation (2000 to 2003), we used a commercial supplement containing 14% CP and 65% TDN. In 2004 and 2005, we used a lesser expensive commodity blend containing 85% soybean hulls and 15% cottonseed meal. In all years supplement was adjusted monthly to target a rate of 1.0% of body weight. Both supplements provided similar calf performance responses. We have also attempted to grow early-weaned calves on ryegrass without supplement; however, their performance has been much poorer compared to supplemented calves. Further description of

supplementation rates are provided later in this document. Considering the total costs for ryegrass establishment, fertilizer, grain supplement, mineral, and supplies, our overall cost of gain averages between $0.30 and $0.45/lb of body weight gain depending on fixed cost of inputs and stocking rate used.

Although we utilize annual ryegrass or rye-ryegrass blends in our Florida early-weaned calf nurseries, this system will not be practical for all regions of the country. For temperate regions of the United States, other grass varieties should be considered. It is important to note that high-quality forage varieties that may not be tolerant to cow grazing may work well in an early-weaned calf grazing system. Young calves are much gentler on the pasture, consuming forage much like a deer or goat. As well, because the calves are smaller their dry matter intake is much less than a mature cow; therefore, moderate yielding, high-quality forages may be good candidates for use in an early-weaned calf nursery.

Summer Grazing

In our system, a major shortcoming of the management of an early-weaned calf occurs once the winter annual ryegrass dies out in the spring. Once early-weaned calves are moved onto perennial, summer pastures their performance declines rapidly. Our annual ryegrass is grazed out by early to mid-May, leaving a 100-day deficit period until the time of normal weaning (early August). Over six years of investigation performance of our early-weaned calves drops by an average of 25% in the summer versus winter periods. Although performance in the winter is similar among early- and normal-weaned calves, performance in the summer period is usually inferior for the early-weaned calf compared to those left with their dams. This decline in performance often results in a greater overall ADG for normal-weaned compared to early-weaned calves when calculated from January (time of early weaning) to August (time of normal weaning). We attribute this decline in summer performance to the lesser digestibility of our summer perennial pastures compared to the winter annual ryegrass (Figure 2). For Florida producers, these data would support the marketing of early-weaned calves in late April or early May. Historically, calf markets are at their greatest at this time of the year. As well, early-weaned calves are lighter at this time enabling producers to enjoy the benefits of lesser transportation costs.

Joao Vendramini (PhD Dissertation, University of Florida, 2005) used early-weaned calves from our program to assess the effects of varying rates of supplementation on performance during both the winter and summer grazing periods. In his studies, he found that voluntary forage intake (annual rye-ryegrass blend) decreased linearly as rate of supplementation increased from 1.0, 1.5, and 2.0% of body weight. Although body weight gain also increased with increased supplementation, the advantage may not offset the increased costs associated with supplementation (Table 2).

Feedlot Performance of Early-Weaned Calves

Early weaning also has positive implications on the value of calves post-weaning. Researchers from the University of Illinois, have been investigating the effect of early weaning on carcass merit. In their studies, they reported that early weaning improved the percentage of calves grading USDA Choice or higher by over 30% compared to normal-weaned calves. In a comparison of weaning age (90, 150, or 210 days), they found that calves weaned at 90 days tended to produce higher quality carcasses.

In many ranch settings, normal-weaned calves are shipped immediately after separation from the cow. When shipped as a complete group (not commingled) these calves typically perform well, nevertheless, buyers often discount fresh-weaned calves due to the potential for stress-related disease. The use of early weaning, followed by 100 days of winter grazing, produces calves that have recovered from the stress of weaning and understand how to eat. Once received into the feed yard, these calves are likely to have fewer incidences of illness. In a recent study conducted in collaboration with our program and North Carolina State University, we examined the productivity of early- versus normal-weaned calves in the feedlot. In that study, early-weaned calves were lighter at the time of normal weaning (492 versus 611 lb), but gained body

weight at a faster rate during the feedlot receiving period (Figure 3). By day 28, body weight was similar (538 versus 617 lb for early- and normal-weaned calves, respectively). Overall, early-weaned calves gained over 1 lb/d more than normal-weaned calves (Figure 3), despite no differences in daily feed dry matter intake (Table 3).

The most striking response to early weaning in our feedlot study was the significant improvement in feed efficiency (Table 3). We have attributed this response to a lesser inflammatory reaction in early- versus normal-weaned calves in response to the stressors associated with weaning and transport. During normal stress events the early inflammatory reaction results in the production of acute phase proteins. In our study, early-weaned calves had a lesser acute phase protein response following transport and entry into the feedlot. Further, a relationship between plasma acute phase protein concentrations and daily body weight gain was observed in normal-weaned steers during the feedyard receiving period, whereas average ceruloplasmin concentrations were negatively associated with body weight gain in normal-weaned ($P < 0.01$; $R^2 = 0.59$), but not early-weaned ($P > 0.05$; $R^2 = 0.21$) calves. Similarly, average haptoglobin concentrations were negatively associated with body weight gain in normal-weaned ($P < 0.01$; $R^2 = 0.40$), but not early-weaned ($P > 0.05$; $R^2 = 0.10$) calves. Other researchers have shown that feeder calf plasma haptoglobin concentrations, upon entry into the feedlot, are positively associated with the incidence of morbidity and subsequent number of medical treatments required.

