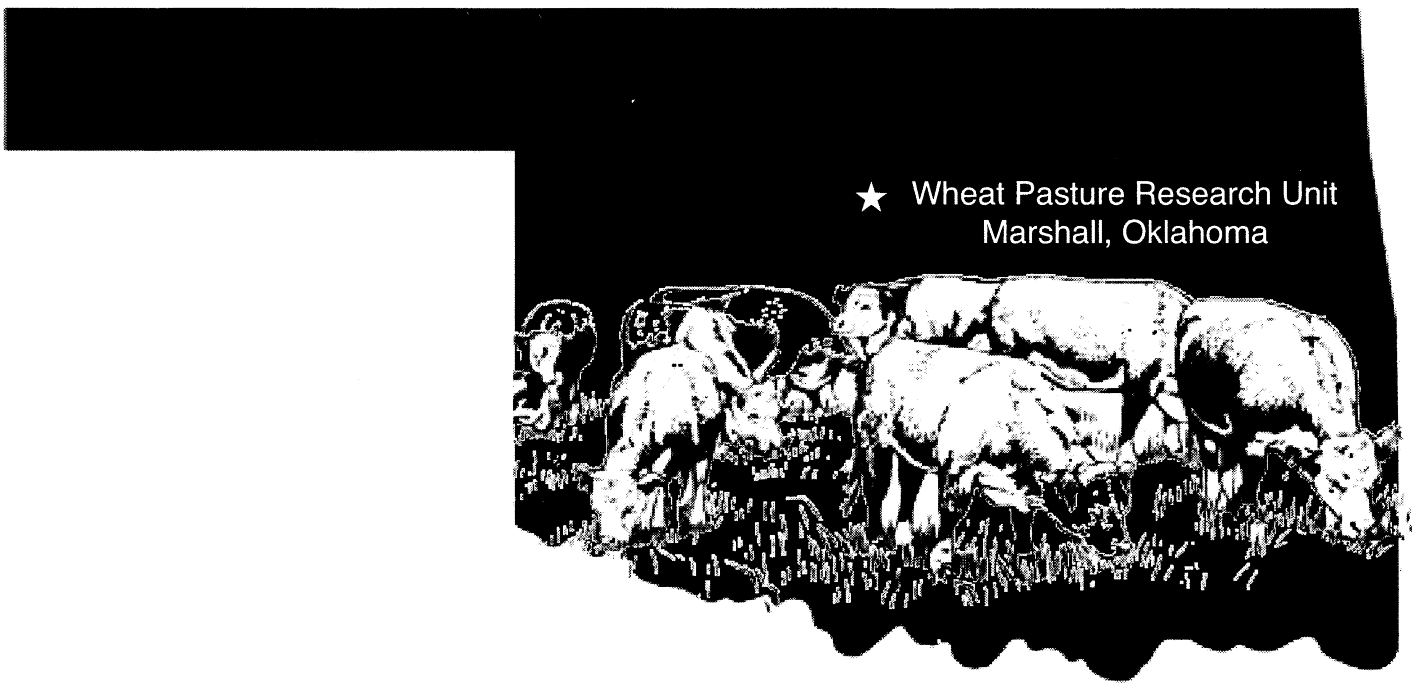
B-816

Dual-Purpose Winter Wheat and Stocker Steer Grazing Experiments at the Wheat Pasture Research Unit, Marshall, Oklahoma



Oklahoma State University
Oklahoma Agricultural Experiment Station
Division of Agricultural Sciences and Natural Resources
Departments of Agricultural Economics, Animal Science, and Plant and Soil Sciences

Dual-Purpose Winter Wheat and Stocker Steer Grazing Experiments at the Wheat Pasture Research Unit, Marshall, Oklahoma*

Simeon Kaitibie

Francis M. Epplin

Gerald W. Horn

Eugene G. Krenzer, Jr.

Steven I. Paisley

Departments of Agricultural Economics, Animal Science, and Plant and Soil Sciences
Division of Agricultural Sciences and Natural Resources
Oklahoma Agricultural Experiment Station
Oklahoma State University

2003

*This material is based upon work supported in part by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement Numbers 93-34198-8410, 97-34198-3970, and 99-34198-7481 and in part by the Oklahoma Agricultural Experiment Station, project H-2237. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the United States Department of Agriculture. Products mentioned in this manuscript are for informational purposes only. No endorsement is implied or intended.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Samuel E. Curl, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Dean of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of $408.07 for 300 copies. 1103 JA.

Dual-Purpose Winter Wheat and Stocker Steer Grazing Experiments at the Wheat Pasture Research Unit, Marshall, Oklahoma

ABSTRACT

Researchers with the Division of Agricultural Sciences and Natural Resources at Oklahoma State University initiated research at the Wheat Pasture Research Unit (WPRU), Marshall, Oklahoma, in 1989. The WPRU is unique in that it includes 16 large (18-24 acre) pastures enabling close approximation to farm production practices. It has been used to evaluate and demonstrate a number of dual-purpose (forage plus grain) wheat management practices as well as practices for managing steers stocked on wheat pasture. Results from specific studies conducted at the facility have been published elsewhere. The purpose of this bulletin is to (i) describe the wheat and stocker production management practices used at the WPRU and (ii) to use data produced at the WPRU in combination with historical prices to determine the economics of dual-purpose wheat-stocker production across years. Wheat grain yield, wheat forage production, stocker steer weight gain, and net return to fixed production resources across several years are presented. The results indicate a considerable amount of variability in net returns across years, varieties, and stocking densities. There was no consistent economically optimal stocking density across the years of the study.

Dual-Purpose Winter Wheat and Stocker Steer Grazing Experiments at the Wheat Pasture Research Unit, Marshall, Oklahoma

In the southern Great Plains, grazing winter wheat is a common practice that produces both livestock weight gain and wheat grain. The lush fall-winter wheat pasture produced by dual-purpose wheat is a valuable source of high-quality forage when perennial pastures are dormant. Many lightweight calves are transported in the fall to the southern Great Plains from locations elsewhere in North America that are deficient in fall-winter forage (Brorsen, Bailey, and Thomsen, 1994). After grazing on winter wheat most of these animals are moved to feedlots in the region for finishing. The unique forage niche provided by dual-purpose winter wheat contributes to the overall beef production sector. Beef cattle are the most important agricultural product in Oklahoma, generating an estimated $1.5 billion in revenue in 2001 (Oklahoma Department of Agriculture, 2002).

Pinchak et al (1996) estimate that up to 80 percent of the 20 million acres annually seeded to wheat in the southern Great Plains is grazed in fall and winter. In Oklahoma, about seven million acres were seeded to wheat in 1995, two-thirds of which producers intended to use for both fall-winter forage and grain (True et al., 2001). As a result of unfavorable weather, only 41 percent was actually used for dual-purpose (True et al., 2001).

Precise estimates of the number of stocker cattle pastured on wheat in Oklahoma are not available. Tweeten (1982) hypothesized that approximately 1.5 million stocker cattle graze winter wheat in Oklahoma. True et al (2001) estimated that the total number of stocker steers and stocker heifers on Oklahoma pastures in the fall-winter of 1995-96 was 868 thousand. True et al (2001) note that a drought extended through much of the 1995-96 wheat production year and reduced fall and winter forage production to less than historical average. The USDA reported that 1.78 million calves, heifers, and steers grazed small grain pastures in Oklahoma, Kansas, and Texas in 2001 (Agricultural Statistics Board). They do not report numbers specifically for Oklahoma. In 2002, the USDA reported that 2.8 million stockers grazed on small grain pastures in the three states (Agricultural Statistics Board). The available estimates suggest a considerable amount of year-to-year variability in the number of stocker cattle pastured on wheat in the state. The quantity of fall-winter wheat forage produced is highly dependent upon the weather. Since the weather in the southern Great Plains is highly variable, it is very likely that the number of stocker cattle grazing on winter wheat pastures in Oklahoma varies considerably because of this.

Researchers with the Division of Agricultural Sciences and Natural Resources at Oklahoma State University initiated research at the Wheat Pasture Research Unit (WPRU), Marshall, Oklahoma, in 1989. The WPRU is unique in that it includes 16 large (18-24 acre) pastures enabling close approximation to farm production practices. A number of research studies that have addressed issues associated with the production of dual-purpose winter wheat and stocker steers on dual-purpose wheat pasture have been conducted at the WPRU and elsewhere. Examples of prior studies include: bloat prevention (Horn, Clay, and Croy, 1977; Anderson and Horn, 1987), stocker steer supplementation strategies (Coulibaly, Bernardo, and Horn, 1996; Horn et al,1995a; Paisley and Horn, 1996; Paisley and Horn, 1998; Paisley, Ackerman, and Horn, 1997; Paisley, 1998; Horn and Paisley, 1999; Horn and Paisley, 2000); use of ionophores (Andrae et al, 1995; Horn et al, 1981; Horn et al, 2002); wheat planting date (Epplin, Hossain, and Krenzer, 2000; Horn et al., 1998; Horn et al., 1999); grazing termination (Krenzer et al, 1995; Redmon et al, 1996); wheat variety selection (Horn et al, 1994; Horn et al, 1995b); genetic trends in winter wheat grain yield and quality under dual-purpose and grain-only management systems (Khalil et al, 2002a; Khalil et al, 2002b); development of a management decision aid (Epplin, Horn, and Krenzer, 1999a; Epplin, Horn, and Krenzer, 1999b; Epplin, Horn, and Krenzer, 1999c); and several other issues (Horn et al, 1995c; Redmon et al, 1995).

Previous research has found that the optimal planting date for dual-purpose wheat is earlier than the optimal planting date for grain only wheat (Epplin, Hossain, and Krenzer, 2000). As a result of the earlier planting date, the expected grain yield from dual-purpose wheat is less than the expected grain yield of grain only wheat. However, for a given planting date, if grazing is properly managed, and if weather is favorable, fall-winter grazing is not expected to adversely affect grain yield of dual-purpose wheat (Christiansen, Svejcar, and Phillips, 1989; Winter, Thompson, and Musick, 1990; Worrell, Undersander, and Khalilian, 1992). Recommended management strategies include delaying livestock placement on the wheat until the plant roots are well anchored, ensuring adequate soil fertility, and removing livestock from the pasture prior to development of the first hollow stem stage of wheat development. Under these conditions, for a given planting date and reasonable stocking densities, fall-winter grazing is not expected to be detrimental to grain yield.

Timing of the termination of grazing for dual-purpose wheat production is extremely important. Redmon et al (1996) emphasized the importance of the timing of livestock removal from dual-purpose wheat. They found that net return from wheat as well as total net return from cattle plus wheat declined under normal cattle and wheat price situations when cattle were permitted to graze beyond the first hollow stem stage of growth.

A number of important issues that influence the economics of dual-purpose winter wheat production and stocker steer production on wheat remain to be investigated. For example, selection of stocking density is an important management decision. However, wheat fall-winter forage yield, wheat grain yield, and stocker steer weight gain response to stocking density have not been precisely determined. True et al (2001) reported that the average fall-winter grazing stocking density in the drought year of 1995-96 in Oklahoma was 0.37 steers per acre. If too few animals are stocked on the wheat forage, the excess forage will be lost. If too many animals are stocked, weight gain will be limited and in the extreme case animals may lose weight. Alternatively, supplemental feeding maybe required. Data produced at the WPRU enable a comparison of the economic consequences of different stocking densities across seven wheat production years.

