Economic Factors Affecting Cow Herd Performance

Ruslyn Ramsey
Graduate Research Assistant

Damona Doye
Extension Farm Management Specialist

Clement Ward
Extension Livestock Marketing Specialist

Economic performance of the beef cow-calf or cow herd enterprise can be measured in alternative ways. Three measures of performance, among others, are cost of production, pounds of calves produced, and rate of return on assets. Using these performance measures and SPA (Standardized Performance Analysis) data from New Mexico, Oklahoma, and Texas, research at Oklahoma State University found key factors that influence economic performance. The objective of the research was to utilize unique data to identify economic factors within a ranch manager's control that are important in determining economic performance.

This extension fact sheet summarizes a decade of SPA data and recent research findings. A previous extension fact sheet F-231, "Cow-Calf Financial and Production Performance: What We Are Learning from Standardized Performance Analysis (SPA) Data" summarizes earlier data and gives numerous references regarding cost management and production management. Results presented here provide insight into factors that affect performance across many sizes and production conditions in the southern plains region.

SPA Data Summary

Cattlemen, researchers, and extension specialists for cow-calf producers jointly developed Standardized Performance Analysis (SPA) software. Its purpose is to integrate financial records and production records into a single analytical tool. The SPA software utilizes enterprise accounting concepts, focusing on the cow-calf production process through weaning the calf (McGrann).

Data needed for a SPA are organized into two main categories. First, the financial data required includes cash operating costs (purchased feed, pasture rents, fuel, and veterinary services, etc.), liabilities, cost and market value of assets, changes in inventories, and other expenses in the year calves are weaned. Records used in calculating financial costs include IRS tax schedules (especially Schedule F), depreciation schedules, loan payment schedules, beginning and ending fiscal year balance sheets, and income statements.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
http://osufacts.okstate.edu

Second, the production data required includes cow and calf inventories, inventory reconciliation for exposed females (i.e., culls, sales, purchases, transfers, and deaths), feed and grazing acres, and feed used. For the production data, some records prior to the fiscal year are also necessary. Reproduction measures that are calculated include pregnancy percentage, pregnancy loss percentage, calving percentage, calf death loss, calf crop or weaning percentage, and female replacement rate, where all ratios are based on exposed females. Calving distribution information is a secondary SPA measure so data are not required but are included when available.

Standardized Performance Analysis data used in this study were compiled largely by Texas A&M University and credit is given to them for allowing the data to be used by Oklahoma State University. Data selected for use were for Oklahoma, Texas, and New Mexico cow herds from 1991 to 2001. Total observations numbered 394 with 63 from Oklahoma, 293 from Texas, and 38 from New Mexico. Production systems vary widely across this geographic region, from arid land-extensive operations to more intensive operations based on improved forage in higher rainfall areas. Both commercial and seedstock operations are included in the data. Data collected are from individual producer records. This research adds to other findings from SPA data for the upper Great Plains and eastern Cornbelt states (Dunn; Miller et al.).
A summary of the data used in the OSU research is shown in Table 1. Considering the minimum and maximum values for each variable, it is clear that cow herds in the three Southern Plains states vary widely. Figures 1-11 show the distribution of the data for the variables in this study.

Figures 1 to 3 are groupings of cow herd observations for the three performance variables: (1) Cost – defined as economic pretax cost before non-calf revenue adjustment per hundredweight; (2) Production – defined as pounds weaned per exposed female (lbs); and (3) Profit – defined as percent return on assets. Clearly, there are a number of low-cost, productive, profitable cow herds in the SPA database. These low costs, high production, and positive profits represent goals or incentives for cow herds not achieving those levels.

Figure 4 shows the distribution of cow herd size. Over half the observations in the SPA database are for herds of 100-700 cows, considerably larger than average cow herd size in any of the three Southern Plains states.

Figures 5 to 7 show the distribution of investments for land, machinery and equipment, and livestock (breeding stock primarily). A significant percentage of cow herds are managed entirely on leased land, with very little invested in machinery and equipment, and modest investments in breeding stock.

