INTRODUCTION

Stockering calves in the southern United States has been an economically viable enterprise for many years (Prevatt et. al., 2011b). Historically, the system that yielded the best opportunity for profitability was purchasing lightweight calves in the fall and adding 100 to 200 kg of BW gain until marketing in the spring (Prevatt et. al., 2011a). The value of BW gain was worth more than it cost to put the BW gain on the calves in this system in most years. With the exponential price increases in feed, fuel, and fertilizer during 2008 and the significant increase in cattle prices, it is prudent to reassess the potential for continued profitability in this segment of the beef industry.

SOUTHERN SECTION INTERDISCIPLINARY BEEF CATTLE SYMPOSIUM:
Forage and co-product systems for stockers in the South: Have fundamental shifts in markets changed the optimal system?¹

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ABSTRACT: Stockering calves in the southern United States has been an economically viable enterprise for decades. Historically, the system that yielded the best opportunity for profitability was to purchase lightweight calves (130 kg to 220 kg) in autumn, add 100 to 200 kg of BW gain, and sell them in the spring. In most years, the value of the BW gain was worth more than the cost of BW gain in this system. With the exponential price increases in feed, fuel, and fertilizer during 2008 and the significant increase in cattle prices, it is prudent to assess the potential for continued profitability in this segment of the beef industry. Evaluation of 37 grazing experiments indicated that the forage systems most likely to result in inexpensive costs of BW gain for stocker calves involve tall fescue with legumes or ryegrass with small grains. Even with increased input prices, these systems still yield economical BW gain for stocker calves. Likewise, many diets can be blended to produce ADG of 1 kg using co-products that are abundant across the South. With many of these co-products, the most important performance factor in determining their value is G:F. In several experiments, DMI has exceeded 3% of BW in stocker calves, and the resulting G:F has been less than desirable. Several experiments have reported G:F of 0.13 to 0.16, resulting in economical BW gain, whereas some experiments have reported G:F as low as 0.09, which could result in BW gain that costs more to produce than it is worth. From 1979, the value of BW gain for stocker calves in Alabama has averaged US$1.05/kg. However, in the last 3 yr, the value of BW gain has risen to $2.32/kg. Fundamental shifts in feed, fuel, and fertilizer prices experienced in the United States between 2005 and 2010 have markedly changed the amount of capital needed to purchase several hundred stocker calves and to provide adequate feedstuffs for BW gain. However, the value of BW gain associated with producing feeder calves from those stockers has experienced a concomitant increase. The optimal system still uses high-quality cool-season forages and supplementation with co-product feeds. With this system, a significant margin of profit still exists for the Southeastern stocker cattle production system.

Key words: co-products, cost of body weight gain, forages, stocker cattle, value of body weight gain

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INTRODUCTION

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VALUE OF BODY WEIGHT GAIN

Each week, the USDA Agricultural Marketing Service reports cattle prices for the state of Alabama. Data from these reports were used to calculate the value of BW gain for stocker calves (Prevatt, 2011a). It is important to note that these calculations are based on averages and not on purchasing and selling a particular set of calves. Values used for purchase price were the average Alabama market price for medium and large frame, number 1 muscle steers in the BW range of 181 to 227 kg during the month of October. For selling price, the average for medium and large frame, number 1 muscle steers in the BW range of 317 to 363 kg in April were used. The actual calculation was based on purchasing a 204-kg steer in October and marketing a 340-kg steer in April resulting in 136 kg of BW gain over 180 d. As an example, the average price in October 2010 for a 204-kg steer was $2.56/kg and in April 2011 the average price for a 340-kg steer was $2.70/kg. Purchase price was $522.24/calf and selling price was $918.00/calf. Calculated value of BW gain was ($918.00−$522.24)/136 kg of BW gain. Thus, calculated value of BW gain for this example was $2.91/kg of BW gain (Table 1).

It is important to understand that this calculated value of BW gain is based on average figures. It is certainly possible to purchase cattle for more or less than the average price in October and it is possible to sell cattle for more or less than the average price in April. A major factor affecting profitability in the stocker enterprise is that the calves are purchased in the fall of the year when market prices are typically less as a result of an increased supply of feeder calves being offered at auction markets so that the cow–calf producers do not have to feed and care for them during the winter. In the United States, an estimated 25.8 million calves (72.7% of the total) were born from January 1 through June 30 in 2011, which is similar to most other years (USDA, 2011). Additionally, these feeder calves are generally sold 1 at a time through various auction markets and have had little to no management, such as castration, before this point in their life. As a result of the combined factors above, new crop calves can generally be purchased at a discounted value. After 130 kg or more of BW gain through the winter months, the calves are then sold as uniform lots that fit the modern transportation industry (21,768 to 22,676 kg load lots). Historically, this additional price for uniform lots was $0.065 to $0.13/kg but over the last 5 yr, it increased to $0.11 to $0.22/kg (Prevatt, 2011a). These price increases would equate to a concomitant increase in the value of BW gain ranging from $0.16 to $0.55/kg of BW gain.

