ABSTRACT: Stocker cattle production practices may affect subsequent performance of cattle in economically meaningful ways. Literature was reviewed to summarize possible carryover effects of stocker cattle management on finishing performance and carcass traits. The most consistent effects of stocker phase practices on finishing-phase and carcass performance of cattle appear to be explained by changes in placement weight of feeder cattle. Increasing placement weight typically is confounded with age at placement, ADG during stocker period, and duration of the stocker period. It may also be confounded with other factors, such as season of grazing and/or finishing. Data from studies comparing calf-fed to yearling-fed cattle indicate that as age or BW at feedlot entry increased, finishing ADG, DMI, and HCW increased \((P < 0.01)\) whereas G:F and days on feed decreased \((P < 0.01)\). As age and BW at feedlot entry increased, marbling score decreased \((P < 0.01)\) whereas Warner-Bratzler shear force increased \((P < 0.01)\). Studies with yearling cattle entering the feedyard after a forage-based backgrounding phase indicate that as backgrounding ADG increased, finishing ADG, DMI, and days on feed decreased \((P < 0.01)\) yet HCW and ribeye area increased \((P < 0.01)\) with no effect \((P = 0.45)\) on marbling. Stocker cattle systems are complex, integrated systems in which producers typically seek to maximize their own economic return with little regard for subsequent performance. If cattle are owned across both stocker and finishing phases of production, then management decisions should focus on maximizing return over the entire ownership period and not just within one segment of ownership. Of the traits of feeder cattle that can be affected by stocker cattle systems, BW is the primary determinant of their value when they are placed into commercial feedyards.

Key words: carryover effects, stocker cattle, stocker systems

INTRODUCTION

Stocker cattle production is an important part of the beef cattle production system in the United States. Stocker cattle producers are primarily concerned with achieving optimum performance and profitability of stockers during their ownership phase but also should consider the effects of stocker production practices on subsequent finishing phase and carcass performance of the cattle they manage. Buyers of feeder cattle seek to optimize their net return on the cattle they buy; therefore, they may discount feeder cattle that have been managed during the stocker phase in a manner that they perceive decreases subsequent performance. Decisions typically are made to maximize financial return to a single phase of production rather than to maximize biological efficiency to the integrated system. However, as some producers seek to integrate the stocker and finishing phases, with plans to...
own cattle through multiple phases of production, information is required on how to optimize performance and net return over the integrated system.

Stocker cattle production systems are highly complex with a myriad of interrelated factors that could interact to affect subsequent performance. Some of these factors are geographic location, forage type and quality, type and amount of supplementation, rate of BW gain, use of technology (e.g., implants, ionophores), and a host of animal-related factors (e.g., behavior, stocker and feeder BW, age, condition, health, genotype). Many of these factors (e.g., age and BW or forage species and season) are, for practical purposes, inextricably confounded.

An excellent review of the literature concerning carryover effects of stocker systems on subsequent performance was published by Drouillard and Kuhl (1999). In summary, that article found few stocker phase management practices that had significant carryover effects on subsequent phases. Several issues were raised, such as the confounding mentioned above, the variability of production systems, and occasional inadequate experimental methods and documentation. The current paper focuses mainly on literature published after that review.

**Feeder Cattle Age and Body Weight**

Many reports have investigated the effect of cattle age and BW when they are placed on feed, primarily by comparing calf-fed vs. yearling-fed systems. Calf-fed systems are those in which cattle are placed on a high-concentrate diet directly after weaning whereas in yearling systems, cattle are grazed on pasture or grown on high-forage diets for a period of time and then placed on the finishing diet. Klopfenstein et al. (2000) placed calves or yearlings on feed at 14 or 20 mo of age, respectively. Calves exhibited 0.4 cm more backfat than yearlings, but there was no difference in taste panel ratings or Warner-Bratzler shear force (WBS). Sainz and Vernazza Paganini (2004) placed calves, short yearlings, and long yearlings on feed at 180, 300, and 550 d of age and 230, 300, and 425 kg BW, respectively. Older and heavier animals at placement exhibited increased DMI and BW when slaughtered at a constant backfat thickness. This would indicate an increase in apparent mature size. However, age and BW at placement did not affect G:F and was inversely related to percentage grading as USDA Choice. Interestingly, accretion of backfat on pasture was negligible, regardless of age or ADG.

Guretzky et al. (2005) placed calves, short yearlings, and long yearlings on feed. Calves were 180 d of age and 236 kg BW at placement. Age and BW of yearling classes were not reported. In that study, yearling classes gained BW faster than calves, but age and BW entering the finishing phase had no effect on quality grade. Barham et al. (2012) evaluated the interaction of age and BW at placement with implant programs. Calves (placed on feed at 285 d of age at 300 kg BW) and yearlings (placed on feed at 410 d of age at 310 kg BW) were either implanted with a single implant late in the finishing period or 4 implants through the stocker and finishing phases. No interactions of placement age with implant programs were evident in finishing or carcass characteristics. Increased placement age increased ADG and decreased marbling and the length of the finishing period but had no effect on WBS.

Winterholler et al. (2008) evaluated a calf-fed vs. yearling production system using wheat pasture. Calf fed were placed on feed at 228 kg for 169 d; yearlings were grazed on wheat and then placed on feed at 445 kg for only 88 d. Yearlings exhibited greater ADG and DMI but less G:F than calf-fed animals. Furthermore, yearlings had greater HCW (17%) and ribeye area. The larger ribeye area may be simply an effect of increased HCW. Stocker production system did not affect carcass quality grade. Myers et al. (1999) observed that calf-fed steers exhibited greater ADG, DMI, and lower G:F than similar steers that were grazed for 82 d before finishing (yearling fed). Stocker-phase treatment did not affect cumulative concentrate intake. Calf-fed cattle tended to grade Choice at a greater rate as well as have lighter livers and rums as a percentage of HCW.

Harris et al. (1997) placed 2 groups of cloned and half-sibling steers on feed as either calves or yearlings. Cattle in the yearling treatment were grazed on Bermuda grass for 123 d. When fed to a constant BW, yearlings exhibited greater ADG but marbling was similar to calf-fed animals. When fed to a constant age, ADG was similar but calf fed were heavier and fatter and had greater marbling scores. Griffin et al. (2007) summarized data from multiple calf-fed vs. yearling-fed trials in Nebraska, representing over 1,100 cattle across 8 yr. Yearlings consumed more feed on a daily basis, gained BW faster, and were heavier at slaughter than calves. However, calf-fed cattle consumed more feed in aggregate, were 18.7% more efficient, and were fatter. Quality grade was not affected, except that when marbling scores were adjusted to a constant backfat thickness, yearlings had more marbling than calves.

Anderson et al. (2005) compared 2 integrated systems from calving to slaughter. For the purposes of this review, the 2 systems can be classified as calf-fed and yearling-fed systems. Calf-fed steers gained BW slower but were more efficient than yearling-fed steers and also exhibited greater marbling. Yearlings were heavier at slaughter and had larger ribeye area on an absolute basis but similar ribeye area in relation to HCW. Brewer et al. (2007) compared beef palatability attributes from cattle finished as calves or yearlings. Calves produced steaks that were more tender and flavorful, even when quality grades were equal. This would seem to indicate that quality grades alone were not sufficient to predict ultimate palatability differ-
ences between these 2 management systems. Furthermore, calves produced meat with a greater percentage of soluble collagen, which may be indicative of better palatability. Increased aging times might reduce differences in palatability of beef from calf-fed and yearling production systems; however, Pierson and Fox (1976) reported no effect of aging on soluble collagen content of beef.

Robinette et al. (2011, 2012) evaluated the interaction of prefinishing implant with plane of nutrition during the stocker phase. Steers were either implanted with 4 implants (2 in the stocker phase and 2 in the finishing phase) or 2 implants (during the finishing phase only). A portion was finished as calves (2 implants in the finishing phase only). The remaining cattle of each implant group were subjected to either unrestricted growth (i.e., ad libitum wheat pasture; ADG = 1.1 kg/d) or restricted growth (i.e., heavily stocked wheat pasture; ADG = 0.68 kg/d) during a stocker phase. The finishing phase was in a commercial feedyard in the initial year and was conducted in a GrowSafe feed intake system (GrowSafe Systems Ltd., Airdrie, AB, Canada) in the second year. No plane of nutrition × implant interaction was observed. As expected, unrestricted yearlings were heavier at both placement and slaughter and consumed more feed during finishing. As observed in the study of Barham et al. (2012), cattle finished as yearlings had fewer days on feed compared with calf-fed groups. Harvest BW and HCW of unrestricted yearlings was greater than calf feds and restricted yearlings, which did not differ. Finishing ADG of calf feds was 0.22 kg less than both yearling finishing groups, which did not differ. Prefinishing implantation of yearlings in a restricted growth period reduced marbling score and percentage USDA Choice compared with calf feds, but neither unimplanted restricted growth yearlings nor unrestricted growth yearlings (whether implanted prefinishing or not) differed in carcass quality grade or marbling from calf feds.

In summary, when cattle are placed on feed at greater age or BW, they typically exhibit increased daily feed intake, ADG, and HCW. They are also typically less feed efficient, but this effect is more variable. Calf feds tend to be fatter and have less desirable yield grades. Quality grade effects are variable. Although differences in daily DMI are apparent, aggregate total feed intake may be similar, depending on the relative duration of the stocker and finishing periods. Yearlings typically have higher absolute ribeye area, but ribeye area relative to HCW is typically similar to calf feds. Age and BW at placement for finishing and, in turn, duration of the feeding period and age at slaughter might affect palatability attributes of beef that are not explained by marbling scores and quality grades. Regression analysis (regression procedure; SAS Inst. Inc., Cary, NC) of the raw data from Barham et al. (2012) and Robinette et al. (2011, 2012) indicated that for each day of age increase at feedyard entry, there was a 0.3 ± 0.016 d reduction ($P < 0.01$, $R^2 = 0.52$) required to finish to 1.2 cm backfat thickness, total BW gain during finishing phase decreased by 0.36 ± 0.04 kg ($P < 0.01$, $R^2 = 0.19$), HCW increased by 0.08 ± 0.03 ($P = 0.01$, $R^2 = 0.02$), marbling score decreased by 0.31 ± 0.082 ($P < 0.01$, $R^2 = 0.04$), and WBS increased by 0.004 ± 0.0008 kg ($P < 0.01$, $R^2 = 0.52$). In those studies, even though marbling scores decreased and WBS increased, most carcasses in these studies were within the low Choice quality grade and shear values were well below the consumer toughness threshold of 4.3 to 4.5 kg (Miller et al., 2001).

**Stocker-phase Average Daily Gain**

Rate of BW gain during the grazing phase is a key component of stocker system profitability (Horn et al., 2005) and is thought to influence ability of cattle to express compensatory gain. In a compilation of several Nebraska studies concerning summer grazing, Klopfenstein et al. (2000) reported a range of compensation in grazing calves from 18.7 to 88% after calves were fed to differing rates of gain through the winter. Conclusions were that compensatory gain on grass is variable and hard to predict, but compensation of only around 50 to 60% of initial restriction can be expected. The extent of compensation for previous restriction is usually greater when the restriction is moderate and of short duration (i.e., ≤ 3 mo; Hornick et al., 2000). Fox et al. (1972) stated that if the period of restriction is too extensive, then steers cannot fully compensate.

Klopfenstein et al. (2000) conducted a large study of 790 cattle subjected to high and low ADG in both summer and winter. Neither season nor rate of gain affected percentage Choice when quality grade was adjusted to a common backfat thickness. Hersom et al. (2004) stocked steers on wheat pasture to achieve low, medium, and high ADG. Increasing grazing ADG linearly increased fat accretion. Although greater ADG produced lower DMI during the finishing phase as a percentage of BW, pasture ADG did not affect ADG or G:F in the finishing phase and body composition at slaughter was similar. Restriction of growth rate during the stocker phase was found to increase maintenance requirements during finishing, possibly due to increased heat production. Neel et al. (2007) used hay and soybean hulls to simulate grazing that achieved low, medium, and high rates of BW gain. Steers were then finished on either concentrates or forage for an equal number of days. Although there were main effects of finishing type, no interactions between finishing type and stocker phase ADG were observed for finishing or carcass performance. Low ADG during the stocker phase improved finishing ADG; however, high stocker-phase ADG increased HCW and USDA Quality grade. In a companion paper (Duckett et al., 2007), the
stocker-phase treatments did not affect color scores of fat or lean or palatability traits at slaughter. Robinette et al. (2011, 2012) reported that restricting the growth of calves during the stocker phase had no effect on overall ADG during the finishing phase or carcass characteristics at slaughter and reduced performance during the stocker phase was not compensated for in the finishing phase.

Lewis et al. (1990) evaluated intensive vs. extensive cattle production systems. In essence, these could be considered calf-fed and yearling-fed production systems, respectively. It is interesting to note that prices of inputs in the U.S. cattle industry have changed dramatically from 1990; however, the observations in this study are still valuable. Cost of BW gain was less in the extensive system unless corn price was very low relative to other inputs. However, the extensive system increased interest costs. Increasing the purchase price of feeder animals had essentially no effect on the ranking of the systems. The extensive system produced more total weight at a lower break-even price.

Beck et al. (2012) found that net return was greater for yearling-finishing programs at all Choice–Select spreads even though carcass quality was improved by finishing cattle as calf fed compared with yearlings (Barham et al., 2012). Aggressively implanting cattle with a high propensity to marble decreased carcass quality grades compared with delaying implantation, yet profitability was greater with aggressive implanting at both high and low feed prices. To a large degree, net return in finishing systems is tied more closely to increasing HCW than increasing carcass quality and the economic relationships were not altered significantly at either low or high feed prices. Increased rates of BW gain during the stocker phase seem to have variable or negligible effects on subsequent finishing phase performance and although reduced performance during the stocker phase often results in compensatory gain, this is transient in nature and does not usually result in greater performance throughout the finishing phase.

A regression analysis was conducted on the raw data from the studies reported by Barham et al. (2012) and Robinette et al. (2011, 2012) for cattle that went through a forage-based backgrounding phase before entering into a finishing phase, using the regression procedure in SAS. Total BW gain during backgrounding was negatively related to finishing ADG (–0.002 ± 0.0006; \( R^2 = 0.04; P < 0.01 \)), total BW gain during finishing (–0.35 ± 0.06; \( R^2 = 0.12; P < 0.01 \)), days on feed (–0.09 ± 0.01; \( R^2 = 0.24; P < 0.01 \)), and G:F (–0.00009 ± 0.00001; \( R^2 = 0.17; P < 0.01 \)) but was positively related to HCW (0.27 ± 0.05; \( R^2 = 0.11; P < 0.01 \)) and ribeye area (0.007 ± 0.0009; \( R^2 = 0.24; P < 0.01 \)). It is interesting to note that total BW gain during backgrounding had no effect on either marbling score (\( P = 0.63 \)) or WBS (\( P = 0.09 \)). Cattle used in these studies were harvested at a common backfat endpoint (targeted at 1.2 cm) so it would likely not be a surprise that increased BW gain before finishing decreased days on feed and total BW gain during finishing, but these data do indicate that increased BW gain before finishing does carry through the finishing phase leading to increased carcass weights and ribeye area but does not affect indicators of carcass quality or tenderness.

### Stocker Forage Systems

Type of forage may impact subsequent performance, but forage type is often confounded with ADG and placement BW. Choat et al. (2003) grazed steers on wheat pasture or native range and then measured finishing and carcass performance. The wheat pasture treatment reduced finishing ADG and G:F but increased HCW, ribeye area, and marbling score. Fat thickness and yield grade were not affected by stocker phase forage system. Much of this effect may be due to differences in stocker-phase ADG and feeder placement weight. Coleman et al. (1995b) limit fed silage- or corn-based growing diets to achieve similar ADG followed by serial slaughter during finishing. After 45 d of finishing, 75% of the steers graded Choice, and those fed silage during the growing phase produced tougher and less flavorful steaks. Differences between the growing diets largely disappeared at 75 d on the finishing diet. Interestingly, when corrected for fill and ADG was included as a covariate, carcass composition was not different between the 2 growing diets (Coleman et al., 1995a). Ross et al. (2005) measured gene expression in fat tissue from steers grazed on either wheat pasture or native range (with supplementation). Grazing treatment appears to affect adipose gene expression during the grazing phase, but differences decreased after finishing on a concentrate diet to a constant fat thickness. In a grass-based finishing system, Allen et al. (1996) observed that stocker-phase forage type influenced finishing-phase and carcass performance more than finishing forage type.

Phillips et al. (2004) grazed calves on either wheat pasture or native range (with supplement) or fed similar calves a concentrate diet during the growing phase during the winter. Calves were all subsequently grazed on a common high-quality pasture in the spring and then finished on a traditional concentrate diet. Decreased winter stocker ADG (0.13 vs. 0.80 kg/d) did not affect ADG on the subsequent spring pasture but did improve ADG and G:F during the finishing period. Capitan et al. (2004) investigated multiseason stocker grazing strategies in 2 experiments over 2 yr. Steers grazed either wheat pasture or dormant native range during the winter and then grazed 1 of 4 different species/combos of forage during the summer. A control group of steers from both winter grazing treatments was placed directly on a finishing diet after winter grazing. In 1 yr, there was no difference in winter
ADG between winter wheat and native range, and there were therefore no differences in finishing performance or carcass traits. In the second year, steers that had grazed wheat were heavier, ate more feed, and were less efficient in the feedyard than steers that had grazed native range. Steers that had grazed wheat were also heavier at slaughter and produced carcasses with more fat and marbling. Influence of summer systems on finishing performance was also mixed between years. In the first year, cattle finished during the summer gained BW more rapidly, were more efficient, and produced lighter carcasses with less fat and marbling than cattle finished in the fall after summer grazing. In yr 2, there were minimal differences among the summering systems. These results illustrated the complexity of grazing systems and the often-observed variability of results. The authors indicated that steers that are restricted during the winter grazing season can compensate in either a subsequent grazing season or in the finishing phase. Type of forage or forage system during the stocker phase seems to affect finishing performance primarily through affecting feedyard placement weight.

### Stocker Supplementation Programs

Many stocker systems incorporate supplementation to cattle grazing pasture, typically to economically improve ADG and profitability of the grazing period. Felix et al. (2011) supplemented cattle fed to achieve high or low ADG with either corn or corn dried distillers grains with solubles. More energy in the growing phase decreased finishing ADG. There was an interaction of ADG and supplemental energy source for marbling; however, these results need to be confirmed because the ADG realized in the experiment did not conform to the experimental design (i.e., animals fed for low ADG on corn actually gained equal to animals fed for high ADG on dried distiller’s grains). Energy sources and energy levels have been shown to affect cattle physiology (i.e., pro-inflammatory cytokines and rectal temperature; Reuter et al., 2008), and additional research into the potential effects of energy sources may be warranted.

Pavan and Duckett (2008) supplemented steers grazing tall fescue with either corn grain or corn oil (with a soybean hull carrier). Supplement type did not affect carcass traits. However, HCW and dressing percentage were greater for supplemented vs. unsupplemented cattle. Furthermore, unsupplemented cattle were leaner than corn-oil supplemented cattle. Marbling score and ribeye area were not different. Both quality and yield grades of similar steers grown on concentrate were greater than all grazing treatments. Horn et al. (2005) reported that energy supplementation of steers grazing wheat pasture reduced subsequent finishing-phase ADG in only 1 of 2 yr of their study. Supplementation did not affect DMI or G:F in either year.

### Stocker Implants

Response to implants has received more research focus than many other stocker management factors, possibly due to the relative ease and low cost of conducting implant experiments. Duckett and Andrae (2001) reviewed effects of implants in cattle and concluded that suckling- and stocker-phase implants have minimal carryover effects on subsequent finishing and carcass performance. Furthermore, they recommended an implant in every phase of production and estimated that, cumulatively, implants can increase net return by US$93/animal. Platter et al. (2003) evaluated 10 lifetime implant programs compared with nonimplanted calves. Control animals exhibited increased marbling compared with implant treatments. Implants at branding, weaning, and backgrounding had no effect on marbling or taste panel characteristics. Branding and weaning implants did not affect WBS of steaks whereas an implant increasing WBS. Implants improved ADG (12 to 21%), HCW (9 to 14%), and ribeye area with no effect on fat thickness.

Barham et al. (2012) compared an aggressive implant program (i.e., 4 implants during stocker and finishing phases) to a delayed program (i.e., 1 implant during finishing) in 2 experiments. The aggressive implant program improved ADG in both experiments and decreased marbling and increased WBS in 1 experiment conducted with cattle having a high potential for marbling but not the other study conducted with cattle with less marbling potential. These differences in response make the case that much of the variability encountered when comparing the results of research delving into the carryover effects from management before finishing on carcass traits are due to deviation in the response of animals of differing genotypes to management. As a result, the aggressive program improved overall net return in 1 experiment but had no effect in the other (Beck et al., 2012).

Robinette et al. (2011, 2012) observed no effects of estrogenic stocker-phase implants on finishing or carcass performance in either calf-fed, low-ADG yearling, or high-ADG yearling production programs. Reuter (R. R. Reuter, unpublished data) evaluated 5 implant treatments in heifers grazing wheat pasture. Heifers were either not implanted, implanted with 40 mg trenbolone acetate and 8 mg estradiol (Revalor G; Merck Animal Health, Summit, NJ), or implanted with 200 mg testosterone propionate and 20 mg estradiol benzoate (Synovex H; Pfizer Animal Health, New York, NY) early in the grazing period, late in the grazing period, or at both points in the grazing period (i.e., a reimplant during grazing). After grazing, heifers were finished and loin steaks evaluated for WBS. Stocker

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**References**

- Felix et al. (2011)
- Pavan and Duckett (2008)
- Horn et al. (2005)
- Barham et al. (2012)
- Robinette et al. (2011, 2012)
- Duckett and Andrae (2001)
- Platter et al. (2003)
- Reuter (2008)
- Beck et al. (2012)
implant treatments had no consistent carryover effects on finishing performance. The Revalor G treatment and Synovex H reimplant treatment increased WBS compared with the control treatment when steaks were aged 7 d. There was no effect of implant treatment on WBS when steaks were wet aged 14 d.

Implants during the stocker phase typically improve profitability. There is some variability throughout the literature on the carryover effects of prefinishing implants on carcass quality. This variability may be related to prefinishing implant type, marbling potential of the cattle, the duration from the stocker implant until slaughter, or interactions between prefinishing management and management during the finishing phase. Postmortem aging seems a viable solution to potential increases in WBS, whether those increases result from stocker phase implants or increased age at placement.

**Prediction of Finishing Performance and Carcass Traits**

The majority of this review has presented research conducted on stocker cattle that were subjected to a treatment and then followed through the finishing phase to determine what carryover effect that treatment may have. As part of a conclusion of this review, a different approach was also considered, that is, how well finishing-phase performance can be predicted without knowing any of these stocker-phase treatments. Galyan et al. (2011) used a very large dataset (i.e., >600,000 animals) to predict feedlot performance from initial shrunk BW and sex for pens of cattle in commercial feedlots. These 2 variables accounted for 76, 46, 84, and 81% of the variation observed in DMI, ADG, final BW, and HCW, respectively, but only 22% of the variation in G:F. These 2 variables (i.e., sex and BW) accounted for a significant portion of the variation in several traits of interest during finishing. There are likely other traits that affect finishing performance that are unrelated to stocker phase management, such as season of finishing and genetic factors. For some traits, there may be relatively little finishing variation remaining to attempt to explain with carryover effects from other stocker-phase management practices.

Reinhardt et al. (2009) reported results from 15,631 steers fed in Iowa feedyards over 4 yr. In this dataset, increased placement BW was associated with increased final BW and HCW but decreased incidence of disease, ADG, LM area per unit of HCW, and marbling score.

A regression analysis was conducted on the raw data from the studies reported by Reuter et al. (2011) and Robinette et al. (2012) for cattle that went through a forage-based backgrounding phase before entering into a finishing phase. In this regression, finishing-phase variables and carcass traits were regressed on placement BW, placement fat thickness measured by ultrasound, placement hip height, and ADG observed during the prior stocker period. These variables were regressed in PROC GLMSELECT of SAS to determine which independent variables were significant in the model. When those variables were identified, they were added to a simple PROC GLM model in a time, in this order: BW, fat thickness, hip height, and stocker-phase ADG. This order of variables was selected to model the relative ease with which a commercial feedyard could obtain data about the steers they placed on feed; that is, a feedyard could simply measure BW, fat, and hip height at placement but it would have no way of measuring prior ADG without receiving that data from the stocker producer. The final objective was to determine how much predictive power stocker-phase ADG would have to predict finishing performance, given that placement BW, fat thickness, and hip height were already known. Under this analysis scenario, stocker-phase ADG had limited predictive power (Table 1). In the Reuter et al. (2011) dataset, stocker-phase ADG had a partial $R^2$ of 4% for finishing ADG and dressing percentage. In the Robinette et al. (2012) dataset, stocker-phase ADG had a partial $R^2$ of 20, 4, and 15% for finishing days on feed, HCW, and dressing percentage, respectively. For most traits, placement BW provided the majority of the predictive power.

In contrast, Lancaster et al. (2011) reviewed 17 published trials using steers to evaluate carryover effects from stocker production systems typical to the southern Great Plains. Overall, no stocker-phase-influenced trait was related to finishing ADG. However, finishing DMI was significantly influenced by stocker period length ($R^2 = 0.41; \text{coefficient} = 0.0045$ kg/d), stocker period total BW gain ($R^2 = 0.29; \text{coefficient} = 0.0059$ kg/kg BW gain), and placement weight ($R^2 = 0.29; \text{coefficient} = 0.006$ kg/kg placement BW). Feed efficiency (kg feed/kg BW gain) was significantly increased by stocker period total BW gain ($R^2 = 0.44; \text{coefficient} = 0.0023$ kg/kg BW gain) and placement weight ($R^2 = 0.39; \text{coefficient} = 0.002$ kg/kg BW gain).

In Table 2, regression coefficients are presented from several datasets to illustrate the effect of placement BW on finishing ADG. With the exception of the dataset of Lancaster et al. (2011), coefficients are remarkably similar, indicating that finishing ADG increases by 0.0014 to 0.002 kg/d for each kilogram increase in placement BW.

**Summary and Conclusions**

There may be potential areas that offer promise to identify characteristics of cattle that add value to the overall production system, that is, investigating effects of energy sources. For traits in which there is currently limited prediction ability (i.e., feed efficiency and carcass quality), measuring response of individual animals as compared
with group means may uncover valuable detail. Improving research quality through managing gut fill and reporting complete descriptions (e.g., of animals and environments) that allow for improved meta-analysis should improve ability to find relationships. Furthermore, a systematic approach that attempts to build a stocker cattle production computer model may be more fruitful than attempting to directly compare specific systems, as these systems often confound several traits of interest and are limited in their scope of inference. Stocker cattle production involves complex interactions of many factors that affect stocker-phase and subsequent cattle performance. A single factor, that is, placement weight, may be the most important predictor of finishing phase performance. As such, the equations reported in Table 2 of Galyean et al. (2011) may be the most succinct summary of the carryover effects of stocker systems on finishing performance, with the exception of feed efficiency. Similar to a previous review (Drouillard and Kuhl, 1999), other stocker-phase management decisions seem to have inconsistent or negligible carryover effects. Stocker cattle producers should make management decisions primarily to maximize their own net return and place only secondary consideration on potential effects on subsequent performance, unless the stocker producer is retaining ownership into the finishing phase of production. If cattle ownership occurs through multiple stages of production, then management decisions should focus on maximizing net return over the entire ownership period.