General Healthcare of the Early-Weaned Calf

One common question related to weaning calves at this young age is health status. It is understandable that one would be concerned with the viability of calves of this age. In fact, ranch-derived calves at 50 to 90 days of age have a very high health status. This is related to the passive immunity that they obtained from their mothers through colostrum. This colostrum provides important immunity to calves of this age. In comparison, calves of normal weaning age (6 to 8 months) have little to no remaining passive immune protection. If normal-weaned calves are not properly vaccinated they will be more susceptible to succumbing to disease at the time of weaning compared to 50 to 90 day old early-weaned calves. We do not recommend vaccinating calves at the time of early weaning, as the vaccine will likely be neutralized by the calf's own passive immunity. Early-weaned calves should be vaccinated according to the same schedule used for the normal-weaned calves in the herd. One exception to this rule relates to producers that may "gather" early-weaned calves from multiple sources. In this situation, the producer often does not know the health status of the herds from which the calves are sourced. Further, the stress of transport and commingling may elicit the onset of disease. In these situations the producer should work with their veterinarian to develop a health-care plan that will take into consideration the balance between disease pressure and immune protection.

One important difference that we have noticed in early-weaned calves is their susceptibility to internal parasites. We typically treat our early-weaned calves for internal parasites twice during the 200-day grazing period. By following this management schedule, we have noticed significant improvements in calf body weight gain following anthelmetic treatment.

Summary of Important Concepts

1. Early weaning must occur prior to the start of the breeding season to gain the full reproduction benefits associated with this management practice. Calves should *not be less than 50 days of age* at the time of early weaning.

2. Early-weaned calves grow well on high quality annual pastures such as ryegrass, when provided supplemental grain at a rate of 1% of body weight. When high-quality pastures are not available, early-weaned calves will require access to greater rates of a high-quality supplemental concentrate. At the time of early weaning (50 to 90 days of age), the crude protein requirement of the early-weaned calf diet may be as high as 20% on a dry matter basis.

3. If planning to ship at the same time, vaccinate the early-weaned calves on the same schedule as the normal-weaned calves. Calves should not be vaccinated at the time of early weaning, as the vaccine

will be neutralized by the calf's own passive immunity. Early-weaned calves are highly susceptible to internal parasites. Consider anthelmetic treatment every 50 to 60 days.

4. In our experiences in Florida, we have been unable to maintain the high growth rate of the early-weaned calf into the summer. Depending on the region of the country, producers should carefully examine their pasture forage options and consider the efficiency of moving the calf to regions closer to feeding and finishing.

5. When received into the feedlot at the time of normal weaning, early-weaned calves have greater feed efficiency compared to normal-weaned contemporaries. This is an important production response for producers to consider when evaluating retained calf ownership opportunities.

6. Early-weaned calves have been shown to have carcasses of greater USDA quality score compared to normal-weaned contemporaries. This response is likely the result of being placed onto concentrate diets at an earlier age. Our early-weaned calves have similar USDA carcass quality scores as normal-weaned calves when grazed on pasture until the time of normal weaning,

Acknowledgments

The following individuals, companies, and agencies have provided invaluable assistance and support for the successful completion of the studies described in this document:

Diamond V, Cedar Rapids, IA
Dr. J. Earnest Minton, Kansas State University
Dr. Jerry Spears, North Carolina State University
Dr. Joao Vendramini, Texas A&M University, Overton (FL PhD Dissertation)
Dr. Lynn Sollenberger, University of Florida, Gainesville
Dr. Paul Mislevy, University of Florida, Ona
Dr. Robert Kalmbacher, University of Florida, Ona
LakeLand Animal Nutrition, Lakeland, FL
Sebastian Galindo, University of Florida, Gainesville (MS Thesis)
Student Interns, Conapec, University of Soa Paulo, Brazil
USDI-NRI, Tropical/Subtrpical Agriculture Research Program

Table 1. Performance of early weaned calves in both winter and summer grazing seasons over six consecutive years (average daily body weight gain; lb/d ± stnd. dev.).[a]

