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Should I Buy (or Retain) Stockers to Graze Wheat Pasture?

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Winter wheat grain, valued at $478 million in 2020, ranks fifth in value of commodities produced in Oklahoma. However, this does not include the value for pasture used in producing cattle and calves. The beef industry is estimated at $2.6 billion and is Oklahoma's largest agricultural commodity in terms of gross sales.

Wheat producers may be interested in grain yields only, forage yields only (if wheat is grazed out), or both grain and forage yields (dual-purpose wheat) if livestock are taken off pasture before first hollow stem. How can a farmer/rancher calculate potential returns to wheat grain and pasture? Profit potential in forage depends on the following factors:

1. the costs of producing forage,
2. the returns to livestock utilizing forage (or rents received through lease agreements) and
3. forage yields and wheat price.

Production costs of establishing dual-purpose wheat are frequently higher than producing grain only. Factors such as increased seeding rates, increased likelihood of insect pests, greater difficulty in controlling weeds and higher fertility costs all contribute to greater production costs in the dual-purpose system as compared to grain only.

Returns to livestock depend on the purchase price of cattle, costs of supplemental feed and other inputs into the livestock production process, the timing of forage production (amount produced before dormancy in winter), the efficiency of the livestock in converting forage to weight gain and the sale price of cattle. Forage yields depend primarily on planting date, weather, variety seeded and fertilization.

In this Extension Fact Sheet, factors that should be considered in deciding whether to buy or retain cattle to graze wheat pasture are discussed. Impacts on potential profit of variability in forage yield and returns to livestock are demonstrated. Means of managing risks associated with variability in forage production and utilization are outlined.

Wheat Production Costs

Farm records should provide the data needed to establish historical costs of producing wheat and forage as illustrated in a wheat enterprise budget (Table 1). The budget incorporates information about the specific resources, management practices and technology used in the production process. Table 1 shows an example budget summary for dual-purpose wheat listing inputs, costs and returns per acre (excluding government payments for participation in commodity programs) generated using OSU Enterprise Budget Software.[1] An assumed yield of 27 bushels per acre is based on the statewide average wheat yield for 2012 to 2021 and subject to a 18% yield reduction associated with dual-purpose wheat production.[2] The wheat price is projected at $5.75 for the 2022 marketing year. Seeding rate and nitrogen fertilization practices are those used to produce grain and forage with returns from grazing forage based on a $0.40 per pound gain pasture rental rate.

With current prices, the grain budget shows negative returns to overhead, risk and management. Even with good records to indicate likely costs and yields and an expert forecast of market prices, profit potential from a particular plan is uncertain. Recent prices are higher than historical averages. Table 2 shows the sensitivity of grain returns (excluding government payments) to yields and prices given the costs listed in Table 1. High yields and high prices lead to positive projected profits given production costs. Lower yields and lower prices (or higher total costs of production) result in negative returns highlighting the importance of managing production costs.

Livestock Returns

If wheat pasture is not grazed or is under-utilized, then it may result in forgone income (an opportunity cost) to the wheat producer. The amount of income forgone depends on the returns to livestock utilizing forage or the potential income from leasing grazing rights. Wheat producers who do not have the time or capital or who do not wish to take on the additional risk associated with livestock may lease grazing rights to others.

[1] Information about OSU enterprise budget software is available at www.agecon.okstate.edu/budgets, through your local Extension office, or the OSU Agricultural Economics Department, 515 Agricultural Hall, Stillwater, OK 74078, 405-744-9836.

[2] USDA-NASS Quick Stats Database, quickstats.nass.usda.gov

Table 1. Dryland Wheat Enterprise Budget—Grain and Pasture.

PRODUCTION	Units	Price	Quantity	$/Acre	Your Value
Wheat	Bu.	$5.75	27	$155.25	
Small Grain Pasture[1]	Acre	$72.18	1	$72.18	
Total Receipts				**$227.43**	
OPERATING INPUTS	**Units**	**Price**	**Quantity**	**$/Acre**	**Your Value**
Wheat seed	Bu./acre	$15.00	2	$30.00	
Fertilizer[2]	Acre	$62.23	1	$62.23	
Custom Harvest	Acre	$31.38	1	$31.38	
Pesticide	Acre	$33.79	1	$33.79	
Crop Insurance	Acre	$13.00	1	$13.00	
Annual Operating Capitol	Dollars	5.25%	83.03	$4.36	
Machinery Labor	Hrs.	$15.00	0.51	$7.65	
Custom Hire	Acre	$15.20	1	$15.20	
Machinery Fuel, Lube, Repairs	Acre	$20.33	1	$20.33	
Other Expenses		$-	0	$-	
Total Operating Costs				**$217.94**	
Returns Above Total Operating Costs				**$9.49**	
FIXED COSTS	**Units**	**Rate**		**$/Acre**	**Your Value**
Machinery/Irrigation	$/value				
Interest at	Dollars	4.75%		$3.92	
Taxes at	Dollars	1.00%		$1.26	
Insurance	Dollars	0.85%		$0.70	
Depreciation	Dollars			$8.74	
Land	$/acre	-			
Interest at	Dollars	0.00%		$ -	
Taxes	Dollars	0.00%		$ -	
Total Fixed Costs				**$14.62**	
Total Costs (Operating + Fixed)				**$232.56**	
Returns Above All Specified Costs				**$(5.13)**	

[1] Pasture value is based on $0.40 per pound gain.

[2] Fertilizer - NH_3 100 pounds @ $.35 per pound, DAP 60 pounds @$.32 per pound, UAN (28% N) 30 pounds @ $.18 per pound.

Table 2. Income (excluding government payments) Above All Costs at Differing Yields and Prices ($/acre).[1]

Yield	Price per bushel				
(bu./acre)	$4.75	$5.25	$5.75	$6.25	$6.75
17	($76)	($67)	($59)	($50)	($42)
22	($54)	($43)	($32)	($21)	($10)
27	($32)	($19)	($5)	$8	$22
32	($11)	$5	$21	$37	$53
37	$11	$29	$48	$66	$85

[1] If custom harvest is used, the custom harvest charge used is based on the new yield.

To estimate the net returns to livestock, a producer should develop an enterprise budget for the livestock enterprise, that is, estimate the costs of livestock production (e.g. feed, veterinarian costs, stocker purchase costs) and income from sale of livestock. A stocker steer enterprise budget used in developing these estimates is shown in Table 3. The stocker steers are projected to gain 2 pounds per day over a 120-day holding period (November 1 to March 1) and are subject to sale weight shrinkage of 3% and a 2% death loss. A positive return to land, overhead, risk and management of $26.82 per head is projected when 450-pound steer calves are purchased at $185 per hundredweight and sold 120 days later at 669 pounds for $164 per hundred weight.[3] This projection suggests the producer would be better off by purchasing stockers for wheat pasture.

[3] Calf price projections are based on CME November 2021 and March 2022 feeder cattle contract prices on September 15, 2021, adjusted by Oklahoma National Stockyards – OKC basis estimates provided by beefbasis.com.

Table 7. Worksheet for Calculating Per Acre Returns to Dual Purpose Grain and Forage Production.

Dual Purpose Wheat Returns to Land, Overhead, Risk and Management
(Without Government Payments)

	Example	Your Value
Total Receipts	$227.43	_____
- Total Operating Costs (custom harvest adjusted)	-217.94	_____
- Total Fixed Costs	-14.62	_____
Wheat Returns per Acre	$-5.13	_____ (A)

Stocker Returns to Land, Overhead, Risk and Management

Total Receipts	$1,075.70	_____
- Total Operating Costs (w/additional fertilizer/seed)	- 1,036.29	_____
- Total Fixed Costs	12.59	_____
Stocker Returns per Head	$26.82	_____ (B)

Stocking Rate (Head per Acre);

$$\text{Head/Acre} = \frac{\text{Lbs DM Produced per Acre}}{\text{(Lbs DM per Lb of Gain) x (Lbs of Gain per Head)}}$$

$$= \frac{1{,}800}{10 \times 240} \qquad \text{_____}$$

$$= .75 \qquad \text{_____ (C)}$$

Stocker Returns per Acre = Stocker Returns per Head (B) * Head/Acre (C)

= $26.82 x .75 _____

= $20.12 _____ (D)

Total Returns ($/A) to Land, Overhead Risk and Management

Wheat Returns (A)	$-5.13	_____
+ Stocker Returns (D)	+$20.12	_____
Total Returns	$14.99	

Table 8. Sensitivity of Total Returns Per Acre to Grain and Cattle Prices.[1]

Grain Price	Stocker Sale Price = $149/cwt Stocker Purchase Price			Stocker Sale Price = $164/cwt Stocker Purchase Price			Stocker Sale Price = $179/cwt Stocker Purchase Price		
($/bu)	$170/cwt	$185/cwt	$200/cwt	$170/cwt	$185/cwt	$200/cwt	$170/cwt	$185/cwt	$200/cwt
$4.75	($34)	($86)	($137)	$39	($12)	($64)	$113	$62	$10
$5.25	($21)	($72)	($124)	$53	$1	($50)	$127	$75	$24
$5.75	($7)	($59)	($110)	$66	$15	($37)	$140	$89	$37
$6.25	$6	($45)	($97)	$80	$28	($23)	$154	$102	$51
$6.75	$20	($32)	($83)	$93	$42	($10)	$167	$116	$64

[1] Based on budgets used in this publication and a stocking rate of .75 head per acre.