Lastly, figures 8 to 11 show variables that reflect management of the cow herd. Again, some categories clearly demonstrate achievable goals or objectives for cow herds not at those performance levels. Potential improvements include lesser amounts of feed fed per cow, higher calving percentages, lower calf death losses, and shorter breeding seasons.

Key Economic Factors

Variables included in regression models and their influence on performance measures are discussed here. A summary of results is shown in Table 2.

Cow herd Size

Economies of cow herd size have been found in some previous research. That means cost per unit declines with larger herd sizes. Thus, Beginning Fiscal Year Breeding Cow Inventory (the measure of cow herd size here) was expected to be important. A squared term was included because economies of size were expected to have a declining effect, as cow herds get very large. However, it was also recognized that economies might not exist in production because larger cow herds may not be managed as intensively for best production performance.

Herd size was found to significantly affect costs and profit, but not production. Results for the cost model indicated economies of size exist in the cow-calf enterprise. Larger cow herds tended to have lower per cow costs though the size advantage was not large. Both herd size and its squared term indicated cost per unit declines at a decreasing rate as herd size increases. Herd size was not significant in the production model. Thus, while herd size can positively affect production costs, it may not improve physical production itself. Herd size was found to affect profit (Return on Assets), but the quadratic term was not significant. Larger herds may affect return on assets through lower per unit costs or through marketing larger numbers of weaned calves at premium prices.

Investment in Land

The investment in real estate (market value of land plus improvements) was expected to increase cost. Whether or not real estate investments contributed to increased production was questionable and depended on how land is managed. Real estate investment was expected to be associated with a lower return on assets unless the return generated by ranch profits was more than the return generated by renting land. Investment in real estate was found to increase per unit costs. Leasing land may be less costly and an option to consider rather than land ownership in providing forage for a cow-calf operation. Real estate investment did not lead to increased production nor did it contribute to long-term profits of the cow herd enterprise. However, it is recognized that the decision to own land may be influenced more by personal goals of producers, such as wealth accumulation and asset growth than the expected contribution to enterprise profitability. Still, it is important to understand the investment effect, or lack of effect, on the cow-calf enterprise.

Investment in Machinery and Equipment

The anticipated effect from the investment in machinery and equipment was similar to that for real estate. Machinery and equipment investments were expected to increase costs. Larger investments in machinery, equipment, and vehicles translate into higher operating costs for repairs, fuel and lube, depreciation, and taxes plus interest on the investment. Machinery and equipment investments could contribute to increased or decreased production depending on where the investments are made and how they contribute to the cow herd operation. Simply investing in a nicer pickup truck does not lead to increased production, whereas investing in buildings or equipment that could enhance calving percentage and decrease calf death loss could increase production. Investment in machinery and equipment was anticipated to have a negative effect on profits.

Machinery and equipment ownership contributed to increased costs as expected without also increasing either production or profits. Results suggest producers should carefully consider machinery ownership, perhaps substituting custom work, to minimize costs. Producers also need to recognize when an investment in machinery and equipment may realistically affect production and when it will not.

Investment in Livestock

The investment in breeding livestock was expected to increase costs. Like other investments, larger breeding stock investments translate into higher operating costs. The effect of breeding stock investments on production could have mixed results. Ideally, the investment in better quality breeding stock with increased reproductive rates would increase pounds weaned per cow. However, if the increased investment is not clearly related to enhanced production, the anticipated relationship may not result. A positive sign was anticipated in the profit model, again assuming that a wise investment in breeding stock increased productivity and profitability. However, overzealous investment in breeding stock without the commensurate increase in production may detract from profitability.

In fact, the investment in breeding livestock significantly increased per unit costs, but also increased production. Perhaps producers with higher levels of investment in breeding livestock have higher quality livestock and wean more pounds per cow. Increased breeding stock investment did not significantly affect cow herd profitability, suggesting the increased gain in production was insufficient to offset the increased costs and significantly improve long-term profits. Here, too, producers are advised to carefully invest in better breeding stock in order to achieve the multiple goals of lower costs, higher production, and increased profitability.

Feed Fed

Grazing is thought to be the most cost effective means of meeting beef cows' nutritional needs. Hence, low cost systems would be expected to use little purchased or raised

feed that has been mechanically harvested, stored, and hauled. Increasing pounds of raised/purchased feed per breeding cow (feed cost) was expected to increase costs, but was also expected to increase production. Increased feeding may increase total pounds weaned as a result of higher weaning weights or better reproductive rates based on the increase in cows and/or bulls condition. Higher feed costs were also expected to adversely affect profits. This would occur if the benefits of feeding relative to grazing do not outweigh the added costs.

Pounds of feed fed were significant in both the cost model and the profit model. As pounds of feed fed increases, per unit costs increased. However, while pounds of feed fed affected costs, it did not improve production. Perhaps to be significant, feed must be strategically fed to increase conception and/or weaning weights. In the profit model, increased feed per cow did not translate into higher production or calving profits, but it did increase costs.

Calving Percentage

Calving percentage could be interpreted as a proxy for production management skills and, if significant in the cost and profit models, would indicate a relationship between production skills and financial skills. Calving percentage was expected to be negatively associated with costs because as calving percentage increases, fixed costs per cow decrease. Obviously, a positive relationship was expected between calving percentage and pounds weaned. Generally, a positive relationship would be expected between calving percentage and profits, given the expected negative effect on costs and the positive effect on production.

Calving percentage, clearly a variable within the purview of management, was the only variable that was significant in all three models. Increased calving percentage decreased per unit costs, increased pounds weaned, and increased profits. This finding reinforces the importance of high levels of reproduction to meet cow-calf enterprise success and contribute to long-term profitability and sustainability. Because of the significance of calving percentage in all three models, it can be concluded that better management to increase live, healthy calves is an important strategy to improve enterprise performance, leading to decreased costs, increased production, and improved profits.

Calving Death Loss

Calving death loss based on exposed females also can be interpreted as a proxy for production management skills. In the cost model, this variable was expected to be positive because calving mortality also is accompanied by increased morbidity, resulting in higher veterinary and related costs. Calving death loss was expected to adversely affect pounds weaned because higher death loss reduces the number of calves marketed and potentially the weight of calves marketed. Higher death loss similarly was anticipated to negatively affect profits.

Increased calving death loss increased per unit costs and reduced production. These results also emphasize the importance of management of the cow herd. Effective management to reduce calving losses can have an associated effect along with investing in technology and improving management to increase calving percentage. However, in this study, calving death loss had no direct, significant effect on profit.

Breeding Season Length

Length of Breeding Season is an indicator of management skills and intensity. Longer breeding seasons result in a lack of uniformity of weaned calves and potentially lower prices as calves are sold in smaller, uneven lots. A shorter, more intensive calving season typically better utilizes labor, decreases death loss, and increases calves' health. Breeding season length was expected to reduce costs, increase productivity, and contribute to enhanced profitability.

Length of the breeding season, like calving death loss, affected costs and production, but not profit. Longer breeding seasons increased costs and decreased production. Thus, shorter, well-defined breeding seasons can reduce costs and increase pounds weaned per exposed female.

Summary and Conclusions

In this study, cow-calf Standardized Performance Analysis data were used to analyze cow-calf operations and determine how costs, production, and profitability were affected by management variables. Three models were estimated. All variables were significant in the cost model. Variables associated with increasing costs were pounds of feed fed, calf death loss, and investments in real estate, livestock, and machinery and equipment. Costs per hundredweight were negatively related to herd size, calving percentages, and length of breeding season. Thus, production and financial management both contribute significantly in explaining total costs. It was also shown that economies of size increased at a decreasing rate.

Pounds weaned per exposed female were significantly affected by four factors. Investment in livestock and higher calving percentages had positive impacts on pounds weaned, while death losses and longer breeding seasons had negative impacts.

For the percent return on assets model, only three variables had a significant effect. The beginning fiscal year breeding cow inventory and calving percentage increased the return on assets, while an increase in pounds of feed fed decreased return on assets.

One additional comment should be made here. Some variables were important for managing costs and increasing production, but not for profitability as measured by rate of return on assets. There are potentially two explanations for this seemingly contradictory result. Both are related to the data for this research. First, how effectively producers and, in many cases, those helping to do the SPA analyses were able to report the data for just the cow herd enterprise exclusive of other ranching enterprises is not known. Second, and related to the first point, the range of return on assets in Table 1 was very wide, from –45.1% to 48.5%. That emphasizes the first point and may explain why some variables that are expected

to affect long-term returns were not statistically important in this study. However, an investment or management variable that was not statistically significant can still be economically important and must be managed effectively.

Overall, results from this OSU research indicate the importance of management to cow herd costs per unit, production, and profitability. Management is key to effective investments, managing costs, and employing husbandry skills, all combining to improve long-term profitability and sustainability.

References

Dunn, B.H. "Characterization and Analysis of the Beef Cow-Calf Enterprise of the Northern Great Plains Using Standardized Performance Analysis." Ph.D. thesis, South Dakota State University, 2000.

McGrann, J. Cow-Calf Standardized Performance Analysis (SPA) Handbook and Software User Manual. Department of Agricultural Economics, Texas A&M University. 2000.

Miller, A.J., D.B. Faulkner, R.K. Knipe, D.R. Strohbehn, D.F. Parrett, and L.L. Berger. "Critical Control Points for Profitability in the Cow-Calf Enterprise." The Professional Animal Scientist. 17(2001):295-302.

Table 1. SPA Variable Summary Statistics.

Independent Variable	Calculation	Unit	Mean	Std. Dev.	Min.	Max.	N
Economic Pretax Cost Before Non-calf Revenue Adjustment per Cow	(Total Pretax Costs ÷ Lbs. of Weaned Calf Production per Breeding Cow) X 100	$	412	160	138	1,717	394
Pounds Weaned per Exposed Female	Total Pounds of Calf Weaned ÷ Total Number of Females Exposed	Pounds	430	80	195	638	394
Percent Return on Assets (Cost Basis)	((Net Enterprise Income from Operations + Total Interest Expenses - Family Living Withdrawals) ÷ Average Total Enterprise Assets) X 100	%	1.12	10.05	-45.08	48.54	394
Beginning Fiscal Year Breeding Cow Inventory	Number of Breeding Females at Beginning of Fiscal Year	Cows	711	1,754	10	13,884	394
Real Estate Improvements	Average Asset Value ÷ Number of Breeding Cows	$	1547	2208	0	16,230	394
Machinery and Equipment (Market Value)	Average Asset Value ÷ Number of Breeding Cows	$	174	307	0	3,264	394
Livestock (Market Value)	Average Asset Value ÷ Number of Breeding Cows	$	653	300	0	1910	394
Pounds of Raised/Purchased Feed per Breeding Cow	Total Pounds of Raised and/or Purchased Feed Fed ÷ Number of Breeding Females	Pounds	1675	1561	0	7,610	394
Calving Percentage	(Number of Calves Born ÷ Number of Exposed Females) X 100	%	85.8	9.3	49.3	104	382
Calving Death Loss Based on Exposed Females	Number of Calves that Died ÷ Number of Exposed Females	%	3.5	3.5	0	23	384
Length of Breeding Season	Number of Days from Beginning to End of Breeding Season	Days	133	77	11	365	394

Note: Statistics constructed from Standardized Performance Analysis data in Oklahoma, Texas, and New Mexico from 1991-2001.

Table 2. Significant Variables and Signs

Variable	Cost[1]	Lbs[2]	ROA[3]
Beginning Fiscal Year Breeding Cow Inventory	-	NS	+
Investment in Real Estate-Land and Improvements	+	NS	NS
Investment in Machinery and Equipment	+	NS	NS
Investment in Livestock	+	+	NS
Pounds of Raised/Purchased Feed Fed per Breeding Cow	+	NS	-
Calving Percentage	-	+	+
Calving Death Loss Based on Exposed Females	+	-	NS
Length of Breeding Season	+	-	NS

(NS is not significant)

[1] Economic pre-tax cost before non-calf revenue adjustment per cow

[2] Pounds weaned per exposed female

[3] Percent return on assets (cost basis)

Figure 1. Cost measure: cow herd cost per hundredweight (precav. before non-calf revenue adjustment).

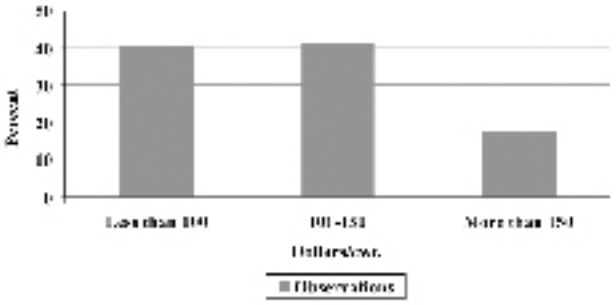


Figure 2. Production measure: pounds weaned per exposed female.

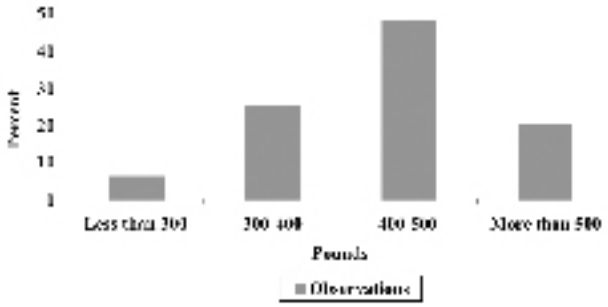


Figure 3. Returns measure: percent return on assets.

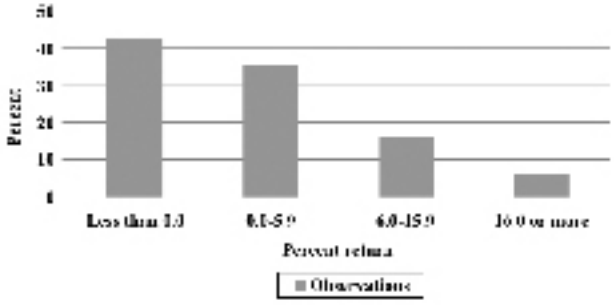


Figure 4. Cow herd size (beginning fiscal year breeding cow inventory).

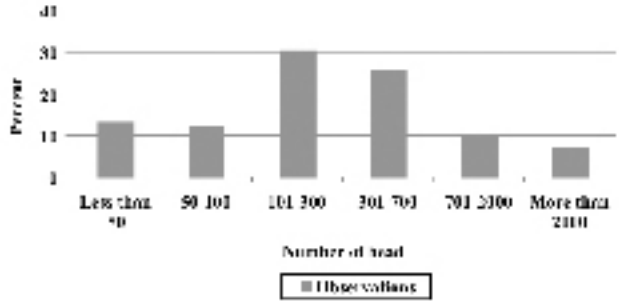


Figure 5. Real estate investment per cow (land and improvements).

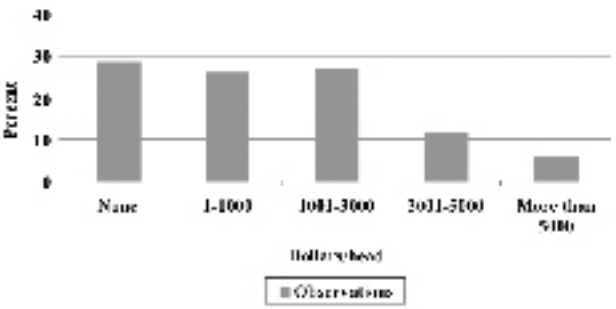


Figure 6. Machinery and equipment investment per cow.

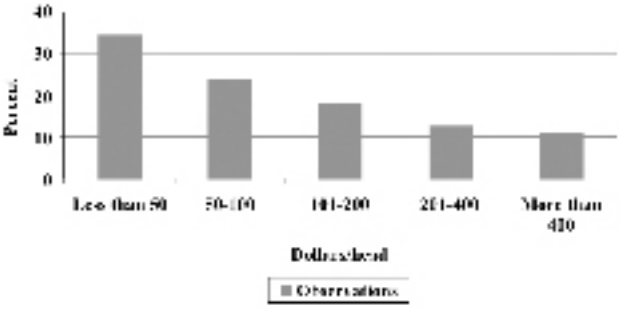


Figure 7. Livestock investment per cow.

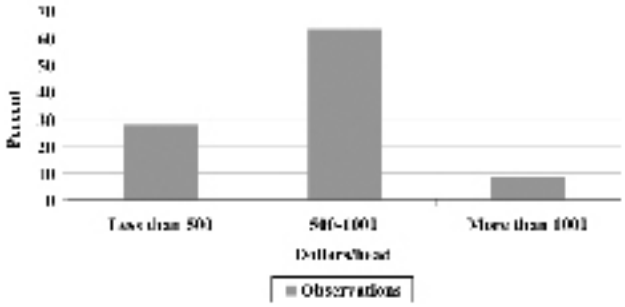


Figure 8. Purchased or raised feed per breeding cow.

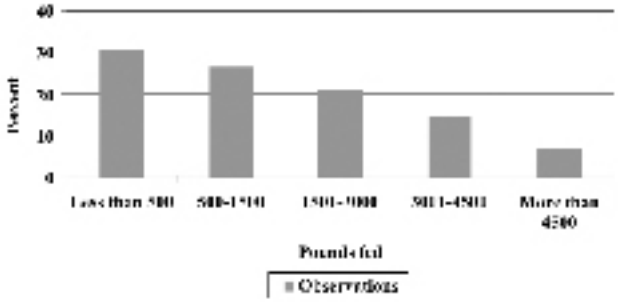


Figure 9. Calving percentage.

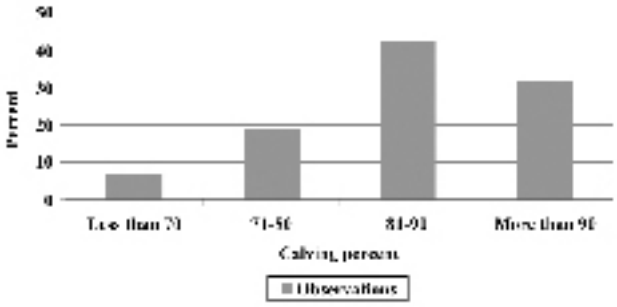


Figure 10. Calving death loss (based on exposed females).

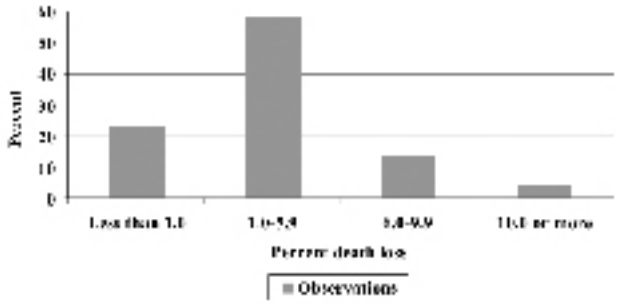
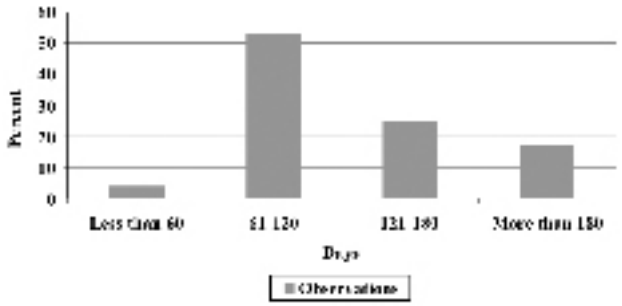


Figure 11. Breeding season length.



The Oklahoma Cooperative Extension Service
Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 42 cents per copy. 0704 JA