Historically, the value of BW gain from October to April during the interval from 1979 through 2010 ranged from $0.53 to $2.91/kg with a mean of $1.05/kg. During the most recent decade (2001 to 2010) the value of BW gain ranged from $0.75 to $2.91/kg with a mean of $1.49/kg (Fig. 1). The value of BW gain for the 5-yr period of 2001 to 2005 was $1.14/kg whereas the value of BW gain from 2006 through 2010 averaged $1.85/kg. Furthermore, the mean from 2008 to 2010 was $2.32/kg and ranged from $1.63 to $2.91/kg. In summary, the value of BW gain associated with purchasing lightweight calves in the fall, managing for 130 kg or more of BW gain, and marketing in the spring has substantially increased. However, the value of BW gain has also become more volatile. Additionally, calculations based on the 2008 to 2010 average of $2.32/kg of BW gain and a conservative $0.13/kg price increase for a load lot (i.e., $0.33/kg of BW gain), this would increase the value of BW gain to $2.65/kg.

### COST OF BODY WEIGHT GAIN

As indicated previously, the stocker cattle system that has yielded the best opportunity for profitability has been to purchase lightweight calves in the fall, get them healthy, and then put on 130 kg or more BW gain by spring. Historically, the forage system used in the South to accomplish this has relied on cool-season forages. The vast majority of the forage acreage used would consist of tall fescue, small grains, annual ryegrass, and/or legumes. Ball and Prevatt (2009) evaluated data from 37 grazing experiments involving stocker cattle at several Agricultural Experiment Stations in Alabama. This analysis was conducted after the rapid price increases in fuel and fertilizer experienced across the United States in 2008. Numerous forage systems were evaluated and ranked based on the pasture costs per kilogram of BW gain. Eight of the top 10 included legumes. The only combination that did not use legumes was rye and ryegrass. Based on the data reported and in-

<table>
<thead>
<tr>
<th>Year, October to April</th>
<th>Value in October, $/kg²</th>
<th>Value in April, $/kg³</th>
<th>Value of BW gain, $/kg⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001 to 2002</td>
<td>2.14</td>
<td>1.58</td>
<td>0.75</td>
</tr>
<tr>
<td>2002 to 2003</td>
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<tr>
<td>2007 to 2008</td>
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<td>0.93</td>
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<tr>
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<td>2.29</td>
<td>2.03</td>
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<td>2.38</td>
</tr>
<tr>
<td>2010 to 2011</td>
<td>2.56</td>
<td>2.70</td>
<td>2.91</td>
</tr>
</tbody>
</table>

1From Prevatt et al., 2011a.
2Value in October was for feeder steers, 204 kg, $/kg.
3Value in April was for feeder steers, 340 kg, $/kg.
4Value of BW gain was calculated by dividing the gross margin (value of 340 kg animal – value of 204 kg animal) by the BW gain (136 kg).
Tall Fescue value of BW gain realized during that same time period. It ADG. ADG for stockers grazing endophyte-infected tall fescue within 3 to 7 yr, depending on the assumptions used to with a growth promotant. Both of these management prac- tionophores, nor in most cases were the cattle implanted with a growth promontant. Both of these management practices have been shown to consistently increase stocker calf ADG.

Tall Fescue

Gunter and Beck (2004) summarized the advantages of novel-endophyte fescue over traditional endophyte-infected tall fescue. They reported stocker cattle BW gains for several southeastern experiments. Combining ADG from fall, spring, and season-long experiments, the overall ADG for stockers grazing endophyte-infected tall fescue was 0.57 kg compared with 0.86 kg for those grazing novel-endophyte tall fescue. As more novel-endophyte fescue is incorporated into stocker grazing systems, it would most certainly offer faster rates of BW gain, and it could potentially decrease the cost of BW gain associated with forage production. Even though there is an establishment cost associated with converting endophyte-infected pastures to novel-endophyte, it has been estimated that the conversion process would break even and begin producing a return within 3 to 7 yr, depending on the assumptions used to calculate all input cost variables (Gunter and Beck, 2004).

Use of clovers in both endophyte-infected and novel-endophyte fescue have been shown to increase animal performance in terms of both ADG and BW gain per hectare (Beck et al., 2012). In addition, clovers can also decrease the cost of stocker cattle BW gain simply because the amount of N they are capable of providing to the system would reduce fertilizer N costs substantially. For example, Ball et al. (2007) indicated that white clover is capable of fixing 84 to 168 kg/ha of N per year. Legumes are high in nutritional quality, but when planted with novel-endophyte fescue, they do not dilute the toxic effects of endophyte but rather supply an additional high-quality forage.

Cool-Season Annuals

The other forage combination that produced economic BW gains but did not include legumes was the rye and ryegrass combination planted on a prepared seedbed. Even though this forage system requires greater N input than a tall fescue and clover system, the stocker BW gains are large enough to offset this additional input cost. In a recent report from Arkansas, Beck et al. (2007) evaluated various small grains and ryegrass combinations for stocker production. A combination of rye and ryegrass yielded the greatest BW gain per hectare as well as the lowest pasture cost of BW gain when compared with all other combinations, including ryegrass or small grains alone. In years in which rainfall is not limiting, it is not uncommon for rye and ryegrass combinations to produce 600 to 700 kg BW gain/ha (Kouka et al., 1994; Beck et al., 2007). Other cool-season annual combinations have been shown to produce economical BW gains in stocker calves as well. In areas where winter-kill is less likely to occur, an oats and ryegrass combination can yield similar BW gains to a rye and ryegrass combination (Myer et al., 2008; Mullinex et al., 2012). Likewise, in some studies ryegrass alone has produced extremely large BW gain per hectare. Beck et al. (2007) reported significantly less BW gain per hectare for ryegrass alone in yr 1 of a 2-yr study but in yr 2, ryegrass alone and all combinations of small grain and ryegrass produced similar BW gains of approximately 700 kg BW gain/ha. Bransby et al. (1999) reported BW gain per hectare of 645 to 898 kg across 2 yr and 4 locations in Alabama for stocker calves grazing only ryegrass.

Many forage systems exist that can provide adequate performance for stocker cattle production in the southeast. It is beyond the scope of this review to evaluate all of these options. As indicated previously, tall fescue and cool-season annuals certainly provide the best opportunities for profitability for producers across the southeastern United States. In general, systems involving tall fescue require less annual input costs than cool-season annuals, and it should be noted that they generally yield less production per hectare than rye/ryegrass systems (Gunter and Beck, 2004; Beck et al., 2007). This specific comparison was evaluated by Beck et al. (2008) in Arkansas over a 3-yr period. In general, BW gain per hectare was greater.
for stocker calves grazing ryegrass than tall fescue. Profitability was least for the system using endophyte-infected tall fescue and similar for novel-endophyte tall fescue and ryegrass.

**Co-products**

In general, the greater number of days that stocker calves can be grazed on forages that produce ADG of 1 kg, the greater the potential for profitability. However, there will always be times of limited forage availability in most stocker production systems. These periods of inadequacy can be managed by supplementation with co-product feeds. In the southeastern United States, numerous co-products are produced. Two general strategies could be used during times of forage inadequacy. The first would involve minimal amounts of supplemental feed, yielding minimal amounts of BW gain. The second strategy would be to feed at a level to produce ADG of 1 kg or greater, similar to the ADG anticipated from the forage system. Both of these strategies can involve considerable expense unless close attention is given to input costs.

When cool-season forage research at the various Agricultural Experiment Stations in Alabama is conducted, the incoming calves are usually held for various lengths of time as forage mass accumulates to adequate amounts for grazing. Evaluation of the Alabama Agricultural Experiment Station data (D. L. Rankins, Jr., unpublished data) from several years indicated that the average length of time was 61 d and the average incoming BW was 236 kg. The 2 general strategies described above yielded the following data: for the first, low-supplement strategy calves were offered grass hay (bermudagrass or bahiagrass) and 1.2 to 2.0 kg/d of soybean hulls; they consumed 5.5 kg/d of hay and had ADG of 0.65 kg. Using the second strategy involving a greater amount of supplementation, cattle were fed various combinations of co-products in a free-choice manner resulting in ADG of 1.12 kg and DMI of 7.75 kg/d. Subsequent BW gain on cool-season forages was 1.15 and 1.11 kg/d, respectively for calves on these 2 strategies. These are not replicated results but a simple compilation of various data accumulated over several years. This information can be further evaluated to assess the potential cost of BW gain associated with these 2 feeding strategies. Current Alabama enterprise budgets indicate that a minimal cost of production for grass hay in the Southeast would be $0.11/kg (Prevatt et. al., 2011c). Using a value of $0.25/kg for soybean hulls, the feed costs per kilogram BW gain would be $1.44 when feeding hay and supplementing with 1.5 kg/d soybean hulls. Feeding the free-choice co-products would result in feed costs of $1.17/kg BW gain, assuming a blended cost of $0.169/kg of feed.