Year	Winter grazing[b]	Summer grazing[b]	Stocking rate, calves/acre	
			Winter	Summer
2000	1.89 ± 0.04	1.21 ± 0.07	3.3	3.3
2001	2.08 ± 0.06	-------	3.3	-------
2002	1.35 ± 0.07	1.31 ± 0.18	4.4	2.4
2003	1.60 ± 0.06	1.34 ± 0.06	4.0	1.2
2004	1.73 ± 0.11	1.48 ± 0.05	6.7	2.0
2005	2.15 ± 0.10	-------	5.3	-------
Average	1.80 ± 0.07	1.34 ± 0.09	4.7	2.2

[a]Calves are approximately 60 to 90 days of age at the time of early weaning. All calves are provided supplemental feed at a target rate of 1.0% of body weight during both grazing seasons. A commercial feed (14 and 65% CP and TDN, respectively) was utilized in 2000, 2001, 2002, and 2003 and a commodity blend of soybean hulls and cottonseed meal (85:15) was used in 2004 and 2005.

[b]Winter and summer grazing periods each are approximately 100 days. Winter grazing always occurred on annual ryegrass. Ryegrass was typically fertilized twice using a complete fertilizer, once upon emergence and again approximately 50 days into grazing. Summer grazing consisted of established limpograss in 2000 (Arthington and Kalmbacher, 2001) and established stargrass in all other years.

Table 2. Performance of early-weaned calves grazing winter rye-ryegrass pastures and supplemented with different levels of concentrate.[a]

Item	Concentrate, % BW			SEM	Response	P =
	1.0	1.5	2.0			
Average daily gain, lb/d	1.63	1.79	1.96	0.07	Linear	< 0.05
Forage OM intake, % BW [b]	1.8	1.3	1.1	0.01	Linear	< 0.01

[a]J.M. Vendramini. 2005. PhD Dissertation. University of Florida – IFAS.
[b]Forage organic matter intake determined on grazing calves by the use of a sustained release bolus containing an indigestible.

Table 3. Effects of early- versus normal weaning age on calf feedlot performance[a].

Period[b]	Early-weaned	Normal-weaned	SEM [c]	*P* =
Receiving				
ADG, lb/d	1.92	0.88	0.22	0.03
DMI, lb/d	12.5	11.6	0.62	0.36
G:F	0.154	0.076	0.010	0.01
Growing				
ADG, lb/d	3.04	2.60	0.11	0.05
DMI, lb/d	19.4	19.6	0.77	0.84
G:F	0.157	0.133	0.006	0.06
Finishing				
ADG, lb/d	3.02	2.91	0.12	0.77
DMI, lb/d	19.2	20.2	0.64	0.33
G:F	0.157	0.144	0.007	0.35
Overall				
ADG, lb/d	2.71	2.76	0.24	0.82
Total BW gain, lb	650	589	20.5	0.10
Total DMI, lb	4,231	4,357	165.2	0.62
G:F	0.154	0.135	0.004	0.02

[a]Early-weaned calves were removed from their dams at 85 d of age. Normal-weaned calves remained with their dams until the day of normal weaning (average age = 300 d).
[b]Receiving diet = d 0 to 28; Growing diet = d 28 to 112; and Finishing diet = d 112 to table values are least square means. ADG = average daily body weight gain.
[c]Largest SEM of least square means (n = four pens/treatment).

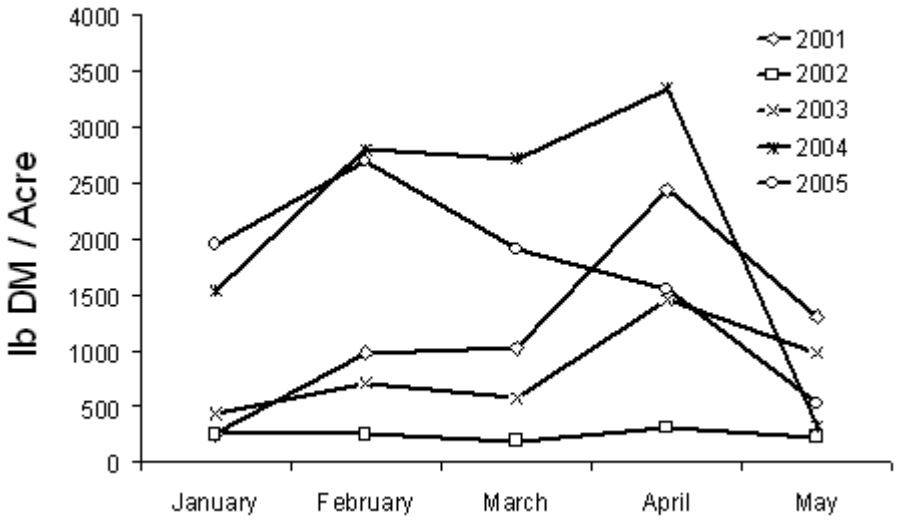

Figure 1. Annual ryegrass availability during the winter grazing months (2001 through 2005). Annual stocking rate = 3.3, 4.3, 4.0, 6.7, and 5.3 calves/acre and Pooled SEM = 333, 81, 108, 133, and 219 for 2001, 2002, 2003, 2004, and 2005 respectively.