Table 1. Explanatory power of selected traits of individual feeder cattle at placement on finishing and carcass performance

<table>
<thead>
<tr>
<th>Performance trait^2</th>
<th>Predictor trait^1</th>
<th>Model R^2</th>
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<tbody>
<tr>
<td></td>
<td>BW, kg</td>
<td>Fat, mm</td>
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<tr>
<td>Reuter et al., 2011^3</td>
<td>DOF, d 39%, 0.41</td>
<td>11%, 3.2</td>
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<td></td>
<td>ADG, kg/d 12%, 0.002</td>
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<tr>
<td></td>
<td>HCW, kg 27%, 0.32</td>
<td>11%, 3.7</td>
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<td></td>
<td>DP, % BW –</td>
<td>–</td>
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<tr>
<td></td>
<td>Marbling score –</td>
<td>4%, 4.2</td>
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<tr>
<td></td>
<td>Ribeye area, cm^2/kg HCW –</td>
<td>–</td>
</tr>
<tr>
<td>Robinette et al., 2012^4</td>
<td>DOF, d 59%, 0.29</td>
<td>1%, 2.11</td>
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<tr>
<td></td>
<td>ADG, kg/d 12%, 0.0015</td>
<td>–</td>
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<td></td>
<td>G:F – – – –</td>
<td>–</td>
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<tr>
<td></td>
<td>HCW, kg 70%, 0.56</td>
<td>1%, 3.7</td>
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<tr>
<td></td>
<td>DP, % BW 9%, 0.01</td>
<td>–</td>
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<tr>
<td></td>
<td>Marbling score –</td>
<td>–</td>
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<tr>
<td></td>
<td>Ribeye area, cm^2/kg HCW 22%, 0.0004</td>
<td>–</td>
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</tbody>
</table>

1^Trait of feeder cattle known at the beginning of the finishing period. Fat = 12th rib fat depth; HH = hip height; ADG_s = ADG during the previous stocker period.
2^Selected finishing and carcass performance traits. Model R^2 is the coefficient of determination from the final model of the performance trait modeled as a function of the predictor traits in PROC GLMSELECT (SAS Inst. Inc., Cary, NC). The body of the table reports 2 terms: 1) the partial R^2 of each independent variable when added in this order: BW, Fat, HH, and ADG_s; and 2) the coefficient for each independent variable in the final model. DOF = days on feed; DP = dressing percentage.
3^n = 253 animals
4^n = 93 animals. Hip height data was not available. No independent variables entered the model for F:G ratio or marbling score.

Table 2. Coefficients observed from selected datasets from regressing finishing-phase ADG on placement BW

<table>
<thead>
<tr>
<th>Citation</th>
<th>No. steers (or pens)</th>
<th>r^2</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galyean et al., 2011</td>
<td>1,986 pens</td>
<td>0.46</td>
<td>0.0014</td>
</tr>
<tr>
<td>Lancaster et al., 2011</td>
<td>1,558</td>
<td>0.00</td>
<td>0.00006</td>
</tr>
<tr>
<td>Reinhardt et al., 2009</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Reuter et al., 2011</td>
<td>263</td>
<td>0.12</td>
<td>0.002</td>
</tr>
<tr>
<td>Robinette et al., 2012</td>
<td>93</td>
<td>0.12</td>
<td>0.0015</td>
</tr>
</tbody>
</table>

LITERATURE CITED


Brewer, P. S., J. M. James, C. R. Calkins, R. M. Rasby, T.J. Klopfenstein, and R.V. Anderson. 2007. Carcass traits and M. longissimuslum-
Carryover effects of stocker cattle systems