In general, our research has sought ways to use low-cost by-products that would produce stocker cattle BW gains of approximately 1.0 kg/d at an economical cost of BW gain. In the 1990s, the main strategy was to use poultry litter as a feedstuff. Most of this research was published in a review article (Rankins et al., 2002) and can be summarized as follows. A blend of 50% poultry litter and 50% co-product (e.g., soybean hulls, corn gluten feed, hominy feed, wheat middlings) produced ADG of 1.0 kg/d with a G:F of 0.125 to 0.10. When co-products are priced at $0.25/kg, this blend can still produce very economical stocker cattle BW gains.

More recently, we have evaluated other roughage sources to blend with various co-products to achieve BW gain of 1.0 kg/d in an economical manner. In areas where rice mill feed is abundant, it can provide ADG of 1.0 kg and greater when used as 40 to 60% of a diet. Stacey and Rankins (2004) reported ADG of 1.0 to 1.3 kg/d and G:F of 0.09 to 0.12 with varying concentrations of rice mill feed and either cracked corn or soybean hulls. Even with increased feed prices, a blend of 50% rice mill feed and 50% soybean hulls can produce ADG of 1.26 kg with a G:F of 0.09 and result in a cost of BW gain below the value of BW gain discussed earlier.

Kennedy and Rankins (2008) evaluated cotton gin trash and peanut hulls as roughage sources for stocker calves. Both roughage sources were fed at 45% of the total diet and yielded stocker cattle BW gains of approximately 1.0 kg/d. Gin trash produced significantly faster ADG than peanut hulls, primarily because of intake rather than digestibility. This study and a previous study (Rankins and Gamble, 2000) indicated that protein supplementation was beneficial with peanut hull-based diets, but gin trash-based diets were apparently adequate in protein content (i.e., no response to protein supplementation).

Many co-products have been evaluated as energy sources for stocker calves in the southeast. Poore et al. (2002) presented a summary on the use of soybean hulls, corn gluten feed, and wheat middlings for backgrounding beef calves. Numerous reports have shown that soybean hulls are equal to or greater than corn in providing energy to beef cattle consuming forage-based diets or diets based on the by-products described above (Allison and Poore, 1993; Garces-Yepez et al., 1997; Gurung and Rankins, 1998). Likewise, wheat middlings, corn gluten feed, and dried distillers grains can provide valuable energy sources for stocker calves. Wheat middlings have a greater potential for eliciting acidosis whereas corn gluten feed and dried distillers grains could contain S concentrations in excess of 0.5%. Diets containing greater than 0.4% S are capable of inducing polioencephalomalacia in growing calves. There are numerous research reports that describe the value of many co-products that are currently available. However, the biggest factor in use for stocker cattle production is price. Many of these co-products have seasonal price trends. During a calendar year, the price of soybean
hulls will vary by as much as twofold; therefore, producers interested in feeding certain co-products should study market trends in their region before purchasing them. Purchase price of the co-product will play a greater role in determining profitability than will the nutritional value.

Many of these co-products result in a wide range of feed efficiency values when fed to growing beef cattle. In the review article by Poore et al. (2002), feed efficiency values for soybean hulls fed to steers ranged from 0.16 to 0.09. Similarly, we have observed efficiency values for soybean hulls in the same range (Rankins et al., 2010; Starnes et al., 2012). Some of this wide range is likely a result of greater than expected levels of DMI of this highly digestible co-product. In addition, it is not uncommon for nutrient content of the various co-products to fluctuate from 1 production facility to another. It is not uncommon for 300-kg beef steers consuming diets similar to those described above to consume in excess of 3% of BW. Poore (2002) reported DMI of 3.6% of BW for steers fed free-choice soyhulls for 84 d. Starnes et al. (2012) reported DMI of 4.4% of BW for steers fed 50% peanut hulls and 50% corn gluten feed free-choice for 106 d.

Summary and Conclusions

Fundamental shifts in feed, fuel, and fertilizer prices experienced in the United States between 2005 and 2010 have markedly changed the amount of capital needed to purchase several hundred stocker calves and to provide adequate feedstuffs for BW gain. Cost of calves has escalated to record amounts in the spring of 2012, adding additional pressure to profit margins. However, the value of BW gain associated with producing feeder calves from those stockers has experienced a concomitant increase. The optimal system still uses high-quality cool-season forages and supplementation with co-product feeds. With this system, a significant margin of profit still exists for the Southeastern stocker cattle production system.

LITERATURE CITED