Objectives

The purpose of this bulletin is to (i) describe the wheat and stocker production management practices used at the WPRU and (ii) to use data produced at the WPRU in combination with historical prices to determine the economics of dual-purpose wheat-stocker production across years. A description of the WPRU is followed by a discussion of the wheat production practices and the stocker steer production practices used on the 16 pastures from 1989 to 2000. Stocking density experiments are also described. Wheat grain yield, wheat forage production, and stocker steer weight gain, across several years are presented. Data from WPRU stocking density experiments are used to determine net returns to fixed production resources across years and stocking densities.

The Wheat Pasture Research Unit

The WPRU is located northwest of the intersection of state highways 74 and 51 in northwest Logan County in central Oklahoma. The predominant soil type at the WPRU and on much of the cropland in north-central Oklahoma is Kirkland silt loam (fine, mixed, thermic Udertic Paleustoll). The 440-acre facility includes 16 pastures, that are either 18 or 24 acres (Table 1 page 10).

Dual-purpose wheat production is complicated by the variability of weather in the region. Table 2 (page 10) contains monthly rainfall precipitation for the years 1988 through 2000 for Marshall, Oklahoma. Over the time period from 1988 to 2000, average annual rainfall was approximately 33 inches, but ranged from 25.5 inches in 1990 to 42 inches in 1999. In the very important wheat forage production month of October, rainfall ranged from 0.46 inch in 1993 to 7.73 inches in 1998. On average, except for 1994 and 2000, the month of September showed moderate to high rainfall.

Table 3 (page 10) contains monthly data for the Palmer Drought Severity Index (PDSI) for Central Oklahoma. The PDSI is published by the National Oceanic and Atmospheric Administration (NOAA) and provides another measure of weather variability. It has values that generally range from -6 to +6, with negative values used to denote dry periods and positive values, wet periods. PDSI values ranging from 0.5 to -0.5 generally imply "normal"; -0.5 to -1.0 is incipient drought; -1.0 to -2.0 is mild drought; -2.0 to -3.0 imply moderate drought; and -3.0 to -4.0 imply severe drought. Similar ranges of positive values are used to describe wet periods. Based upon the PDSI, September of 1992 was "severely wet" whereas September of 1998 was a time of "severe drought."

The data in Table 3 confirm the presence of incipient drought in much of 1994 including the months of September and October. Drought-like conditions were evident for the months of December, January, and February in 1994-95, although this period was preceded by two months of above average rainfall. This accounts in part for the extremely low wheat grain yields obtained in June of 1995. The PDSI shows there was incipient to severe drought for almost all of the 1995-96 wheat production year. Stocking density was not a treatment at the WPRU in the 1995-96 crop year.

Wheat Production Activities

Table 4 (page 11) includes a list of the wheat production enterprise field operations used at the WPRU. In a typical year, five tillage operations were conducted. After grain harvest in June, an offset disk operation was performed. This was followed by a chisel operation, a second offset disk operation in July, a pass with a field cultivator in August, and a second field cultivation in September.

During the first field cultivation in August, anhydrous ammonia (82-0-0) was applied preplant, typically at the rate of 170 pounds per acre. Nitrogen application level was based upon a targeted yield goal of 3,000 pounds (dry matter) of fall-winter forage and 50 bushels of grain per acre. It was assumed that adequate soil nitrogen fertility requires 0.3 pound of available soil nitrogen per pound of forage target yield, and two pounds of available soil nitrogen per bushel of grain target yield. Soil tests were used to determine the level of residual soil nitrogen and fertilizer was applied as necessary to meet the target requirements. The actual quantity of anhydrous ammonia applied varied. For example, 189 pounds per acre were applied in 1989, with 98 pounds per acre in 1991, and 168 pounds per acre in 2000. In 1992, the soil pH across pastures ranged from 4.7 to 4.9. ECCE lime at two tons per acre was applied across all the pastures in the summer of 1992. By the summer of 1994, the average soil pH across the pastures had increased to 5.7.

In September (usually the first week) wheat seed was drilled into furrows at a rate of 120 pounds per acre. At the same time, diammonium phosphate (18-46-0) was placed in the furrows at the rate of 50 pounds per acre. In some years, the herbicide Finesse was applied at 0.4 ounce per acre. For budgeting purposes alternate year applications of Finesse are assumed. Grazing of the pastures was initiated after the plants became well anchored, usually in early November, and continued until the development of the first hollow stem in ungrazed exclosures, usually in late February or early March. The wheat grain was combine-harvested from the fields in June.

Stocker Steer Production Activities

Steers used in the WPRU experiments were predominantly crosses; 1992-1997 data on their origin are presented in Table 5 (page 11). Table 6 (page 11) includes the total number of steers purchased, average purchase weights, and receiving dates. After the steers were acquired they were transported to the WPRU and placed in a receiving program. The receiving program varied in length from year-to-year. It lasted four days in 1993-94 and 22 days in 1998-99.

In the receiving program, steer calves were initially vaccinated with modified live virus (MLV) strains of Infectious Bovine Rhinotracheitis (IBR), Bovine Virus Diarrhea (BVD), and Bovine Respiratory Syncytial Virus (BRSV) plus a Leptospira Pomona bacterin within 24 hours of arrival. They were also given an intranasal IBR/Parainfluenza 3 (PI_3) vaccine and a Pastuerella haemolytica bacterin-toxoid "One-shot." Nine days after the initial vaccination the calves were revaccinated with MLV strains of IBR, PI_3, and BRSV, a 5-way clostridial bacterin-toxoid, a Pastuerella haemolytica bacterin-toxoid "One-shot," and an injection of Ivermectin to treat internal and external parasites.

During the receiving program, the calves were fed free choice bermudagrass hay, amounting to an intake of about eight pounds per steer per day, and two pounds per steer per day of a soybean meal-based, high protein supplement that contained vitamin E, Deccox®, and selenium. The steers were implanted with Synovex-S® immediately before placement on wheat pasture.

Following the receiving program the steers were weighed and placed on pastures. The recorded placement weights are shown in Table 7 (pages 12-13). The steers were provided free-choice access to a high calcium commercial mineral mixture, but received no other supplemental feed except for limited amounts of alfalfa hay when snow covered the wheat fields. Steers were only removed from the pastures for weighing.

Considerable variation occurs in the mineral composition of wheat forage. Most wheat forage produced in Oklahoma contains marginal to sufficient phosphorus and magnesium, excess potassium (which is characteristic of small grains forages in general), and inadequate amounts of calcium for growing cattle. Therefore, calcium is the macro mineral of primary concern in many wheat pasture grazing situations. In these situations, wheat pasture stockers should be supplemented with an additional 10 grams of calcium per day. The total daily calcium requirement of a 400-pound steer calf gaining two pounds per day is 28 grams. The high calcium mineral mixture was made available to meet this requirement. An average of 8.40 pounds of the commercial mineral mixture was consumed per steer during the grazing period.

Stocking Density Experiments

Stocking density experiments were initiated at the WPRU in 1992. Several studies (e.g. Bruckner and Raymer, 1990) suggest that varietal differences in forage production may exist. Four semi-dwarf hard red winter wheat varieties Karl, 2163, 2180, and AgSeCo 7853 were grazed in the first two years, 1992-93 and 1993-94. In the following years, except for 1995-96, Karl and 2163 were replaced with Longhorn and Scout 66. In 1997-98 and subsequent years, Tonkawa replaced all varieties, except for 1999-00 when 2174 was also included.

In 1992, Karl was the most popular variety in Oklahoma, although it is susceptible to acid soil conditions and leaf rust. Varieties 2163 and AgSeCo 7853 were new wheat varieties. Variety 2163 is acid-tolerant and less susceptible to leaf rust than Karl, while AgSeCo 7853 shows moderate to high tolerance to soil acidity and leaf rust. Variety 2180 is early maturing and shows moderate to high resistance to soil acidity and leaf rust. Scout 66 is a tall late maturing wheat variety, which is highly susceptible to both soil acidity and leaf rust. Tonkawa is resistant to leaf rust, but susceptible to soil acidity. The wheat varieties used in this experiment were generally tolerant to soil-borne mosaic virus. By the year 2000, many of these wheat varieties had lost their initial appeal to producers, such that in 2000 the top wheat variety by percentage of Oklahoma seeded acres was Jagger at 38.1 percent.

Charts of wheat grain yield by stocking density for each year in which stocking density was a treatment variable are presented in Figure 1 (page 24). The charts tend to show that in 1995, 1997, 1998, 1999, and 2000 stocking density did not have a significant effect on wheat grain yield. The results from 1993 and 1994 are less clear. However, when pooled over the seven years, stocking density was not a statistically significant factor in explaining wheat grain yield. This suggests that with the range of stocking densities used in the study, if grazing is delayed until plants are anchored, if fertilization is adequate, and if grazing is terminated prior to development of first hollow stem, grain yield is independent of stocking density. This finding is consistent with research by Christiansen, Svejcar, and Phillips; Redmon et al. (1996); Winter, Thompson, and Musick; and Worrell, Undersander, and Khalilian. However, as a result of the earlier planting date, the expected grain yield from dual-purpose wheat is less than the expected grain yield of grain only wheat (Epplin, Hossain, and Krenzer, 2000).

After the first two years of the stocking density experiment, stocking densities were adjusted depending on the amount of forage available at placement, and sometimes, during grazing. Standing wheat crop was measured per acre per pasture, three times in 1992-93, and four times in the subsequent years, except for 1999-00 when the measurement was done three times. The results, together with the average standing crop, are reported in Table 8 (pages 14-15). The initial standing crop measurements were made prior to cattle placement. Subsequent measures were taken from areas that had been grazed. The results indicate that average standing crop was highest for the 1994-95 crop year and lowest for the 1992-93 year. Data from exclosed areas that were not grazed is not available.

Table 9 (page 16) contains wheat grain yields from the dual-purpose forage plus grain experiments, as well as the corresponding county averages from all wheat harvested in the county (includes grain only and dual-purpose wheat). To enable comparison with county averages, wheat yields were averaged across years and compared with the Logan County average for each year. In general, Logan County average yields compared favorably with experimental yields. For three of the seven crop years, the county average was higher than the experiment average. Wheat yields were very low in 1995. On the other hand, county and experiment yields were consistently high in 1997-98, 1998-99, and 1999-00.

Table 7 shows the average stocking densities, initial placement, and final weights of the stocker steers; average daily gain and weight gain per steer. In the 1989-90 and the 1991-92 crop years, a single stocking density of 0.50 and 0.51 steers per acre respectively was used. In the 1992-93 and 1993-94 crop years, stocking densities ranged from 0.42 to 0.83 steers per acre. In subsequent years, stocking densities were established using a variable stocking density grazing system based on available forage to ensure similar grazing pressures for all wheat varieties. Forage mass was determined immediately prior to each interim weight, and stocking densities were adjusted following weighing to maintain similar ranges of herbage allowance across all varieties. The range in stocking density was gradually increased each year in an attempt to characterize forage and grain production responses across a wide range of stocking densities (Paisley, 1998).

Average steer purchase weights per year, but not per pasture, were available for some years (data for 1989-90 and 1994-95 are not available). These weights are reported in Table 6. To obtain steer purchase weights for each pasture, steer placement weights per pasture were adjusted by the difference between the average steer purchase weight per year and the average steer placement weight per year. The average weight difference of 11.5 pounds was used to adjust placement weights in years for which purchase weights were not available.

Steer placement weight across all years was 510 pounds. The highest weights (574 pounds) were observed in 1998-99, and the lowest (462 pounds) in 1989-90. The average daily gain after placement on wheat, across all years was 2.22 pounds. Steers in 1997-98 had the highest ADG at 2.65 pounds while the lowest ADG, 1.41 was for steers in 1992-93. On average, steers were removed from pastures at 759 pounds, after 112 grazing days. The highest steer sale weights were not achieved with the longest grazing periods. For instance in 1997-98, wheat pastures were grazed for 118 days to achieve a steer sale weight of 855 pounds, while in 1996-97, pastures were grazed for 128 days to achieve a sale weight of 743 pounds.

The grazing dates and number of grazing days are shown in Table 10 (pages 17-18). The average number of grazing days varied from 85 in 1991-92 to a high of 134 for the Scout 66 variety in 1994-95. A chronological summary of some production activities are presented in Table 11 (page 19). It shows an average placement date of November 12 and an average removal date of March 5. The receiving program required an average of 15 days, from October 28 to November 12. In most years, wheat was planted in the first week of September.

Procedure for Economic Analysis

Enterprise budgets were used to determine returns to machinery and equipment fixed costs, labor, land, and management for each pasture each year. Estimates on costs and returns for the dual-purpose wheat production enterprise were made under the assumption that the producer owned the land and owned the steers. It was assumed that the type of cattle used in the trials was consistent across pastures and years. Therefore average returns were calculated and compared across years and across stocking density. Returns were determined for each stocking density and variety in each crop production year.

Wheat Production Returns and Costs

Table 12 (page 19) includes the base enterprise budget developed for the purpose of estimating net returns to fixed production resources. For the wheat enterprise, gross receipts are obtained from the sale of wheat grain. Oklahoma City market wheat prices were used. June wheat prices are reported because the wheat grain was harvested in June. As reported in Table 13 (page 19) the highest June wheat price of $5.48 per bushel was recorded in 1996. That coincided with the drought period when inventories and production were low. Otherwise the nominal June wheat prices did not appear to follow any trend. However, it is evident that after the high of 1996, wheat prices declined. A stocker budget was used to determine the value of the fall-winter forage and thus forage value is not included in the wheat budget.

Table 14 (page 20) includes the prices and quantities of some of the inputs used in the wheat production enterprise. For budgeting purposes it was assumed that the herbicide Finesse was applied at 0.4 ounce per acre every other year at a cost of $13.00 per ounce. As shown in Table 14, the winter wheat seed price is the August Oklahoma City wheat price received, multiplied by two.

This assumption was used due to the absence of more precise wheat seed price data. Even though the U.S. average price is higher in many cases, the rationale is that most producers save seed from the previous year's wheat harvest. Operating capital costs reflect the opportunity costs of the cash inputs for the 10-month period between seeding in September and grain harvest in June.

Machinery and Equipment Cost

This section includes methods used to estimate costs of machinery operations and labor costs for both the wheat production enterprise and the steer production enterprise. The farm machinery complement selection (MACHSEL) program was used to determine machinery costs for the wheat production enterprise (Kletke and Sestak, 1991). The size of the dual-purpose wheat pasture enterprise may affect its cost structure. Ahearn, Whittaker, and El-Osta (1993) found that costs of producing wheat decline with increase in the size of the enterprise. Olson and Lohano (1997) suggest that such costs may level off and even begin to rise after achieving economies of size. USDA's 1997 Census of Agriculture estimated an average wheat farm size in Oklahoma of 448 acres.

Table 15 (page 20) includes machinery costs for the wheat production enterprise. Machinery fixed costs used in the enterprise budgets include depreciation, taxes, and insurance, as well as interest on the average investment in machinery and equipment. The costs were based on market interest rates and a wage rate of $6 per hour.

The wheat crop was assumed to be custom harvested at $13 per acre and $0.13 per bushel for every bushel above 20 bushels per acre. Labor was assumed fixed at 0.774 hours per acre at a wage rate of $6 per hour. Machinery fuel, lube, and repair costs for the wheat production enterprise were also estimated using MACHSEL (Kletke and Sestak, 1991).

Determining machinery fixed costs for the steer production enterprise entailed making assumptions that were then crosschecked with extension specialists for validity. It was assumed that 1.25 hours of labor were used per head per year, at a wage rate of $6 per hour. Machinery, equipment (including fencing, feeders, waterers, chutes), fuel, and repairs were estimated at $10 per steer per year. Fixed production costs were estimated to be $2.50 per steer for interest on the average investment in machinery and equipment and $5.50 per steer for machinery and equipment depreciation, taxes, and insurance.

Stocker Steer Production Returns and Costs

The stocker steer base enterprise budget is included in Table 16 (page 21). Steer purchase prices were based on prices paid at Oklahoma City. In Table 17 (page 22), October Oklahoma City market prices for medium/large frame No. 1 steers for 1989 through 1999 are listed. The operating costs include the cost of steer calves, order buyer fees, cost of shipping to pasture, receiving program costs, machinery fuel and repairs, and machinery fixed costs. The order buyer fee was assumed to be $0.50 per hundredweight. The cost to ship steers from the purchase location to the WPRU was assumed to be $2.10 per head.

The cost of the combination of IBR, BVD, BRSV, and PI_3 is approximately $0.90 per head per treatment. The cost of Ivomec-F (administered once) was $0.50 per hundred pounds of body weight. The cost of the five-way clostridia and Synovex-S® were $0.25 and $0.70 per head, respectively. The total veterinary and medicine costs were estimated to be $9.00 per head.

Prices of bermudagrass hay and the soybean meal-based supplement were budgeted at $0.03 per pound and $0.09 per pound, respectively. There were two days of inclement weather in a typical year, so 12 pounds of alfalfa hay per day for two days, at a cost of $0.06 per pound was included in the budget. The high calcium mineral mixture was budgeted at a cost of $0.09 per pound. The interest on operating capital is based on market interest rates. The cost of operating capital was adjusted to reflect the value over the five-month period in which the steer production enterprise was effectively undertaken.

For a typical farm situation, anecdotal evidence suggests that a death loss of 2% would be representative. Hence, for economic analysis a 2% death loss was assumed. It was assumed that at the end of the grazing period steers were shipped to the Oklahoma City market for sale. The Oklahoma City market March sale prices for medium/large frame No. 1 steers are reported in Table 18 (page 22). The costs of marketing plus sales commission are estimated at $2.00 per hundredweight. The estimated returns to the stocker steer enterprise are expressed in dollars per head. These values were converted into dollars per acre by multiplying by stocking density.

Net Returns Across Years

Enterprise budgets were developed and used to determine net returns per acre to machinery and equipment fixed costs, land, labor, and management for dual-purpose wheat production across years and stocking density. Table 19 (page 23) includes the net returns to machinery and equipment fixed costs, land, labor, and management calculated by pasture, and where possible, averaged across pastures with identical stocking densities for each crop production year. Changes in wheat and cattle prices as well as grain yields and livestock gains are considered. The use of different stocking densities between varieties within years for 1994-95 and 1996-97 and single varieties in subsequent years (except for 2000) made it impossible to compute average net returns across varieties for years other than 1992-93 and 1993-94.

More uniform data were available for 1992-93 and 1993-94 than for subsequent years. In the first two years of the stocking density experiment, sixteen pastures each were cultivated. There were four varieties and four stocking densities. However, since there were only 16 pastures, the variety by stocking density treatments could not be replicated. In the first year, the pastures of wheat varieties Karl, 2163, 2180, and AgSeCo 7853 were each stocked at 0.50, 0.61, 0.72 and 0.83 steers per acre. A computation of the average net returns by stocking density across pastures showed that the highest returns ($38 per acre) were realized when the stocking density was 0.61 steers per acre, while the lowest returns ($3 per acre) were realized when the stocking density was 0.83 steers per acre. Net returns decreased as stocking density increased from 0.61 to 0.83.

In 1993-94 the stocking densities were the same as those for the prior year, except for the lowest stocking density, which was changed from 0.50 to 0.42 steers per acre. The same varieties were used in the wheat pastures. The highest net returns ($48 per acre) were observed when stocking density was 0.61 steers per acre and the lowest net returns ($39 per acre) were realized when the stocking density was 0.42 steers per acre. Consistent with results from 1992-93, net returns decreased as stocking density increased from 0.61 to 0.83.

In 1994-95 and 1996-97 wheat varieties Karl and 2163 were replaced with Longhorn and Scout 66. Four different stocking densities were used for each variety. Therefore for these years, the average returns in the table represent returns from only one pasture. It was believed that root rots limited grain yields across all varieties in 1994-95. The highest net returns ($46 per acre) in 1994-95 were achieved with AgSeCo 7853 when the stocking density was 0.93 steers per acre. However, with a similar stocking density (0.92) net returns with Scout 66 were -$11. In the same year, the lowest net returns (-$28 per acre) were achieved from Scout 66 when the stocking density was 0.43 steers per acre. The general increase and decline in net returns with decrease in stocking density did not follow the same pattern as in the first two years. In general, as a result of low grain yields, net returns from Scout 66 and Longhorn were less across all stocking densities than from 2180 and AgSeCo 7853.

In the 1996-97 year the results suggested a different pattern. The highest net returns of $111 per acre were realized from AgSeCo 7853 at a stocking density of 0.91 steers per acre. The lowest net returns (-$4 per acre) were realized from 2180 when the stocking density was 0.46 steers per acre. In 1996-97 a severe freeze on April 13 reduced grain yield of 2180 in pastures not heavily grazed. The top three net returns for the 1996-97 year were obtained from pastures seeded with AgSeCo 7853, whereas the lowest two net returns were obtained from pastures seeded with variety 2180.

In the 1997-98 year the only wheat variety cultivated was Tonkawa, and it was grazed at four different stocking densities: 0.34, 0.42, 0.56, and 0.83 steers per acre. The highest net returns ($58 per acre) were achieved when the stocking density was 0.83 steers per acre. The lowest net returns ($36 per acre) occurred when the stocking density was 0.34 steers per acre.

The stocking densities in 1998-99 were 0.38, 0.47, 0.62, and 0.89 steers per acre, and Tonkawa was the only variety. The highest net returns ($81 per acre) were achieved at a stocking density of 0.47 steers per acre, and the lowest net returns ($32 per acre) occurred at a stocking density of 0.38 steers per acre.

In the 1999-00 year, two varieties, Tonkawa and 2174, were seeded in the wheat pastures. The lowest net returns ($43 per acre) resulted from 2174 at a stocking density of 0.46 steers per acre. Strawbreaker severely reduced yields in pastures seeded to 2174. The highest net returns ($169 per acre) were realized from a pasture seeded to Tonkawa with stocking density 1.06 steers per acre. The next highest net returns ($160 per acre) were obtained at stocking density 1.16 steers per acre on a pasture seeded to Tonkawa.

The three greatest returns across all years ($150, $160, and $169) occurred in 1999-00. This was not a function of high grain yields or high gain rates. The average daily gains associated with these returns were 2.13, 1.52, and 1.56 pounds, respectively. The relatively high returns resulted from a change in cattle prices. These animals were purchased in the fall of 1999 for $86 per hundredweight when they weighed approximately 500 pounds. In the spring of 2000, after gaining less than 200 pounds they were sold for $99 per hundredweight. The pastures with the high stocking densities (1.06 and 1.16 steers per acre) benefited greatly from the general increase in cattle prices.

Charts of the net returns from each of the seven crop years are presented in Figure 2 (page 25). The chart in the lower right hand corner of Figure 2 includes the net returns across all seven crop years. The three dots in the upper right hand corner of the chart labeled seven crop years, represent the net returns from the three high stocking density pastures from the 1999-00 crop year. As noted, these abnormally high returns resulted from the general increase in cattle prices during that production year. If these three observations were considered to be outliers, it is clear from the chart that there was no consistently optimal stocking density during the time period of the study.

Summary and Conclusions

The opportunity to grow wheat for grain and forage for livestock is important for many producers in the Southern Plains. A series of stocking density experiments at the WPRU was initiated to generate data to investigate ways of helping the producer make that decision. A comprehensive look at the procedures and practices employed by researchers at the WPRU, and an estimation of the costs and returns from those dual-purpose wheat production experiments was presented.

The data show that the highest or lowest stocking densities do not necessarily yield the highest net returns for the dual-purpose wheat production enterprise. Except for about three years, discerning a true pattern of movement between stocking density and net returns was difficult. This problem was partly created by the lack of uniformity in the choice of stocking density over the years, and sometimes within years. This in turn occurred because of the researchers' desire to make changes in stocking density in response to perceived changes in forage production. Hence a measure that takes into account grazing days, forage production, and stocking density may create more uniformity than stocking density alone.

The study found a considerable amount of variability in net returns across years, varieties, and stocking densities. This variability in net returns is due in part to variability in production and in part to variability in market prices. Steer rates of gain varied from 1.41 pounds per head per day in 1992-93 to 2.65 pounds per head per day in 1997-98. Wheat grain yield varied from 16 bushels per acre in 1994-95 to 45 bushels per acre in 1997-98. Wheat grain sale price varied from $2.31 per bushel in 1999 to $5.48 per bushel in 1996. In most years, the October purchase price (dollars per pound) for 400-500 pound stocker steers was greater than the March sale price (dollars per pound) for 700-800 pound steers. However, 500-pound stockers could have been purchased in the fall of 1999 for $86 per hundredweight and sold in the spring of 2000, after gaining 200 pounds for $99 per hundredweight. One result of the production and price variability is that no single stocking density is consistently economically optimal.

Literature Cited

Agricultural Statistics Board. Cattle. National Agricultural Statistics Service, United States Department of Agriculture. February 1, 2002.

Ahearn, M., G. Whittaker, and H. El-Osta. "The Production Cost-Size Relationship: Measurement Issues and Estimates for Three Major Crops," In Size, Structure, and the Changing Face of American Agriculture. Arne Hallam (ed) Western Press, Inc, Boulder, Colorado, pp. 107-149, 1993.

Andersen, M. and G. Horn. "Effect of Lasalocid on Weight Gain, Ruminal Fermentation and Forage Intake of Stocker Cattle Grazing Winter Wheat Pasture." Journal of Animal Science, 65(1987):865-871.

Andrae, J., G. Horn, D. Buchanan, and C. Bowen. "Effect of Salt Level in a Monensin-Containing Energy Supplement on Rumen Fermentation of Steers Grazing Wheat Pasture." Oklahoma State Univ. Agric. Exp. Stn. Res. Rep. P-943, pp.145-150, 1995.

Brorsen, B., D. Bailey, and M. Thomsen. "Oklahoma Cattle and the Satellite Video Auction: Location of Buyers, Location of Cattle Purchased, and Quality Premiums. Oklahoma Current Farm Economics 67 (1994):3-13.

Bruckner, P., and P. Raymer. "Factors Influencing Species and Cultivar Choice of Small Grains for Winter Forage." Journal of Production Agriculture 3(1990): 349-355.

Christiansen, S., T. Svejcar, and W. Phillips. "Spring and Fall Cattle Grazing Effects on Components and Total Grain Yield of Winter Wheat." Agronomy Journal 81(1989):145-150.

Coulibaly, N., D. Bernardo, and G. Horn. "Energy Supplementation Strategies for Wheat Pasture Stocker Cattle under Uncertain Forage Availability." Journal of Agricultural and Applied Economics 28(1996):172-179.

Epplin, F., G. Horn, and E. Krenzer, Jr. "Wheat and Wheat-Stocker Production Management Decision Aid." Oklahoma Crop Statement 2-15 (September 17, 1999(b)):4-5.

Epplin, F., G. Horn, and E. Krenzer, Jr. "Wheat and Wheat-Stocker Production Planner." In Wheatland Stocker Conference. Oklahoma State University Cooperative Extension Service. August 6, 1999(a).

Epplin, F.M., G. Horn, and E. Krenzer, Jr. "Wheat and Wheat-Stocker Production Planner." Oklahoma State University Research Report P-974, 1999(c).

Epplin, F.M., I. Hossain, and E.G. Krenzer, Jr. "Winter Wheat Fall-Winter Forage Yield and Grain Yield Response to Planting Date in a Dual-Purpose System." Agricultural Systems 63(2000):161-173.

Horn, G., and S. Paisley. Developments in the management and supplementation of stocker cattle on wheat pasture. Proceedings of the Plains Nutrition Council Spring Conference. San Antonio, TX. Texas A&M Research and Extension Center, Amarillo. Publication No. AREC 99-9, pp. 48-73, 1999.

Horn, G., and S. Paisley. Management and supplementation strategies for stocker cattle grazing winter wheat pasture. Proceedings of the Pacific Northwest Animal Nutrition Conference. Spokane, Washington, pp. 91-122, October 2000.

Horn, G., B. Clay and L. Croy. Wheat Pasture Bloat of Stockers. Oklahoma Agricultural Experiment Station Animal Science Research Report MP-101, pp. 26-31, 1977.

Horn, G., C. Gibson, J. Kountz, and C. Lunsford. Two-Year Summary: Effect of mineral supplementation with or without ionophores on growth performance of wheat pasture stocker cattle. In Wheatland Stocker Conference. Oklahoma State University Cooperative Extension Service, pp.A1-A19, August 2002.

Horn, G., E. Krenzer, D. Bernardo, L. Redmon, and J. Andrae. "Evaluation of Wheat Varieties in the Wheat Grain/Stocker Cattle Enterprise". Proc. Wheatland Stocker Conference, Enid, OK, August 19, 1994.

Horn, G., E. Krenzer, F. Epplin, and J. Kountz. "Effect of Planting Date and Grazing Management on Productivity of Dual-Purpose Winter Wheat." In Wheatland Stocker Conference. Oklahoma State University Cooperative Extension Service. August 21, 1998.

Horn, G., E. Krenzer, F. Epplin, and J. Kountz. "Effect of Planting Date and Grazing Management on Productivity of Dual-Purpose Winter Wheat." Oklahoma State University Department of Animal Science 1999 Animal Science Research Report, pp. 241-248, 1999.

Horn, G., E. Krenzer, L. Redmon, and F. Epplin. "Expanded Wheat Pasture Research Program: Executive Summary." In Wheatland Stocker Conference. Oklahoma State University Cooperative Extension Service. August 11, 1995(c).

Horn, G., E. Krenzer, L. Redmon, F. Epplin, J. Kountz, S. Paisley, and C. Bowen. "Evaluation of Wheat Varieties in the Wheat Grain/Stocker Cattle Enterprise: Year Three." In Wheatland Stocker Conference. Oklahoma State University Cooperative Extension Service. August 11, 1995(b).

Horn, G., M. Cravey, F. McCollum, C. Strasia, E. Krenzer, Jr. and P. Claypool. "Influence of High-Starch vs High-Fiber Energy Supplements on Performance of Stocker Cattle Grazing Wheat Pasture and Subsequent Feedlot Performance." Journal of Animal Science 73(1995a):45-54.

Horn, G., T. Mader, S. Armbruster, and R. Frahm. "Effect of Monensin on Ruminal Fermentation, Forage Intake, and Weight Gains of Wheat Pasture Stocker Cattle. Journal of Animal Science 52(1981):447.

Khalil, I., B. Carver, E. Krenzer, C. MacKown, and G. Horn. Genetic trends in winter wheat grain yield and test weight under dual-purpose and grain-only management systems. Crop Science 42(2002a):710-715.

Khalil, I., B.F. Carver, E.G. Krenzer, C.T. MacKown, G.W. Horn, and P. Rayas-Duarte. Genetic trends in winter wheat grain quality with dual-purpose and grain-only management systems. Crop Science 42(2002b): 1112-1116.

Kletke, D. and R. Sestak. The operation and use of MACHSEL: A farm machinery selection template. Computer Software Series CSS-53. Oklahoma State University Department of Agricultural Economics. 1991.

Krenzer, Jr. E., L. Redmon, D. Bernardo, and G. Horn. "Grazing Termination Date Effects on Net Return per acre in Wheat." Oklahoma State Univ. Agric. Ext. Serv. Rept. PT 95-10, 1995.

Oklahoma Department of Agriculture. Oklahoma Agricultural Statistics 2001. Oklahoma City, 2002.

Olsen, K., and H. Lohano. "Will the Real Cost of Production Please Stand Up." Minnesota Agricultural Economist, No. 687 Winter 1997.

Paisley, S. "Evaluation of Wheat Variety, Stocking Density and Self-Limited Energy Supplements on Performance of Steers Grazing Winter Wheat". PhD Dissertation. 1998. Stillwater: Oklahoma State University.

Paisley, S. and G. Horn. "Effect of Ionophore on Rumen Characteristics, Gas Production, and Occurence of Bloat in Cattle Grazing Winter Wheat Pasture." Oklahoma State Univ. Agric. Exp. Stn. 1998 Animal Science Research Report, pp.141-146, 1998.

Paisley, S. and G. Horn. "Effects of Monensin on Intake of a Self-Limited Energy Supplement for Growing Steers Grazing Winter Wheat Pasture." Oklahoma State Univ. Agric. Exp. Stn. Res. Rep. P-951, pp.218-223, 1996.

Paisley, S., C. Ackerman, and G. Horn. "Effects of Increasing Levels of Magnesium Oxide on Intake of Self-Limited Energy Supplement for Growing Steers Grazing Winter Wheat Pasture." Oklahoma State Univ. Agric. Exp. Stn. Res. Rep. P-958. pp.85-89, 1997.

Pinchak, W., W Worrall, S. Caldwell, L. Hunt, N. Worrall, and M. Conoly. "Interrelationships of Forage and Steer Growth Dynamics on Wheat Pasture." Journal of Range Management 49(March 1996):126-130.

Redmon, L., E. Krenzer, Jr., D. Bernardo, and G. Horn. "Effect of Wheat Morphological Stage at Grazing Termination on Economic Return." Agronomy Journal 88(1996):94-97.

Redmon, L., G. Horn, E. Krenzer, Jr., and D. Bernardo. "A Review of Livestock Grazing and Wheat Grain Yield: Boom or Bust." Agronomy Journal 87(1995):137-147.

True, R., F. Epplin, E. Krenzer, Jr., and G. Horn. A Survey of Wheat Production and Wheat Forage Use Practices in Oklahoma. Oklahoma Agricultural Experiment Station Bulletin B-815, 2001.

Tweeten, L.(ed.) Oklahoma Agriculture 2000. Div. Of Agric., Oklahoma State University, Stillwater, OK 1982.

U.S. Dept. of Agriculture. National Agricultural Statistics Service. 1997 Census of Agriculture. Volume 1, Part 36, Oklahoma, State and County Data. Washington, D.C. 1999.

Winter, S., E. Thompson, and J. Musick. "Grazing Winter Wheat: II. Height Effects on Response to Production System." Agronomy Journal 82(1990):37-41.

Worrell, M., D. Undersander, and A. Khalilian. "Grazing Wheat to Different Morphological Stages for Effects on Grain Yield and Soil Compaction." Journal of Production Agriculture 5(1992):81-85.

Table 1. Acreage for Dual-Purpose Wheat Production Pastures at the Wheat Pasture Research Unit, Marshall, Oklahoma, 1988-2000.

Pasture No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Size (acres)	24	18	18	18	24	18	18	18	24	18	18	18	18	18	18	24

Table 2. Monthly Precipitation (inches) at Marshall, Oklahoma, 1988 – 2000.

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total rainfall
1988	1.17	0.00	3.96	6.58	0.37	2.30	2.58	0.65	6.03	1.23	2.43	0.57	27.87
1989	1.08	1.24	3.35	0.30	3.77	8.95	1.36	2.90	3.25	3.46	0.00	0.16	29.82
1990	1.52	3.25	2.42	3.55	5.39	1.05	1.84	1.19	2.18	0.98	1.50	0.65	25.52
1991	0.52	M[a]	1.10	1.03	4.16	1.20	2.65	1.69	6.80	2.12	2.40	3.86	27.53
1992	0.69	0.71	1.51	1.67	1.75	8.05	3.08	10.15	2.47	0.69	5.64	2.35	38.76
1993	2.17	1.32	1.79	5.84	9.36	3.57	1.74	2.13	3.61	0.46	2.39	1.41	35.79
1994	0.22	0.73	0.90	10.58	2.76	1.00	3.56	2.98	1.52	3.17	4.92	0.72	33.06
1995	0.67	0.00	3.33	3.16	5.64	7.68	3.06	6.52	3.47	0.50	0.12	1.76	35.91
1996	0.00	0.12	1.27	0.95	0.81	4.59	5.85	6.43	3.46	1.61	2.99	0.45	28.53
1997	0.26	4.44	0.00	5.54	3.37	3.33	2.76	4.12	3.70	2.48	0.79	2.52	33.31
1998	1.47	0.63	6.00	3.43	2.60	0.30	3.86	0.34	3.70	7.73	5.01	1.29	36.36
1999	1.12	0.34	2.97	6.50	4.41	9.35	1.43	2.30	5.53	3.60	0.19	4.32	42.03
2000	0.71	2.52	4.60	3.51	3.83	6.31	5.37	0.01	0.01	4.81	1.79	0.99	34.46
Monthly average	0.89	1.28	2.55	4.05	3.71	4.44	3.01	3.19	3.52	2.53	2.32	1.62	

Source: Oklahoma MESONET data available at www.mesonet.ou.edu/mesonetdata/mcd2
[a] Implies missing data

Table 3. Palmer Drought Severity Index (PDSI) for Central Oklahoma, 1988 – 2000[a].

Year	January	February	March	April	May	June	July	August	September	October	November	December
1988	3.68	3.09	3.85	4.05	-1.05	-1.76	-2.02	-2.55	0.55	0.39	0.63	0.65
1989	0.76	1.37	1.34	-1.02	-0.05	1.38	1.58	2.68	3.11	2.81	1.97	1.44
1990	1.63	2.62	4.29	5.04	4.73	-0.95	-1.39	-1.52	-1.25	-1.52	-1.52	-1.43
1991	-1.38	-2.12	-2.50	-2.65	-2.42	-2.3	-2.19	-2.24	1.01	1.23	1.52	3.17
1992	2.90	2.35	1.86	2.08	1.92	2.97	3.41	4.61	4.38	3.47	4.89	5.65
1993	5.70	6.09	5.65	5.72	6.12	-0.21	-0.68	-0.98	0.90	0.38	0.26	0.50
1994	0.09	0.37	0.68	1.17	-0.23	-1.03	-1.06	-0.88	-0.86	-0.91	1.29	1.20
1995	1.35	0.79	1.23	1.56	2.4	3.22	3.11	3.09	3.30	-0.49	-1.08	-0.84
1996	-1.19	-1.85	-1.94	-2.20	-3.2	-3.39	1.05	2.27	2.66	2.31	3.29	2.70
1997	2.21	3.06	2.11	2.75	2.21	2.04	2.26	2.78	2.32	2.32	1.90	2.69
1998	3.58	3.14	4.17	4.16	-0.75	-1.59	-2.68	-3.57	-3.75	1.27	1.82	2.05
1999	2.19	1.68	2.19	3.08	2.71	3.54	-0.11	-0.78	-0.46	-0.66	-1.42	-0.71
2000	-0.83	-1.00	-0.63	-0.69	-0.76	1.04	1.48	-0.75	-1.49	1.47	2.12	2.60

[a] The index generally ranges from -6 to +6, with negative values denoting dry spells and positive values denoting wet spells. PDSI values 0 to -0.5 = normal; -0.5 to -1.0 = incipient drought; -1.0 to -2.0 = mild drought; -2.0 to -3.0 = moderate drought; -3.0 to -4.0 = severe drought. Similar adjectives are attached to positive values of wet spells.
Source: NOAA; available at ftp://ftp.ncdc.noaa.gov/pub/data/cirs/0102.pdsi

Table 4. Field Operations Budgeted for Wheat Production Enterprise.

Month	Field Operation
June	Offset Disk
July	Chisel
July	Offset Disk
August	Field Cultivation; Apply Anhydrous Ammonia (82-0-0)
September	Field Cultivation
September	Drill; Seed and Apply Diammonium Phosphate (18-46-0)
June	Combine Grain

Table 5. Origin and Description of Stocker Steers Pastured at the Wheat Pasture Research Unit, Marshall, Oklahoma, 1992-1997.

Year	Origin of Steers	Breed Description
1992-93	Near Harlem and Chinook, Montana	Predominantly Angus or Angus X Hereford
1993-94	Near Elk Mountain, Wyoming	British X Continental or Beefmaster Crossbred steers
1994-95	Ranch near Paris, Texas	1. Simmental (Fleckvieh) sired calves from F1 Hereford X Brahman dams 2. Simmental, Limousin, or Brangus-sired calves from Brangus or black white-faced dams
1996-97	[a]	Crossbred calves from Brangus and Bradford cows, with calves sired by Limousin, Brangus, Beefmaster, and Hereford bulls

Source: Paisley, S.I., 1998

[a] Data not available.

Table 6. Steer Purchase Weights and Receiving Dates Wheat Pasture Research Unit, Marshall, Oklahoma.

Year	No of Steers	Pay Weight (lbs)	Receiving Date
1989-90	[a]	[a]	[a]
1990-91	207	483	11/15/1990
1991-92	210	467	11/05/1991
1992-93	210	488	11/02/1992
1993-94	210	501	10/28/1993
1994-95	[a]	[a]	10/03 – 10/05/1994
1995-96	180	529	10/30/1995
1996-97	190	478	10/10/1996
1997-98	175	535	10/10/1997
1998-99	185	546	10/20/1998
1999-00	190	497	10/20/1999
2000-01	175	545	12/06/2000

[a] Data not available.

Table 7. Initial Steer Weight, Average Daily Gain, Steer Sale Weight, Weight Gain per Steer and Days on Wheat for Forage plus Grain Experiment at the Wheat Pasture Research Unit, Marshall, Oklahoma, 1989-2000.

			Initial Weight of Steer On Pasture [a]		Average Daily Gain		Steer Sale Weight		Weight Gain per Steer	
Year	Wheat Variety	Stocking Density (strs/acre)	lb/steer	lb/steer Year avg	lb/steer	lb/steer Year avg	lb/steer	lb/steer Year avg	lb/steer	lb/steer Year avg
1989-90	2157	0.50	462	462	2.13	2.13	708	708	246	246
1990-91	2157	0.50	469		2.00		682		213	
		0.61	471		2.07		691		220	
		0.72	471	470	1.76	1.94	660	678	189	207
1991-92	2157	0.51	535	535	2.18	2.18	719	719	184	184
1992-93	Karl	0.50	480		1.80		682		202	
		0.61	482		1.64		666		184	
		0.72	473		0.96		580		107	
		0.83	485		1.10		608		123	
	2163	0.50	484		2.20		730		246	
		0.61	485		1.92		700		215	
		0.72	490		1.39		646		156	
		0.83	478		0.50		534		56	
	2180	0.50	489		2.18		733		244	
		0.61	482		1.90		694		212	
		0.72	486		1.45		649		163	
		0.83	487		0.95		594		107	
	AgSeCo 7853	0.50	480		1.69		669		189	
		0.61	465		1.14		593		128	
		0.72	481		0.68		557		76	
		0.83	478	482	0.99	1.41	589	639	111	157
1993-94	Karl	0.42	497		2.32		805		308	
		0.61	499		2.28		802		303	
		0.72	503		2.44		828		325	
		0.83	491		2.24		789		298	
	2163	0.42	511		2.39		829		318	
		0.61	498		2.38		814		316	
		0.72	512		2.44		836		324	
		0.83	504		2.41		824		320	
	2180	0.42	489		2.58		832		343	
		0.61	497		2.45		823		326	
		0.72	506		2.30		812		306	
		0.83	500		2.02		769		269	
	AgSeCo 7853	0.42	509		2.42		830		321	
		0.61	487		2.32		795		308	
		0.72	511		2.28		814		303	
		0.83	500	501	2.14	2.34	784	812	284	311
1994-95	2180	0.39	547		2.39		824		277	
		0.57	560		2.92		899		339	
		0.76	545		2.55		840		295	
		0.91	556		2.30		823		267	
	AgSeCo 7853	0.36	554		2.53		870		316	
		0.44	527		2.43		830		303	
		0.65	543		2.54		860		317	
		0.93	556		1.95		799		243	
	Longhorn	0.40	568		2.76		913		345	
		0.59	550		2.46		857		307	
		0.72	546		2.62		873		327	
		1.14	537		2.04		792		255	

Table 7. Initial Steer Weight, Average Daily Gain, Steer Sale Weight, Weight Gain per Steer and Days on Wheat for Forage plus Grain Experiment at the Wheat Pasture Research Unit, Marshall, Oklahoma, 1989-2000. (Continued)

			Initial Weight of Steer On Pasture [a]		Average Daily Gain		Steer Sale Weight		Weight Gain per Steer	
Year	Wheat Variety	Stocking Density (strs/acre)	lb/steer	lb/steer Year avg	lb/steer	lb/steer Year avg	lb/steer	lb/steer Year avg	lb/steer	lb/steer Year avg
1994-95 cont.	Scout 66	0.43	547		2.43		874		327	
		0.53	524		2.71		888		364	
		0.78	551		2.51		887		336	
		0.92	547	547	1.96	2.44	809	852	262	305
1996-97	2180	0.46	467		2.26		743		276	
		0.44	470		2.40		763		293	
		0.70	468		2.20		736		268	
		1.09	465		2.03		713		248	
	AgSeCo 7853	0.38	464		2.34		778		314	
		0.42	467		2.10		749		282	
		0.65	469		2.22		766		297	
		0.91	468		1.74		701		233	
	Longhorn	0.46	468		2.36		756		288	
		0.60	463		2.34		749		286	
		0.64	465		2.31		747		282	
		0.94	466		2.09		721		255	
	Scout 66	0.39	467		2.21		763		296	
		0.53	474		2.19		767		293	
		0.63	467		2.14		754		287	
		0.78	465	467	1.61	2.16	681	743	216	276
1997-98	Tonkawa	0.34	594		2.86		931		337	
		0.42	558		2.87		897		339	
		0.56	543		2.48		836		293	
		0.83	474	542	2.37	2.65	754	855	280	312
1998-99	Tonkawa	0.38	575		2.23		821		246	
		0.47	564		2.89		882		318	
		0.62	581		2.26		830		249	
		0.89	577	574	2.18	2.39	816	837	239	263
1999-00	Tonkawa	0.42	516		3.07		793		277	
	2174	0.43	521		3.24		813		292	
	2174	0.46	521		3.06		796		275	
		0.56	516		2.60		750		234	
		0.63	524		2.87		782		258	
		0.56	527		2.95		792		265	
		1.06	505		1.56		645		140	
		1.16	506		1.52		643		137	
	2174	1.16	511	516	2.13	2.56	703	746	192	230
Average across all years				510		2.22		759		249

[a] This is the average weight of the steers when they were moved from the receiving program to the wheat pasture.

Table 8. Standing Wheat Forage per Acre of Pasture, Wheat Pasture Research Unit, Marshall, Oklahoma, 1992-2000.

Year	Variety	Pasture	Standing crop (lb/acre)	Standing crop (lb/acre)	Standing crop (lb/acre)	Standing crop (lb/acre)	Average Standing crop (lb/acre)
1992-93			11/13/92	1/28/93	3/9/93		
	Karl	1	1440	1511	627		1193
	Karl	13	1266	878	268		804
	Karl	4	1410	597	270		759
	Karl	11	1408	655	170		744
	AgSeCo 7853	5	1526	1121	650		1099
	AgSeCo 7853	2	1325	781	468		858
	AgSeCo 7853	15	1562	355	107		675
	AgSeCo 7853	8	1381	563	226		723
	2163	9	1952	1778	1766		1832
	2163	7	1593	1307	581		1160
	2163	12	1784	884	319		996
	2163	3	1701	588	215		835
	2180	16	977	1604	1110		1230
	2180	10	1310	1392	905		1202
	2180	14	1204	715	296		738
	2180	6	1135	726	194		685
1993-94			10/28/93	12/14/93	2/1/94	3/18/94	
	Karl	16	1619	2497	2896	2576	2397
	Karl	6	1405	1883	1883	1397	1642
	Karl	14	1491	2092	1639	1044	1567
	Karl	2	1240	1766	1652	1166	1456
	AgSeCo 7853	9	1495	2487	2563	2297	2211
	AgSeCo 7853	3	1183	1763	1604	1058	1402
	AgSeCo 7853	7	1334	1964	1547	1124	1492
	AgSeCo 7853	12	1370	1883	1189	828	1318
	2163	5	1151	2065	2428	2251	1974
	2163	15	1497	2487	2625	2106	2179
	2163	8	1458	2195	2360	1433	1862
	2163	10	1644	1972	1855	1233	1676
	2180	1	1375	1880	2503	1757	1879
	2180	11	1473	2216	2185	1608	1871
	2180	13	1424	2075	1542	1082	1531
	2180	4	1041	1595	1202	663	1125
1994-95			11/22/94	12/12/94	1/19/95	2/25/95	
	Scout 66	9	2233	2736	3289	3289	2887
	Scout 66	6	2063	2484	2512	2512	2393
	Scout 66	13	2329	2518	2385	2385	2404
	Scout 66	2	2115	1541	988	988	1408
	Longhorn	1	2271	2509	2840	2840	2615
	Longhorn	12	2224	2796	3042	3042	2776
	Longhorn	7	2205	2508	2068	2068	2212
	Longhorn	14	2097	2508	1606	1606	1954
	2180	5	2135	2865	2960	2793	2688
	2180	10	2160	2572	3363	2880	2744
	2180	15	2209	2554	2575	1947	2321
	2180	3	1820	1651	1152	1003	1407
	AgSeCo 7853	1	1375	1880	2503	1757	1879
	AgSeCo 7853	11	1473	2216	2185	1608	1871
	AgSeCo 7853	13	1424	2075	1542	1082	1531
	AgSeCo 7853	4	1041	1595	1202	663	1125

Table 8. Standing Wheat Forage per Acre of Pasture, Wheat Pasture Research Unit, Marshall, Oklahoma, 1992-2000. (Continued)

Year	Variety	Pasture	Standing crop (lb/acre)	Standing crop (lb/acre)	Standing crop (lb/acre)	Standing crop (lb/acre)	Average Standing crop (lb/acre)
1996-97			10/23/96	12/5/96	1/20/97	2/14/97	
	Scout 66	5	1856	2179	2352	2194	2145
	Scout 66	13	1810	2526	2726	2024	2272
	Scout 66	8	1706	2333	1531	1232	1701
	Scout 66	4	1665	1559	1017	558	1200
	Longhorn	16	1633	2760	2947	2544	2471
	Longhorn	12	1999	2836	2531	2200	2392
	Longhorn	2	1544	2066	1852	1809	1818
	Longhorn	7	1667	2183	1028	580	1365
	2180 9	1793	2835	3007	2425	2515	
	2180 3	1501	2137	1914	1896	1862	
	2180 11	2095	2485	2158	1359	2024	
	2180 14	1886	2713	1768	1037	1851	
	AgSeCo 7853	1	1876	2219	2147	1792	2009
	AgSeCo 7853	6	1542	2285	1483	1640	1738
	AgSeCo 7853	15	1732	2211	1929	1575	1862
	AgSeCo 7853	10	2090	1823	1483	979	1594
1997-98			10/24/97	12/12/97	1/20/98	2/17/98	
	Tonkawa	15	1478	3285	2996	2599	2590
	Tonkawa	1	1340	3088	2482	1937	2212
	Tonkawa	3	1245	2733	1526	1017	1630
	Tonkawa	16	1535	2996	1079	504	1529
1998-99			11/6/98	12/17/98	1/20/99	2/26/99	
	Tonkawa	1	718	1857	1973	1680	1557
	Tonkawa	3	701	1629	1281	993	1151
	Tonkawa	15	904	1641	1278	633	1114
	Tonkawa	16	936	2372	2514	2194	2004
1999-00			11/29/99	1/13/00	3/1/00		
	Tonkawa	1	1188	1359	1868		1472
	2174	18	1574	1863	2235		1891
	2174	17	1520	2094	2408		2007
	Tonkawa	4	951	820	1206		992
	Tonkawa	6	1129	288	277		565
	Tonkawa	10	1289	1458	1190		1312
	Tonkawa	8	1202	476	368		682
	Tonkawa	16	979	890	1057		975
	2174	12	1806	595	316		905

Table 9. Wheat Grain Yield from Dual-Purpose Forage plus Grain Experiments at Marshall, Oklahoma, by Variety and Stocking Density, 1993-2000 (bu/acre).

Year	Stocking Density (hd/acre)	Variety: Karl	2163	2180	AgSeCo 7853	Longhorn	Scout 66	Tonkawa	2174	Average Across all Varieties	Logan County Average [a]
1992-93	0.50	32.10	29.80	26.80	25.30						
	0.61	18.10	34.90	27.90	28.80						
	0.72	24.70	17.90	26.50	18.20						
	0.83	15.30	17.80	19.10	20.10					23.96	20.00
1993-94	0.42	28.60	29.80	30.00	25.70						
	0.61	29.70	32.30	25.40	21.20						
	0.72	25.60	20.70	21.00	24.40						
	0.83	25.40	23.90	19.70	20.70					25.26	30.70
1994-95[b]	0.36				15.50						
	0.39			21.80							
	0.40					13.40					
	0.43						7.70				
	0.44				21.00						
	0.53						13.90				
	0.57			18.00							
	0.59					17.80					
	0.65				19.50						
	0.72					13.20					
	0.76			19.10							
	0.78						12.80				
	0.91			19.90							
	0.92						11.70				
	0.93				21.70						
	1.14					13.10				16.26	18.50
1996-97[c]	0.38				44.60						
	0.39						26.00				
	0.42				37.80						
	0.44			10.10							
	0.46			13.40		29.80					
	0.53						23.50				
	0.60					28.00					
	0.63						25.40				
	0.64					32.80					
	0.65				32.50						
	0.70			19.50							
	0.78						19.30				
	0.91				35.30						
	0.94					22.70					
	1.09			13.70						25.90	36.00
1997-98	0.34							44.50			
	0.42							43.90			
	0.56							43.30			
	0.83							47.30		44.75	38.00
1998-99	0.38							32.19			
	0.47							43.43			
	0.62							39.90			
	0.89							34.95		37.62	33.50
1999-00[d]	0.42							42.13			
	0.43								30.57		
	0.46								21.05		
	0.56							40.20			
	0.63							26.07			
	0.56							45.24			
	1.06							40.16			
	1.16							31.12			
	1.16								43.71	35.59	34.50

[a] Logan County average yield obtained from the National Agricultural Statistics Service of the USDA.
[b] It was believed that root rots limited grain yields across all varieties in 1994-95.
[c] A severe freeze on April 13, 1997 reduced grain yield of 2180 in pastures not heavily grazed.
[d] Strawbreaker severely reduced yields in pastures seeded to 2174 in 1999-00.

Table 10. Starting Date, Pull-off Date, and Days on Wheat for Forage plus Grain Experiments at Marshall, Oklahoma, 1989-2000.

Year	Wheat Variety	Stocking Density (hd/acre)	Starting Date	Pull-off Date	Days on Wheat	Average Days for Year
1989-90	2157	0.50	11/17/89	3/12/90	115	115
1990-91	2157	0.50	11/21/90	3/8/91	107	
		0.61	11/21/90	3/8/91	107	
		0.72	11/21/90	3/8/91	107	107
1991-92	2157	0.51	12/5/91	2/28/92	85	85
1992-93	Karl	0.50	11/18/92	3/10/93	112	
		0.61	11/18/92	3/10/93	112	
		0.72	11/18/92	3/10/93	112	
		0.83	11/18/92	3/10/93	112	
	2163	0.50	11/18/92	3/10/93	112	
		0.61	11/18/92	3/10/93	112	
		0.72	11/18/92	3/10/93	112	
		0.83	11/18/92	3/10/93	112	
	2180	0.50	11/18/92	3/10/93	112	
		0.61	11/18/92	3/10/93	112	
		0.72	11/18/92	3/10/93	112	
		0.83	11/18/92	3/10/93	112	
	AgSeCo 7853	0.50	11/18/92	3/10/93	112	
		0.61	11/18/92	3/10/93	112	
		0.72	11/18/92	3/10/93	112	
		0.83	11/18/92	3/10/93	112	112
1993-94	Karl	0.42	11/02/93	3/15/94	133	
		0.61	11/02/93	3/15/94	133	
		0.72	11/02/93	3/15/94	133	
		0.83	11/02/93	3/15/94	133	
	2163	0.42	11/02/93	3/15/94	133	
		0.61	11/02/93	3/15/94	133	
		0.72	11/02/93	3/15/94	133	
		0.83	11/02/93	3/15/94	133	
	2180	0.42	11/02/93	3/15/94	133	
		0.61	11/02/93	3/15/94	133	
		0.72	11/02/93	3/15/94	133	
		0.83	11/02/93	3/15/94	133	
	AgSeCo 7853	0.42	11/02/93	3/15/94	133	
		0.61	11/02/93	3/15/94	133	
		0.72	11/02/93	3/15/94	133	
		0.83	11/02/93	3/15/94	133	133
1994-95	2180	0.39	11/01/94	2/25/95	116	
		0.57	11/01/94	2/25/95	116	
		0.76	11/01/94	2/25/95	116	
		0.91	11/01/94	2/25/95	116	
	AgSeCo 7853	0.36	11/01/94	3/6/95	125	
		0.44	11/01/94	3/6/95	125	
		0.65	11/01/94	3/6/95	125	
		0.93	11/01/94	3/6/95	125	
	Longhorn	0.40	11/01/94	3/6/95	125	
		0.59	11/01/94	3/6/95	125	
		0.72	11/01/94	3/6/95	125	
		1.14	11/01/94	3/6/95	125	
	Scout 66	0.43	11/01/94	3/15/95	134	
		0.53	11/01/94	3/15/95	134	
		0.78	11/01/94	3/15/95	134	
		0.92	11/01/94	3/15/95	134	125

Table 10. Starting Date, Pull-off Date, and Days on Wheat for Forage plus Grain Experiments at Marshall, Oklahoma, 1989-2000. (Continued)

Year	Wheat Variety	Stocking Density (hd/acre)	Starting Date	Pull-off Date	Days on Wheat	Average Days for Year
1996-97	2180	0.46	10/25/96	2/24/97	122	
		0.44	10/25/96	2/24/97	122	
		0.70	10/25/96	2/24/97	122	
		1.09	10/25/96	2/24/97	122	
	AgSeCo 7853	0.38	10/25/96	3/8/97	134	
		0.42	10/25/96	3/8/97	134	
		0.65	10/25/96	3/8/97	134	
		0.91	10/25/96	3/8/97	134	
	Longhorn	0.46	10/25/96	2/24/97	122	
		0.60	10/25/96	2/24/97	122	
		0.64	10/25/96	2/24/97	122	
		0.94	10/25/96	2/24/97	122	
	Scout 66	0.39	10/25/96	3/8/97	134	
		0.53	10/25/96	3/8/97	134	
		0.63	10/25/96	3/8/97	134	
		0.78	10/25/96	3/8/97	134	128
1997-98	Tonkawa	0.34	10/25/97	2/20/98	118	
		0.42	10/25/97	2/20/98	118	
		0.56	10/25/97	2/20/98	118	
		0.83	10/25/97	2/20/98	118	118
1998-99	Tonkawa	0.38	11/12/98	3/2/99	110	
		0.47	11/12/98	3/2/99	110	
		0.62	11/12/98	3/2/99	110	
		0.89	11/12/98	3/2/99	110	110
1999-00	Tonkawa	0.42	11/30/99	2/28/00	90	
	2174	0.43	11/30/99	2/28/00	90	
	2174	0.46	11/30/99	2/28/00	90	
		0.56	11/30/99	2/28/00	90	
		0.63	11/30/99	2/28/00	90	
		0.56	11/30/99	2/28/00	90	
		1.06	11/30/99	2/28/00	90	
		1.16	11/30/99	2/28/00	90	
	2174	1.16	11/30/99	2/28/00	90	90
Average across all years						112

Table 11. Average Dates of Wheat Planting, and Arrival, Placement on Wheat Pasture, and Removal from Wheat Pasture for Steers used at the Wheat Pasture Research Unit, Marshall Oklahoma, 1989-2000.

Date	Activity
September 1-7	Wheat Planted
October 28	Purchased steers arrive on farm
October 28 - November 12	Receiving program
November 12	Placement on wheat
March 5	Removal from wheat

Table 12. Enterprise Budget for Dual-Purpose Winter Wheat[a].

Item	Unit	Price	Quantity	Value
Gross receipts[b]:				
Wheat grain	bu/acre	2.39	43.71	104.47
Operating costs:				
Wheat seed	bu	4.64	2.00	9.28
Diammonium phosphate (18-46-0)	lb	0.25	50.00	12.50
Anhydrous ammonia (82-0-0)	lb	0.19	170.00	32.30
Herbicide (Finesse)	oz	13.00	0.20	2.60
Custom harvest	ac	13.00	1.00	13.00
Custom harvest (> 20 bu/acre)	bu	0.13	23.71	3.08
Interest on operating capital	$	0.08	53.52	4.28
Labor	hr	6.00	0.774	4.64
Machinery fuel, lub., and repairs	$			7.54
Total operating costs, $/acre				**89.22**
Fixed costs for wheat production:				
Machinery and equipment – interest				9.92
Machinery and equipment – depr., taxes and insurance				16.04
Total fixed costs				**25.96**
Total costs, $/acre				**115.18**

[a] Yields, prices, and quantities change across years and pastures.
[b] The value of the fall-winter forage is not included.

Table 13. Oklahoma City June Wheat Prices ($/bu), 1988-2000.

Year	Price
1988	3.35
1989	3.87
1990	2.91
1991	2.50
1992	3.27
1993	2.54
1994	3.07
1995	3.88
1996	5.48
1997	3.28
1998	2.62
1999	2.31
2000	2.39

Source: National Agricultural Statistics Service of the USDA

Table 14. Prices and Quantities of Winter Wheat Seed, Diammonium Phosphate, and Anhydrous Ammonia, 1988-2000.

Year	Winter Wheat Seed		Diammonium Phosphate (18-46-0)		Anhydrous Ammonia (82-0-0)	
	Price[a] ($/bu)	Quantity (bu/acre)	Price ($/ton)	Quantity (lb/acre)	Price ($/ton)	Quantity (lb/acre)
1988	6.84	2	237	50	185	0
1989	7.50	2	243	50	205	189
1990	4.94	2	210	50	167	174
1991	5.20	2	221	50	224	98
1992	5.66	2	216	50	173	177
1993	5.58	2	190	50	179	201
1994	6.54	2	217	50	223	146
1995	8.64	2	254	50	298	140
1996	9.08	2	278	0	267	0
1997	6.78	2	250	50	266	162
1998	4.44	2	247	50	222	119
1999	4.64	2	247	50	194	165
2000	4.62	2	227	50	195	168

[a] August Oklahoma City market price received, multiplied by 2
Source: Prices obtained from National Agricultural Statistics Service of the USDA

Table 15. Machinery Costs for the Wheat Production Enterprise.

Year	Diesel Fuel April Price ($/gal)	Quantity (gal)	Fixed Cost[a] ($/acre)	Variable Cost ($/acre)	Total Labor Hours	Wage Rate	Interest Rate	Total Cost with all Labor ($/acre)
1988	0.72	5.20	27.61	7.96	0.774	6.00	9.32	40.21
1989	0.76	5.20	29.54	8.20	0.774	6.00	10.87	42.38
1990	0.74	5.20	28.47	8.08	0.774	6.00	10.01	41.19
1991	0.75	5.20	26.54	8.14	0.774	6.00	8.46	39.32
1992	0.73	5.20	23.80	8.02	0.774	6.00	6.25	36.46
1993	0.77	5.20	23.49	8.25	0.774	6.00	6.00	36.38
1994	0.69	5.20	24.91	7.78	0.774	6.00	7.14	37.33
1995	0.70	5.20	27.00	7.84	0.774	6.00	8.83	39.48
1996	0.86	5.20	26.31	8.79	0.774	6.00	8.27	39.74
1997	0.79	5.20	26.52	8.37	0.774	6.00	8.44	39.53
1998	0.68	5.20	26.41	7.72	0.774	6.00	8.35	38.77
1999	0.65	5.20	25.96	7.54	0.774	6.00	7.99	38.14
2000	1.00	5.20	27.84	9.63	0.774	6.00	9.50	42.11

Source: Farm Machinery Complement Selection (MACHSEL) (Kletke and Sestak, 1991); Diesel Fuel Price obtained from the National Agricultural Statistics Service of the USDA
[a] Machinery fixed costs include depreciation, taxes, and insurance as well as interest on machinery and equipment.

Table 16. Stocker Steer Enterprise Budget for Dual-Purpose Winter Wheat[a].

Item	Unit	Price	Quantity	Value
Gross receipts:				
Steers (based on death loss of 2%)	cwt/hd	86.17	7.03	593.66
Operating costs:				
Steer calves	cwt	86.01	4.92	423.17
Order buyer fee	cwt	0.50	4.92	2.46
Shipping to pasture	head	2.10	1.00	2.10
Receiving program (21 days)				
Veterinary and medicine	head	9.00	1.00	9.00
Hay (8 lb/str/day)	lb	0.03	128.00	3.84
Soybean meal based supplement (2lb/str/day)	lb	0.09	32.00	2.88
Hay during inclement weather (assume 2 bad days)	lb	0.06	24.00	1.44
High calcium mineral mixture	lb	0.09	8.40	0.76
Other:				
Shipping to market, sales commission, etc	cwt	2.00	7.03	14.06
Interest on operating capital	$	0.08	206.04	16.48
Labor	hr	6.00	1.25	7.50
Machinery fuel, lub., and repairs	$			10.00
Total operating costs, $/head				**493.69**
Fixed costs for steer production:				
Machinery and equipment – Interest				2.50
Machinery and equipment – Depr., taxes and insurance				5.50
Total fixed costs, $/head				**8.00**
Total costs, $/head				**501.69**

[a] Prices, gain, and quantities change across years and pastures. The cost of standing wheat forage is not accounted for in this budget.

Table 17. Oklahoma City October Purchase Price for Medium/Large Frame No 1 Steers, 1989-1999.

Year	Base Price ($/cwt)	Weight Class (lb)
1989	100.71	400-500
1990	104.25	400-500
1991	95.00	500-600
1992	93.23	450-500
1993	98.85	500-550
	100.30	450-500
1994	78.55	550-600
	81.83	500-550
1995	62.50	550-600
	64.33	500-550
	66.33	450-500
1996	65.88	450-500
1997	84.85	550-600
	89.81	500-550
	94.01	450-500
1998	72.63	550-600
1999	86.01	500-550

Source: National Agricultural Statistics Service of the USDA

Table 18. Oklahoma City March Sale Price for Medium/Large Frame No. 1 Steers, 1990-2000.

Year	Base Price ($/cwt)	Weight Class (lb)
1990	82.18	700-800
1991	96.38	600-700
1992	80.16	700-750
1993	86.53	700-750
	88.95	650-700
	92.03	600-650
	97.98	550-600
	103.02	500-550
1994	79.66	800-850
	81.31	750-800
1995	63.97	900-950
	65.53	850-900
	66.88	800-850
	68.84	750-800
1996	55.22	800-850
	55.78	750-800
	56.34	700-750
	57.33	650-700
1997	69.14	750-800
	69.88	700-750
	72.16	650-700
1998	69.28	900-950
	70.87	850-900
	73.07	800-850
	73.95	750-800
1999	67.22	850-900
	68.98	800-850
2000	80.53	800-850
	83.84	750-800
	86.17	700-750
	98.68	600-650

Source: National Agricultural Statistics Service of the USDA

Table 19. Returns to Machinery and Equipment Interest, Depreciation, Taxes and Insurance, and Labor, Land and Management, for Dual-Purpose Wheat Production at the Wheat Pasture Research Unit, Marshall, Oklahoma, 1993-2000 ($/acre)[a].

Year	Stocking Density (hd/acre)	Wheat Pasture								Average Across all Pastures
		Karl	2163	2180	AgSeCo 7853	Longhorn	Scout 66	Tonkawa	2174	
1992-93	0.50	41.51	45.87	37.40	19.71					36
	0.61	7.05	63.85	45.88	37.07					38
	0.72	21.31	10.18	35.73	-15.63					13
	0.83	-13.61	-7.99	12.92	18.73					3
1993-94	0.42	33.58	41.89	49.79	31.01					39
	0.61	48.08	61.92	46.44	35.24					48
	0.72	60.25	43.62	35.76	43.19					46
	0.83	59.83	62.00	22.42	35.07					45
1994-95	0.36				1.25					1
	0.39			15.80						16
	0.40					-3.56				-4
	0.43						-28.41			-28
	0.44				23.90					24
	0.53						16.54			17
	0.57			33.02						33
	0.59					12.54				13
	0.65				26.99					27
	0.72					10.33				10
	0.76			29.09						29
	0.78						30.05			30
	0.91			38.28						38
	0.92						-11.13			-11
	0.93				46.12					46
	1.14					15.53				16
1996-97	0.38				102.52					103
	0.39						41.11			41
	0.42				80.69					81
	0.44			6.71						7
	0.46			-4.31		60.64				28
	0.53						51.66			52
	0.60					76.94				77
	0.63						68.81			69
	0.64					95.85				96
	0.65				98.84					99
	0.70			55.40						55
	0.78						49.97			50
	0.91				111.32					111
	0.94					88.01				88
	1.09			72.57						73
1997-98	0.34							36.48		36
	0.42							49.94		50
	0.56							39.78		40
	0.83							58.00		58
1998-99	0.38							32.34		32
	0.47							80.60		81
	0.62							71.83		72
	0.89							80.49		80
1999-00	0.42							85.25		85
	0.43								54.39	54
	0.46								43.19	43
	0.56							94.00		94
	0.63							73.14		73
	0.56							109.16		109
	1.06							169.22		169
	1.16							160.36		160
	1.16								149.58	150

[a] The returns from both wheat forage (steer production) and wheat grain are included.

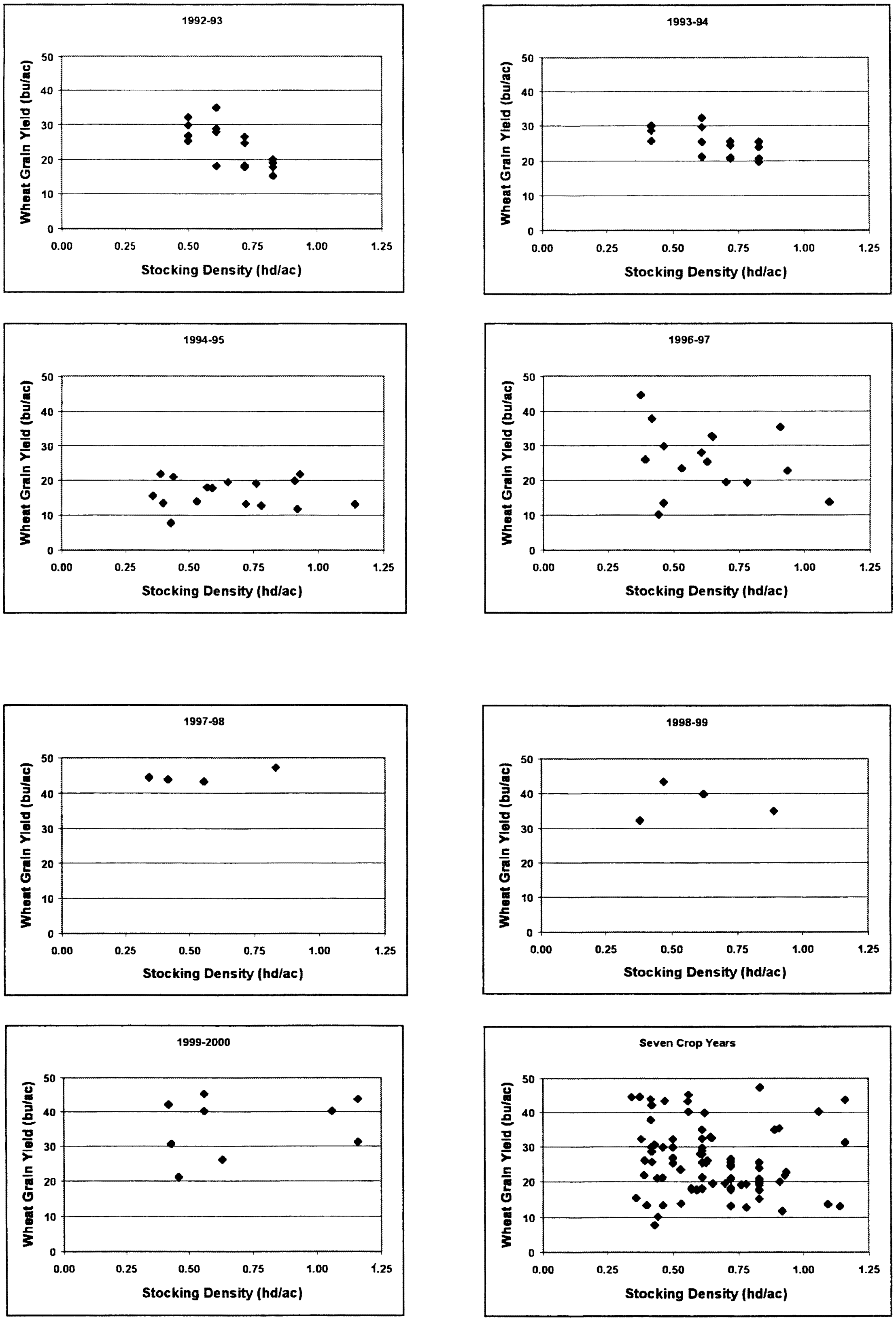


Figure 1. Wheat grain yield response to alternative stocking densities at the Wheat Pasture Research Unit, Marshall, Oklahoma 1993 to 2000.

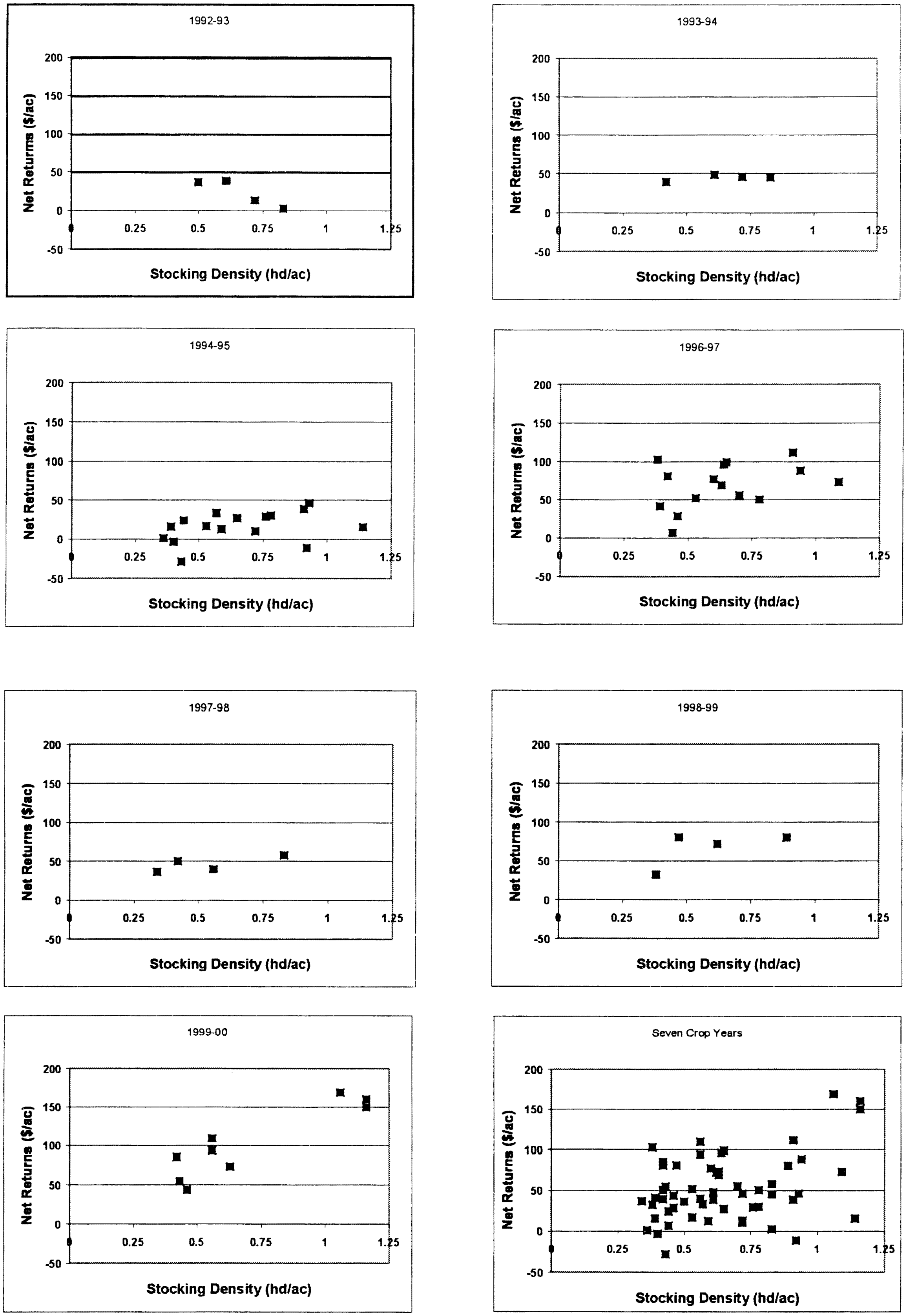


Figure 2. Net returns to machinery and equipment fixed costs, land, labor, and management for seven crop production years from dual-purpose wheat production at the Wheat Pasture Research Unit at Marshall, Oklahoma.

OSU

OKLAHOMA AGRICULTURAL
EXPERIMENT STATION