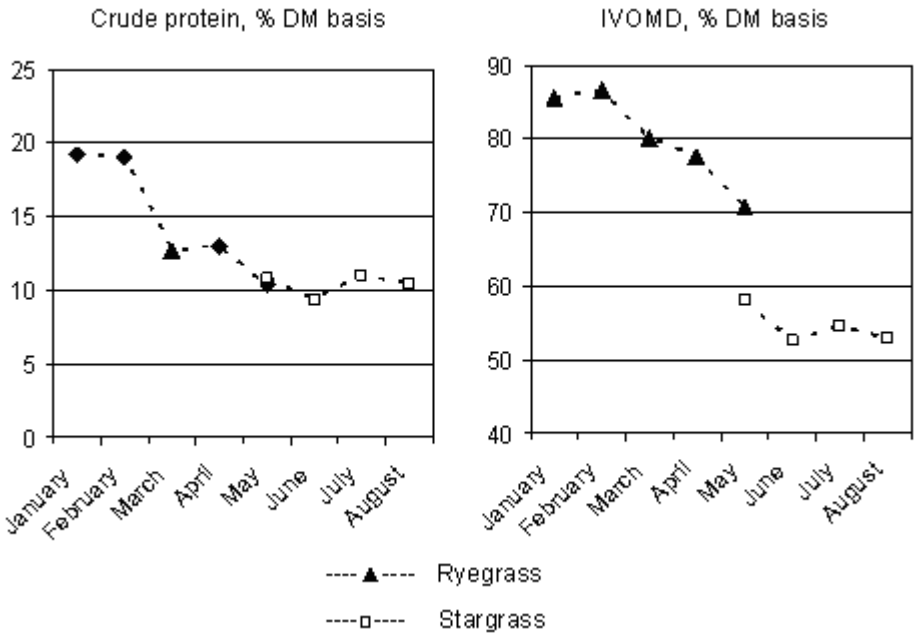

Figure 2. Average ryegrass and stargrass quality over two consecutive seasons (2003 and 2004). Average stocking rate = 1.6 calves/acre. Average SEM = 0.65 and 0.29, and 1.37 and 1.27 for ryegrass and stargrass crude protein and IVOMD, respectively.

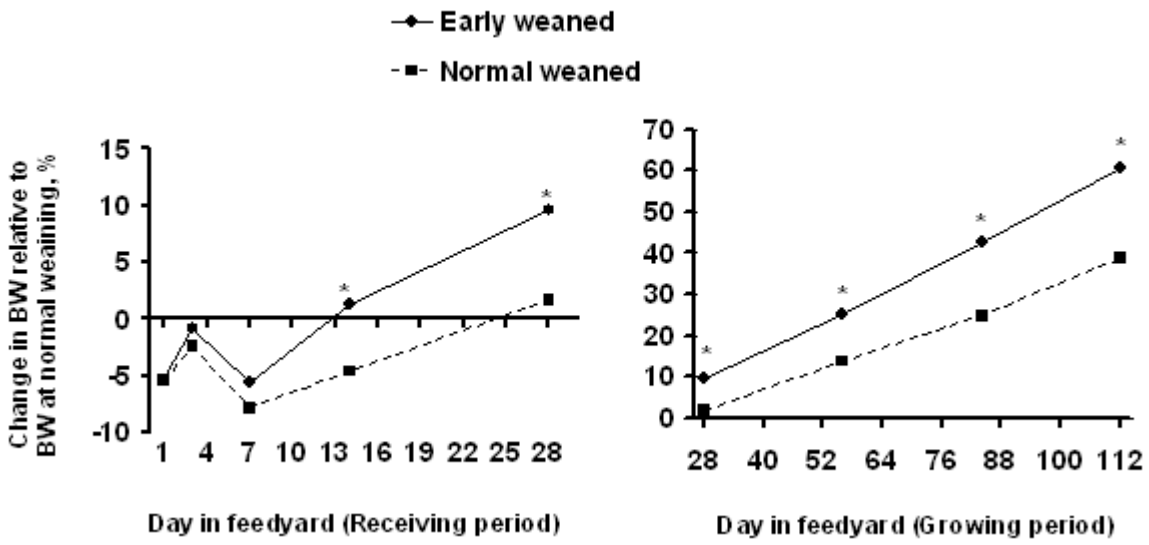

Figure 3. Percent change in body weight relative to weaning weight for early- and normal-weaned calves. Calves were shipped during the first week in August. Early-weaned calves were weaned (early January) and retained on the ranch of origin until the time of normal weaning. Normal weaned calves were shipped the day of weaning.

Notes:

Notes: