OPERATIONAL CHARACTERISTICS AND MANAGEMENT PRACTICE ADOPTION IN STOCKER CATTLE PRODUCTION

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Abstract
This study identifies current production and management practices of Oklahoma stocker cattle producers and analyzes the roles of operational characteristics in determining the adoption of recommended management practices (RMPs). Chi-square analysis is used to reveal statistical differences between characteristics of the stocker operation. Factors influencing the adoption of RMPs are operation size, dependency upon income from the operation, specialization in stocker production, and production system employed.

Keywords
stocker cattle, recommended management practices, production, chi-square

Introduction

Stockers are produced in the growing phase of beef production, after the cow-calf stage, yet before finishing. Stocker cattle are commonly described as weaned calves in post-weaning growing programs that are intended for sale as commercial feeder cattle and weights range between 300-800 lbs. The stocker industry is the aggregate of all post-weaning growing programs pursued by individual enterprises. This industry represents an important segment of the beef production and marketing chain, chiefly serving to increase cattle weight, age, and in many cases, quality while often offsetting seasonal cattle price volatility (Peel 2003).

Stocker numbers in a designated geographic area at a point in time are difficult to measure. However, the January 1, 2008 NASS cattle inventory reports indicated that 1.75 million calves were grazing small grain pasture in the Southern Plains region, consisting of Kansas, Oklahoma, and Texas (USDA-NASS 2008). Oklahoma is surrounded by major cattle feeding states with two-thirds of the total number of cattle and calves on feed in the United States in Colorado, Kansas, Nebraska, and Texas (USDA-NASS 2008). Nationally, Oklahoma is consistently ranked 4th in cattle numbers and in value of production within a national industry

totaling nearly $90 billion in 2007 (USDA-NASS 2007). Thus, Oklahoma's national role in beef production and associated cattle flows to nearby cattle feeding states, indicates that stockers grazing Oklahoma forages is a substantive component of national aggregate stocker output and a sizeable economic force in Oklahoma agriculture.

Stocker production occurs under diverse production strategies, systems, and nomenclatures. One such stocker production or backgrounding strategy adds value to light or poorly managed cattle by upgrading quality and performance and pooling together large, uniform lots of cattle. However, a cow-calf operator may also choose to add value to weaned calves by pursuing a post-weaning growing strategy. Ownership of cattle may be retained into the feedlot stage or feedlots may hold full ownership of stockers in a preliminary phase before feeding (Peel 2003). A variety of production systems may be pursued by stocker producers to achieve the specific objectives of the operation; however, an emphasis is often placed on efficient use of forages to realize cattle weight gain. Cattle may be grazed either seasonally or year-round. The wheat-stocker enterprise is perhaps the most common type of seasonal production strategy; however, some stockers are grazed throughout the summer with a season-long/ early intensive strategy where native range or pasture is the primary forage base. In addition to small grains pasture, winter/ spring production systems may also employ perennial cool season forages. Cattle may be held in semi or full-confinement systems, as is most commonly the case with feedlot operations.

Regardless of the wide variety of programs and motivations associated with stocker production, the stocker enterprise, in itself, should be differentiated as economically viable and distinct from other economic activities (Peel 2003). Notably, producers typically realize relatively inexpensive cattle weight gains compared to the cow-calf and finishing stages of

production. Profitability in the operation stems from two major sources: 1) Cattle management and upgrading cattle quality and 2) Strategic marketing of cattle and speculation by holding cattle over time (Parsons 1996). Returns to forage or grain production can also be realized if the production system allows. However, stocker producers are often exposed to greater risk due to narrower margins of cattle weight gain. In beef production, feed and hay prices can consist of upwards of 50-75% of total production costs (Anderson 1978). Stocker profits also depend heavily upon having a healthy, marketable animal at sale, also making animal performance and herd health key issues in stocker production. Management practices have been recommended by Extension educators and researchers to increase profitability and animal performance, maintain herd health, reduce costs, as well as manage risks in the cattle investment.

Despite the unique position of the stocker industry and the importance of Oklahoma as a stocker producing state as well as its national role, management practice adoption has largely not been examined among stocker cattle producers. Due to the diversity, complexity, and differing motives in production, the industry has been difficult to evaluate. Research is lacking which identifies the current production and management practices of Oklahoma stocker producers. A better understanding of the production strategies pursued by producers and producer types is needed to evaluate the most effective direction for Extension educational efforts in achieving high levels of recommended management practice (RMP)[1] adoption.

The objectives of this study are to evaluate the current production and management practices of Oklahoma stocker cattle producers and analyze gaps between currently implemented management and production practices and those practices recommended by research and extension specialists. The role of operation characteristics as a basis for RMP adoption is useful

[1] The term recommended management practices (RMPs) is used since best management practices are often associated with natural and environmental resource management practices. This study analyzes management practices recommended by extension educators and researchers directly relating to production.

as a starting point. Operation size, the degree to which the operation is dependent upon stocker income, specialization in beef production, and production systems employed are factors that will each be examined independently as factors affecting RMP adoption. Findings will enable researchers and Extension staff to determine how to best direct research and educational programs to achieve the goal of high levels of RMP adoption considering various production systems.

Literature Review

Numerous studies have examined operation size as a farm characteristic impacting technology adoption (Just and Zilberman 1983; Coppock and Birkenfeld 1999; Popp, Faminow, and Parsch 1999; Caswell et al. 2001; Diederen, Meijl, and Wolters 2003; Gillespie, Basarir, and Schupp 2004; Rahelizatovo and Gillespie 2004; Vestal 2005; Banerjee, et al. 2008). Operation scale and size relative to adoption of 26 livestock and range management practices in Utah was examined by Coppock and Birkenfeld (1999). A variety of management practices were analyzed ranging from animal production to finance and marketing practices. Descriptive information was used in cluster analysis to establish typologies among livestock producers. Larger operation size was positively associated with implementation of more rangeland management practices. Vestal (2005) examined management practice adoption among Oklahoma cow-calf producers. Producer groups consisted of large, income dependent, and small, non-income dependent producers. Numerous statistical significances were identified between the two groups pertaining to production, herd health, marketing and risk, and business management practices with large, income dependent producers found to be more likely to adopt recommended practices. Banerjee et al. (2008) determined that larger farms with relatively high yields were more likely to adopt GPS guidance systems. Diederen et al. (2003) used a nested logit model to determine that

structural characteristics of the farm, including farm size and market position, positively influenced the probability that a producer was an innovator or early adopter of a technology. Larger, commercialized beef operations were found to be more likely to utilize alternative cattle marketing channels by Gillespie, Basarir, and Schupp (2004). Size relative to environmental stewardship in the dairy industry was examined by Rahelizatovo and Gillespie (2004) and BMP adoption was clearly more prevalent in larger Louisiana dairies.

Feder and O'Mara (1981) analyzed the adoption of green revolution technologies, neutral to size and scale of the operation, in regions throughout the world. Adoption rates and time patterns were found to be directly related to farm size. The credit constraint for small farmers was identified as a rationale for differential adoption rates. Hodur et al. (2007) identified opportunities for and constraints to expanding value-added enterprises within the cow-calf sector. Opportunities and impediments to adopting value-added enterprises included feedlot constraints and limitations associated with financing and labor. Popp, Faminow, and Parsch (1999) analyzed factors affecting adoption of value-added production on cow-calf farms. Although the study found farm size to be a significant factor for adoption, farm size and scale of the operation were determined to have minimal impact on the decision to invest in cattle backgrounding. In this study, however, the producer's perceptions towards risk and profitability were factors significantly impacting adoption of value-added production components into cow-calf operations. Just and Zilberman (1983) analyzed land-use allocation and technology adoption while considering various risk preferences. If absolute risk aversion was constant, larger farms were found to devote more land to newer technology.

Caswell et al. (2001) examined how technology adoption can drive the relationship between farm and off-farm work and farm economic performance. The amount of off-farm work

undertaken by producers was found to be significantly related to the adoption of technologies that economize on managerial time. Alternatively, operators of large farms, more dependent upon on-farm revenues and found to pursue off-farm work to a lesser extent, were more likely to adopt managerially intensive technologies such as precision agriculture.

A greater concern for economic efficiency also exists when the total percent of household income from the cattle operation is high; thus, total household income and income derived from the enterprise are two operation characteristics frequently analyzed in technology adoption (Coppock and Birkenfield 1999; Fernandez-Cornejo, Hendricks, and Mishra 2005; Vestal 2005; Gillespie, Kim, and Paudel 2007; Banerjee et al. 2008). Gillespie, Kim, and Paudel 2007 found non-adopters of BMPs to be less dependent upon the operation as a generator of household income. This study examined the adoption rate of 16 BMPs related to beef production and determined that percentage of income from the beef operation and total household income had positive effects on the adoption rates of numerous BMPs. In the study by Coppock and Birkenfield (1999), higher levels of income for managers was often associated with larger sized operations, factors found to positively impact management practice adoption in rangelands. Banerjee et al. (2008) also examined total household income in the adoption of GPS guidance systems in the cotton industry. Higher income levels positively impacted the adoption of precision farming technologies. Total household income was also found to significantly increase with adoption of herbicide-tolerant (HT) soybeans (Fernandez-Cornejo, Hendricks, and Mishra 2005). However, off-farm income was positively and significantly related to adoption, making less income dependent producers more likely to adoption HT soybeans.

Specialization has been found to be a significant variable affecting technology adoption in the dairy industry. El-Osta and Morehart (2000) found specialization increased the likelihood

of dairy producers having increased technical efficiency. Furthermore, specialization and use of management-intensive technologies were among the factors that affected the likelihood of a farmer being a top performer in the industry. However, diversification in both beef and dairy production has also been shown to influence technology adoption (Gillespie, Basarir, and Schupp 2004; Gillespie, Kim, and Paudel 2007).

When considering technology adoption, the entire farm production system must be considered since the profitability of various technologies can be influenced between varying production locations (Caswell et al. 2001; Fernandez-Cornejo 2007). Likewise, heterogeneity of the resource base has been shown to influence technology adoption and profitability (Green et al. 1996; Thrikawala et al. 1999). Subsequently, climate, soil fertility, pest infestations, distance to markets or availability of information can all serve as factors which affect the profitability and adoption of certain technologies and management practices. Site-specific data was used by Caswell et al. (2001) to account for such factors. In assessing the adoption of cattle marketing practices, Gillespie, Basarir, and Schupp (2004) consider various beef operation types, including purebred, stocker, and other livestock operations with differing production strategies. Producers with other livestock operations and purebred cattle herds were found to use a variety of alternative marketing arrangements.

Despite the previously conducted research, studies thus far have not investigated the implementation of specific management practices within the stocker industry. In measuring technology and management practice adoption, some studies have included a stocker variable to account for alternative production systems (Coppock and Birkenfeld 1999; Gillespie, Basarir, and Schupp 2004); yet, considering the importance, relative ambiguity of the stocker industry, and viability of the enterprise, stocker production warrants its own analysis. Furthermore, RMPs

have not been evaluated within specific stocker production systems, a consideration that must be applied to stocker management practice analysis considering the diversified nature of the stocker industry.

Conceptual Framework

Farm managers seek to maximize utility from their operation. The resources available, including land, labor, capital, technology, and management skills, define the production capabilities of the farm operation. Each manager derives a specific utility from the allocation of farm resources and the income those resources generate. Managers attempt to increase income because they attach a certain value to profits (Heady 1952). Since farm managers are presumed to derive a significant portion of total utility from income, it is assumed that managers are profit maximizers. Profit is a function of levels of output and input use and input and output prices. Inputs include land, labor, capital, management skills, the operator's time available, and management practices.

Π = f (input quantity, input prices, output prices, output quantity, management practices)

Producers who derive a greater percentage of net income from their cattle operation have a greater incentive to maximize cattle profits. These income dependent producers attribute a greater utility to profits from cattle, relative to producers who are less dependent on income from stocker cattle. It is assumed that the adoption of new technology in the form of RMPs results in greater profits. Income dependent operations are hypothesized to be more likely to adopt RMPs.

Economies of size may enable larger operations to adopt RMPs to a greater extent. Larger operations often have greater financial and managerial capabilities, providing them with the means to purchase specialized and cost-lowering technology. When fixed costs are spread

over a larger quantity of output the long-run average cost curve is falling. Larger operations often have not only the means to obtain capital investment funds, but they have the incentive to expand and specialize production as well. Larger operations also can take advantage of pecuniary economies, receiving price discounts for large volumes of input purchases and price advantages when selling large volumes of output. Larger beef operations have the advantage of grouping cattle together in large lot sizes and can take advantage of numerous marketing channels including video and internet auctions that often function to reduce transaction costs (Schmitz, Moss, and Schmitz 2003). For these reasons it is hypothesized that larger operations are more likely to adopt RMPs.

Adoption of RMPs can also be analyzed from a perspective of diversification versus specialization. Diversification is defined as a "means of growing two or more products in an attempt to avoid the yield and price uncertainty of a single product" (Doll and Orazem 1978). Many cow-calf operators are also stocker producers, growing out their own calves on wheat pasture or inexpensive forage as a means of adding value to their product through weight gain. In the stocker industry, specialized producers are those who solely pursue stocker production, although their methods of production may be opportunistic and vary from year to year. From this perspective, calf production may be viewed in terms of a production possibilities frontier. Specialized stocker producers produce on the upper most portion of the curve. Likewise, specialized cow-calf producers market all their calves shortly after weaning. The possibility for any combination of production lies in between the two axes.

Specialized producers are exposed to the potential for greater returns to their investment; however, specialized producers also face increased risk due to price volatility and a narrower margin of cattle weight gain. Popp, Faminow, and Parsch (1999) outline some of the hindrances

and constraints to backgrounding cattle including risk, cash flow and labor constraints, and differing production strategies. Since stocker producers must be sensitive towards critical risk assessment and breakeven analysis, the adoption of RMPs for the actual production of cattle is more important. Specialized producers must ensure that at the time of cattle sales they have a healthy, marketable animal that is worth more at the end of ownership than when the animal was purchased. Thus, specialized producers are hypothesized to be more likely to adopt RMPs in stocker cattle production.

Management practices are expected to differ according to the particular production system employed by the producer. The use of various forage bases including small grain pasture, warm season forages, and cool season forages affect certain production and forage management practices including supplementation and forage testing. Differing forage bases are certain to affect the producers' primary time of grazing and receiving period and vice versa; the producers' primary time period for grazing cattle will be reflected in the choice of forage base and subsequent production practices. Thus, the production system employed by the producer must be considered when assessing whether or not the producer is following the recommended practice since the RMPs might differ according to each production system. The adoption of RMPs is hypothesized to differ according to production system employed by the producer.

Data Sources

The Oklahoma Beef Cattle Manual (Lalman and Doye 2005), written by sixteen lead authors from six academic disciplines, was distributed through local Extension offices, producer meetings, and by e-mail request from an Oklahoma State University (OSU) website (http://agecon.okstate.edu/cattleman/). Producers who received a copy of the Oklahoma Beef Cattle Manual were asked to complete a "Beef Cattle Management Practices Assessment." Two

surveys were distributed: one for beef producers with only stockers, a second for those also with a cow-calf operation.

The survey documented current production and management practices of Oklahoma stocker producers in the areas of production, forage and introduced pasture, quality assurance and animal health, marketing and risk, genetics, and business planning management. Approximately 54 questions were asked with the majority presented in 1-7 Likert scale. Several of the marketing and risk management questions also asked respondents to fill in blanks with percentages and numerical values. Survey questions are provided in Johnson (2008).

For this study, surveys from 186 producers with stockers only as a beef enterprise are the focus. All of the stocker survey respondents responding to the question regarding operation size were used for the size variables (n=178). For producers responding to income dependency, n=176, primary forage base, n=163, and for time of grazing questions, n=158 surveys. Of the total 745 cow-calf survey respondents, 431 (or 57.9%) indicated that they raised stocker cattle. Comparisons were made with the survey results from producers who exclusively pursued stocker production, considered as specialized beef producers, and with producers who had both cow-calf and stocker operations, considered as diversified beef producers.

Procedures

Producers were grouped according to three variables analyzed (operation size, operation income, and specialization) as factors which affect the adoption of RMPs. Based on the initial frequency distribution of producer responses, stocker operations were categorized into three size groups based on number of stocker/feeders managed each year: 1) small operations: 1-100 head, 2) medium operations: 101-500 head, and 3) large operations: 500+ head (Table 1).

Table 1. Percentage and Frequency of Producer Responses by Size

Number of stocker/feeder cattle managed each year	Percent of Responses	Frequency of Responses
Small (1-100)	38.2	68
Medium (101-500)	32.0	57
Large (500+)	28.8	53

The degree to which the operation is dependent upon income from the stocker operation is the second variable analyzed as a factor influencing adoption of RMPs. Two groups were formed based on the distribution of producer responses: 1) Producers with 0-40% of their past year's household income from their beef cattle operation were labeled less dependent on income from their stocker operation and 2) Producers with 41-100% of their past year's household income from their beef cattle operation were classified as operations heavily dependent on income from their stocker operation (Table 2).

Table 2. Percentage and Frequency of Producer Responses by Income

Percentage of past year's household net income from beef cattle operation	Percent of Responses	Number of Responses
0-40%	62.5	110
41-100%	37.5	66

The third variable analyzed was specialization in stocker production: 1) Specialized beef producers only raised stocker cattle, 2) Diversified beef producers had both a cow-calf and stocker operation (Table 3).

Table 3. Percentage and Frequency of Survey Types

Survey Type Respondents	Percent of Responses	Number of Responses
Stocker survey respondents	30.1	186
Cow-Calf survey respondents	69.9	432

Forage base was the fourth variable analyzed with producers grouped into three forage base categories: 1) Small grains forage, 2) Warm season forages including Bermuda grass, Old World bluestem, weeping lovegrass, and native range, and 3) Cool season forages, fescue and smooth brome.

Table 4. Percentage and Number of Producer Responses by Forage Base

Type of forage base used for stocker cattle:	Percent of Responses	Number of Responses
Small grains pasture	22.7	37
Warm season forage	61.3	100
Cool season forage	16.0	26

The time period which the producer primarily grazes cattle was the final variable analyzed as a factor that affects RMP adoption and was grouped into three categories: 1) Winter/ Spring small grains, 2) Summer, 3) Year-round.

Table 5. Percentage and Number of Producer Responses by Time of Grazing

Time of Grazing	Percent of Responses	Number of Responses
Winter/ Spring small grains	33.5	53
Summer	17.7	28
Year-round	48.7	77

Chi-square tests were performed to determine statistical differences between these producer groups regarding stocker cattle management practice adoption.

Results

Operation Size

Highlighted results from the chi-square analysis are presented in Table 6 with some additional details provided in the text that follows (Johnson 2008). The use of software in designing energy and protein supplements differ across producer size groups as did implanting and dehorning practices. Contrary to the hypothesis, larger operations are less likely to use a form of software when designing a supplementation or feeding plan. Larger operations are more likely to implant calves, excluding heifers intended for replacements. 77.6% of larger producers implant steers as compared to 38.2% of small producers. 94.0% of large producers either dehorn or tip stocker cattle compared with 70.6% of small producers.

Larger operations demonstrate an increased rate of adoption concerning forage production management practices as they are more likely to conduct soil and forage tests as well as know how to properly set stocking rates. 48.1% of large producers conduct soil tests at least

every 3-4 years while 52.4% of small producers never conduct soil tests. Of large producers, 64.2% indicate that they know how to set a proper stocking rate, while 36.4% of small producers indicate likewise.

Operation size is relatively less influential upon the producer's quality assurance and animal health management practices as compared with other sections of the survey. Larger operations are more likely to use modified live respiratory complex vaccines, hot brand, and administer intramuscular (IM) injections in the neck.

Larger operators are found to take a more seasonal approach towards stocker production with smaller operators tending to pursue stocker production year-round. Receiving period and forage base varies according to operation size with larger producers more likely to receive cattle from September to November, utilize small grain pasture, and grazeout winter wheat. The use of bermudagrass as a forage base is used more consistently by smaller producers with 66.7% of small producers indicating that they nearly always graze their cattle on bermudagrass. Furthermore, 53.1% of small producers compared to 83.3% of large producers nearly always use small grain pasture as a primary forage base.

Operation size is a significant variable in the adoption of many marketing and risk management practices. Not surprisingly, larger producers buy and sell cattle through brokers and via video/ satellite auctions more frequently than do small producers. Larger operators retain more of their steers for feeding with 42.9% of large producers retaining at least a percentage of male cattle compared to 29.2% of small producers. Also, larger producers also market their cattle farther from the ranch and sell greater percentages of cattle directly to feedlots. Not surprisingly, larger operators were found to market cattle in larger, more uniform lots with 87.5% of large producers marketing cattle in truckload lots compared to 5.9% of small producers. Larger

producers tend to market their cattle regularly throughout the year. Furthermore, larger producers pursue risk management strategies to a greater extent, placing more value upon various components of preconditioning programs and utilizing risk management tools more frequently. A strong statistical difference was present between producer size groups concerning the use of futures, options, and forward pricing contracts.

Operation size has minimal effect on the adoption of business planning and financial management practices. Only in developing a cash flow and conducting historical analysis do the business management practices of large and small operations differ. 12.5% of large operators conduct historical analysis more than once per year compared to 1.9% of small producers.

Concerning the producer's demographic profile, larger operators are found to pursue off-farm work to a lesser extent. Of larger operators, 71.7% have no off-farm work, compared to 41.2% for small operators. Larger operations also highly value the objective of generating enough income to reduce off-farm work. Of larger operators, 92.5% compared to 58.8% of small operators view this objective as very important. Finally, net income from the cattle operation is also significantly greater for larger operations. Fifty percent of larger operators compared to 2.9% of small operators generated over 60% of net household income from their stocker operation.

Income Dependency

It is assumed that producers who derive a greater percentage of net income from their cattle operation have a greater incentive to maximize cattle profits. Results indicate that income dependent producers are progressive in adopting cost reducing management practices pertaining to forage production. As with larger operators, producers who are dependent on income from the

stocker operation are more likely to conduct soil and forage tests as well as better understand grazing management concepts.

Income dependent producers also demonstrate a tendency to adopt animal health management practices that result in increased animal performance. Statistical differences between producer groups are observed concerning tick control and deworming methods. 11.6% of non-income dependent producers indicate that they do not deworm their stocker calves with only 1.9% of income dependent producers indicating likewise. Income dependent producers are also more likely to administer vaccinations as recommended. 90.3% of income dependent producers administer IM injections in the neck, the ideal practice to reduce injection site lesions, compared to 73.7% of non-income dependent producers. Income dependent producers are more likely to collect data on finished cattle if ownership is retained. 62.5% of non-income dependent producers rarely, if ever, collect finishing data compared to 26.3% of income dependent producers. Income dependent producers are also more willing to use modified-live vaccines in defending against animal diseases.

Like operation size, a number of marketing and risk management practices differ between operation income producer groups. Income dependent producers are more likely to purchase preconditioned cattle and to obtain their cattle through a wider variety of alternatives such as video auction and out-of-state direct purchase. 46.9% of income dependent producers purchase at least a percentage of their cattle preconditioned compared with 20.9% of non-income dependent producers. Income dependent producers are also more likely to retain cattle for feeding, market their cattle directly to feedlots, and are less likely to use local auctions as marketing outlets. Furthermore, income dependent producers more frequently add a premium to their cattle by marketing cattle in larger, uniform lots. 65.1% of income dependent producers

market cattle in truckload lot sizes compared with 30.1% of non-income dependent producers. Finally, producers who are dependent upon stocker income demonstrate a greater tendency to employ the wheat-stocker cattle enterprise as a production system. 83.9% of income dependent producers nearly always graze cattle on small grain pasture compared with 67.1% of non-income dependent producers.

Adoption of several business planning management practices are also statistically significant across producer groups, with more significant differences than indicated by operation size. Income dependent producers generally have a better recordkeeping system, often using computerized financial record keeping systems. 66.1% of income dependent producers use a computer recordkeeping system such as Quicken, Quickbooks, Redwing, or FarmWorks to keep financial records compared to 44.4% of non-income dependent producers. Furthermore, income dependent producers enter data more frequently, are more likely to draft summaries for tax reporting, develop income statements, and generate reports more frequently. In addition, income dependent producers are more likely to keep records on cattle medical treatments.

Producers who are dependent upon stocker income are less likely to be employed off the farm. 75.7% of income dependent producers indicated that they are not employed off the farm compared with 33.6% non-income dependent producers. Income dependent producer's operations range in size levels up to more than 5,000 head. While non-income dependent stocker producers are more likely to have a smaller stocker operation, primarily under 100 head. Furthermore, income dependent producers place a much higher value on generating enough farm income so that off-farm work is not necessary. 90.9% of income dependent producers viewed generating enough farm income so that off-farm work is not necessary as very important, compared with 56.4% of non-income dependent producers.

Specialized Operations

Theory suggests that specialized producers have the potential for greater returns to their investment yet also face increased risk, for example, from price volatility and narrow margins of cattle weight gain in stockers. Specialized stocker producers, those beef producers not also having cow-calf operations, are found to be more likely to adopt a variety of management practices compared to the more diversified producer who simultaneously pursues cow-calf and stocker production.

Of the designated production practices, specialized producers are more likely to implant and dehorn cattle. 58.6% of specialized producers nearly always implant steers compared with 28.8% of diversified producers. However, specialized producers are less likely to use software in designing energy and protein supplements.

Regarding forage and pasture management, specialized producers indicate a shorter hay feeding season length. Specialized producers also consider themselves more knowledgeable about setting stocking rates with 51.7% of specialized producers indicating that they knew how to set a proper stocking rate, compared with 42.0% of diversified producers.

Several statistically significant differences are noted between specialized and diversified producers concerning quality assurance and animal health management practices. Specialized producers individually identify cattle more frequently by the hot branding method (58.1%), compared with 29.4% of diversified producers. However, not all management practices from this section delivered expected results. Specialized producers are found to more frequently administer IM injections in the rump region of the animal, not a RMP, while diversified producers more frequently administer IM injections in the neck.

All of the marketing and risk management practices analyzed between the two producer groups yielded significant statistical differences. Specialized producers market their cattle regularly and sporadically throughout the year rather than seasonally. Specialized producers also market larger lots of more uniform cattle (43.3% compared with 16.4% of diversified producers). The use of futures and options contracts and forward pricing is also more common with specialized stocker producers.

In the business planning and management section, specialized producers analyze and draft summaries more frequently than diversified producers for two-thirds of the given components to financial planning: drafting balance sheets, cash flow statements, income statements, and conducting historical analysis. For instance, 70.9% of specialized producers draft a cash flow plan either once per year or annually, compared to 57.0% of diversified producers. Specialized producers are also more likely to use a computerized record keeping system (52.3% compared with 38.3% of diversified producers).

Regarding the producer's demographic profile, specialized producers are found to be younger and have more stocker cattle. 27.2% of specialized producers were under age 40, compared to 15.8% of diversified producers. 70.5% of diversified producers indicated having between 1 and 100 head of cattle compared to 38.2% of specialized producers.

Production System

Management practice adoption is found to differ between producers grazing cattle during differing time periods and on various forage bases. Implanting practices for both steers and heifers differed according to primary forage base. 80% of producers who nearly always graze cattle on small grains pasture indicate nearly always implanting steers, compared with 55.7% of

producers grazing cattle on warm season forages and 38.5% of producers grazing cattle on cool season forages.

Both producers who graze cattle on small grains pasture and those who primarily graze cattle during the winter and spring are more likely to conduct forage tests on hay or silage produced. Forage testing of both produced and purchased forages are practices least common with producers grazing cattle year-round.

Relative to producers grazing cattle on small grains pasture and those utilizing warm season forages, producers who primarily graze cattle on cool season forages are less likely to individually identify cattle. As expected, use of prescribed fire is also less common with producers grazing cattle during the winter and spring on small grains forage. Concerning, IM injection practices, 85.4% of producers grazing cattle during the winter and spring, compared with 76.0% of producers grazing cattle during the summer and 80.0% of producers grazing cattle year-round, indicate nearly always administering IM injections in the neck.

Numerous marketing and risk management practices differed across the production system producer groups. Many results confirm expectations. For example, producers grazing cattle during the winter or spring on small grains pasture are more likely to receive cattle from September through November. However, retaining a larger percentage of cattle for feeding and marketing cattle directly from the ranch to feedlot are marketing strategies more likely pursued by producers utilizing small grains pasture. Such producers are also more likely to market cattle in truck load, uniform lots. Concerning the use of risk management practices, 31.3% of small grains cattle producers utilize forward pricing at times. 14.0% of producers who graze cattle on warm season forages and 4.4% of producers grazing cattle on cool season forages use this tool at times to manage market price fluctuations.

In regards to business planning management, producers who graze cattle on small grains pasture are also the most likely to draft both a long and short term business plan. 68.6% of these producers indicate that they have both types of business plans for their operation as compared to 42.7% of warm season cattle producers.

Finally, producers utilizing the winter spring/ small grains production strategy are classified into large sized and primarily income dependent operation categories. However, producers who were generally the most dependent upon income from the stocker operation and those who were the largest in operation size are found to primarily utilize warm season production systems and graze cattle in the summer.

Conclusions and Implications

Larger operations often have the means and managerial capacity to implement specialized and cost-lowering methods in stocker production. These operations often face greater risk and pursue a wider variety of methods and practices to reduce it. Concerning business planning and management practices, larger operations may be performing such analysis to report to financial lenders. In addition, larger operations perhaps have greater profit incentives. Their managerial capabilities are often directed towards on-farm work with the objective of generating enough income so that off-farm work is not required.

Producers who derive a greater percentage of net income from their cattle operation have a greater incentive to maximize cattle profits. These income dependent producers likely attribute a greater utility to profits from cattle, relative to other producers. Since profitability in stocker growth is so heavily dependent upon economical forage production, it is perhaps not surprising that producers highly dependent upon stocker income more often choose cost reducing production practices related to forage production, namely the hay feeding season length, soil and

forage testing practices, and stocking rates. These producers also choose animal health practices that increase animal performance. At the end of ownership, stocker producers must have a healthy animal that is worth more than at the time of purchase. Just as recommended forage management practices are the key for controlling costs in the stocker enterprise, a strong animal health program is key to insuring a return on the investment. Income dependent producers also demonstrate themselves to be very attuned to a comparably greater number of business planning and management practices as compared with the size and specialization producer groups.

In theory, specialized stocker producers have the potential for greater returns to their investment but at the same time, they face increased risk due to factors such as price volatility and narrow margins of cattle weight gain. Our results confirm that specialized stocker producers are progressive in adopting recommended management practices concerning marketing and risk management, differing the most from diversified producers in this area. Specialized producers are regularly marketing large lots of uniform cattle. The differences in business planning and management practices between the two producer groups are likely attributed to the fact that many stocker producers must report to lenders to both obtain and repay loans, perhaps more frequently than the diversified cow-calf producer group. The age difference between the two producer groups is also notable.

Management practice adoption differs unquestionably between producers grazing cattle on differing forage bases and during various times of the year. In particular, producers pursuing a wheat-stocker production strategy are more attuned to many recommended management practices, particularly related to marketing and risk management.

Identifying the roles of operational characteristics upon management practice adoption has wide implications for Extension educators and researchers. Evidence from both analyses

suggests that small, non-income dependent, and year-round producers lag behind in adoption of recommended practices. Extension efforts should be focused on such producers. In addition, management practices should be emphasized that are not exclusive to particular producer groups and can be adopted regardless of operational characteristics. The advantages of recommended practices, particularly relating to business planning management, might also be emphasized. This is a category management practice category which can yield tremendous benefits and provide strategic direction to the operation.

Future research might include cost-benefit analysis of particular practices for specific groups of producers. Perhaps producers are aware of management practices recommended by Extension educators to increase biological or economic efficiency, but the costs including operator time and management exceed the benefits of adopting the technology. Future research might also explore producer logic and motivations in adopting specific technologies.

Limitations of this research should also be considered. A larger sample size would have yielded the opportunity to conduct more detailed analysis. Furthermore, many producers who requested or received a copy of the Beef Cattle Management Practice Assessment came to an extension meeting or requested a manual; therefore, the data generated from the survey instrument does not represent a random sample and conjectures applied to the larger population of stocker producers must be done with caution.

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Table 6. Summary of Chi-Square Results					
	Operation Size[1]	**Operation Income[2]**	**Specialized Operations[3]**	**Forage Base[4]**	**Time of Grazing[5]**
Production					
Energy and protein supplements	**(-)use of software		**(-)use of software		
Implanting	*(+)steers, *(+)heifers		*(+)steers, *(+)heifers	*(+)steers, *(+)heifers	
Horns	*(+)		*(+)		
Forages					
Hay feeding season length			*(+)		
Soil testing	**(+)	*(+)			
Setting stocking rate	**(+)	*(+)	**(+)		
Forage testing	*(+)produced, *(+)purchased	*(+)produced, *(+)purchased		**(+) produced	**(+) produced, **(+) purchased
Stockpiling[6]					**(-) bermuda and fescue
Quality Assurance and Animal Health					
Tick control		**(+)fire			**(-)fire
De-worming		**(+)	n.a. [7]		
Modified live vaccines	*(+)	*(+)	n.a.		
Retained ownership and data collection		*(+)data collection only	n.a.		
Individual cattle ID	*(+)hot branding		*(+)hot branding	**(-)none, *(+)visible,*(+) electronic, **(+/-)hot[9]	
Intramuscular injections	**(+)neck	**(+)neck, *(-)rump, *(-)hip	*(-)neck, *(+)rump		**(+)neck
Marketing and Risk Management					
Purchasing preconditioned cattle		*(+)			
Value preconditioned components	*(+)45-day weaned, **(+)respiratory vaccinations		n.a.		
Source of cattle	**(+)broker, *(+)video auction	*(-)in-state auction, *(+)video auction, *(+)out-of-state direct purchase	n.a.		
Receiving period	**(+)Sept-Nov		n.a.	*(+)Sept-Nov	*(+)Sept-Nov
Time of grazing	**(+)winter, *(+)spring, *(+)both winter and spring	**(+)both winter and spring	n.a.	*(+)winter, *(-)summer, *(-)year-round	n.a.

Table 6. Summary of Chi-Square Results					
	Operation Size[1]	**Operation Income**[2]	**Specialized Operations**[3]	**Forage Base**[4]	**Time of Grazing**[5]
Forage type	*(+)small grain, **(-)bermuda	**(+)small grain	n.a.	n.a.	*(+)small grain, *(-)bermuda, *(-)fescue, **(-)smooth brome, *(-)old world, *(-) native, **(-) other
Male cattle sold/ retained	**(-)sold, **(+)retained	*(-)sold, *(+)retained	n.a.	*(-)sold, *(+)retained	
Female cattle sold/ retained		*(+)retained	n.a.		**(-)sold
Marketing frequency	*(+)regularly	*(+)regularly	*(+)regularly	*(-)regularly	*(-)regularly
Lot size	*(+)truckload	*(+)truckload	*(+)truckload	**(+)truckload	*(+)truckload
Lot type	*(+)uniform	**(+)uniform	*(+)uniform	**(+)uniform	*(+)uniform
Male cattle marketing regular sales	*(-)<50 mi. from ranch, **(+)>50 mi. from ranch	*(-)<50 mi. from ranch	n.a.		
Female cattle marketing regular sales	*(-)<50mi. from ranch	*(-)<50mi. from ranch	n.a.	*(-)<50mi. from ranch	
Cattle marketing video auctions			n.a.		
Cattle sold direct from ranch to feedlot	*(+)males, **(+)females	**(+)males, **(+)females	n.a.	**(+)males	
Futures contracts	*(+)		*(+)		
Options contracts	*(+)		*(+)		
Forward pricing	*(+)		*(+)	**(+)	
Business Planning and Management					
Long and short term business plan				**(+)	
Recordkeeping frequency		**(+)	*(+)		
Financial record system		**(+)			
Financial planning/ assessment	**(+)cash flow, **(+)historical analysis	**(+)tax reporting summary, *(+)income statement	*(+)balance sheet, **(+)cash flow, *(+)income statement, **(+)historical analysis		
Recordkeeping related to cattle		**(+)medical treatments	[8]#only analyzed: vaccinations, medical treatments		

Table 6. Summary of Chi-Square Results					
	Operation Size[1]	**Operation Income[2]**	**Specialized Operations[3]**	**Forage Base[4]**	**Time of Grazing[5]**
Demographics					
Extent of off-farm work	*(-)producer	*(-)producer, **(-)spouse			
Age			**(-)		
Education					
Number of cattle	n.a.	*(+)	*(+)#stocker cattle	**(+/-)[9]	
Generating income to reduced off-farm work	*(+)	*(+)			
Reducing labor					
Use of internet					
Net household income					
Net income from cattle operation	*(+)	n.a.			**(+/-)

* indicates variable is significant with a p value <.01, if necessary a distinction is described.
** indicates variable is significant with a p value <.05, if necessary a distinction is described.
[1]Direction of the impact for the operation size variable (represented by either a negative or positive sign) is relative to large operations.
[2]Direction of the impact for the income dependency variable (represented by either a negative or positive sign) is relative to income dependent operations.
[3]Direction of the impact for the specialization variable (represented by either a negative or positive sign) is relative to specialized operations.
[4]Direction of the impact for the forage base variable (represented by either a negative or positive sign) is relative to operations primarily grazing cattle on small grains pasture.
[5]Direction of the impact for the time of grazing variable (represented by either a negative or positive sign) is relative to operations primarily grazing cattle during the winter or spring on small grains pasture.
[6]The stockpiling question was conditional based upon the producer's indication that either native pasture, bermuda grass, or fescue were available forages.
[7]n.a. is shown when no comparable question was asked about stocker production on the cow-calf producer survey.
[8]# describes any distinction between questions for stocker and cow-calf surveys.
[9](+/-) is shown when percentages of producer groups implementing a practice vary across categories generated in the chi-square analysis and no conclusive direction of the impact can be determined.