Table 3. Stocker Enterprise Budget -150 Steers.
November purchase — 450 pounds, March sale — 669 pounds

PRODUCTION:	**Wt.**	**Unit**	**Price/Cwt**	**Quantity**	**$/Head**	**Your Value**
Stockers[1]	669	Lbs.	$164.00	98 Hd.	$1,075.70	_____
Total Receipts					**$1,075.70**	_____
OPERATING INPUTS	**Wt.**	**Unit**	**Price**	**Quantity**	**$/Head**	**Your Value**
Stockers	450	Lbs.	$185.00	1 Hd.	$832.50	_____
Pasture[2]		Head	$96.24	1	$96.24	_____
Hay		Head	$12.00	1	$12.00	_____
Salt		Head	$0.13	1	$0.13	_____
Minerals		Head	$0.25	1	$0.25	_____
Vet Services/Medicine		Head	$8.00	1	$8.00	_____
Vet Supplies		Head	$1.00	1	$1.00	_____
Marketing		Head	$8.00	1	$8.00	_____
Mach/Equip Fuel, Lube Repairs		Head	$15.07	1	$15.07	_____
Machinery/Equipment Labor		Hrs.	$15.00	1.60	$24.00	_____
Other Labor		Hrs.	$15.00	1.50	$22.50	_____
Annual Operating Capitol		Dollars	5.25%	316.21	$16.60	_____
Total Operating Costs					**$1,036.29**	
Returns Above Total Operating Costs					**$39.41**	
FIXED COSTS		**Unit**	**Rate**		**$/Head**	**Your Value**
Machinery/Equipment						
Interest at		Dollars	4.75%		$2.92	_____
Taxes at		Dollars	1.00%		$0.96	_____
Insurance		Dollars	0.85%		$0.45	_____
Depreciation		Dollars			$8.26	_____
Land						
Interest at		Dollars	0.00%		$ -	_____
Taxes at		Dollars	0.00%		$ -	_____
Total Fixed Costs					**$12.59**	_____
Total Costs (Operating + Fixed)					**$1,048.88**	
Returns Above all Specified Costs					**$26.82**	

[1] Stocker sale weight adjusted for 3% shrink.
[2] Small grain pasture rental $0.40 per pound gain, adjusted on a stocking rate of .75 head per acre.

Stocker returns per head are quite sensitive to steer calf and steer prices. A $15 per hundredweight difference in the price paid for calves results in an approximate $98 per head variation in returns. Table 4 indicates the sensitivity of stocker returns per head to stocker calf and steer prices.

Likewise, stocker returns per head are sensitive to the rate of daily gain and to the length of ownership. Table 5 shows returns under alternate scenarios, using the income and cost data in Table 3.

To calculate returns to grain and forage, stocker returns per head must be converted to stocker returns per acre. Then, wheat and stocker returns per acre can be summed. Stocker returns per acre are the product of stocker returns per head and the stocking rate (or head per acre). The stocking rate is, in turn, a function of forage yield (pounds of dry matter produced per acre), livestock efficiency in grazing forage (pounds of dry matter consumed per pound of gain) and pounds of gain per animal. Profitable stocker production is the result of matching economic conditions to alternative production systems combined with sound animal husbandry and business management.[4]

Table 4. Sensitivity of Stocker Returns per Head to Steer Calf Prices and Steer Prices ($/head).[1]

Purchase Steer Calves	Sell Steers $149/cwt	$164/cwt	$179/cwt
$170/cwt	($3)	$96	$194
$185/cwt	($72)	$27	$125
$200/cwt	($140)	($42)	$57

[1] Steer calves weigh 450 pounds; steers sold weigh 669 pounds; all other costs equal.

Table 5. Sensitivity of Stocker Returns to Rate of Gain and Length of Ownership ($/head).[1]

Rate Of Gain	Length of Ownership (days) 90	120	150
1.75	($61)	($8)	$49
2.00	($35)	$27	$91
2.25	($9)	$61	$135

[1] Steers are sold for $164/cwt at end of holding period.

[4] For a general discussion of the factors that affect the economics of stocker production, refer to the publication, *Economics of Stocker Production*, Veterinary Clinics of North America, 22(2): 271-296, July 2006, available at www.vetfood.theclinics.com.

Forage Yields

Several factors impact the forage yield of small grains. Some of these, such as soil type, rainfall and temperature are largely beyond the control of the farmer. Other factors, such as variety selection, seeding rate, fertility and planting date are controllable by the farmer. Among the controllable factors, planting date has the largest influence on the amount of forage produced by small grains. As long as sufficient moisture is available to fuel crop growth, planting in early September will result in greater fall forage production than planting in October (Figure 1). The tradeoff, however, is that planting prior to October 1 generally reduces wheat grain yield potential, regardless of grazing (Figure 2). In fact, it is estimated that approximately 2/3 of the 18% wheat grain yield penalty associated with dual-purpose wheat production is due to early sowing and approximately 1/3 is due to grazing by cattle. Refer to OSU Fact Sheet PSS-2157 *Impact of Grazing on Wheat Grain Yield* for more information on how planting date and grazing affect dual-purpose and grain-only wheat yield potentials.

Rapid canopy closure leads to greater light interception and more fall forage production. Increasing wheat seeding rate to 90 to 120 pounds per acre and narrowing row spacing to 7.5 inches or less will hasten canopy closure and significantly increase fall forage production relative to the 60 pounds per acre seeding rates traditionally used for grain-only production. The need for rapid canopy closure makes seedling health and vigor even more important in a dual-purpose wheat production system than in a grain-only system, so emphasis should be placed on seed quality in addition to seed quantity.

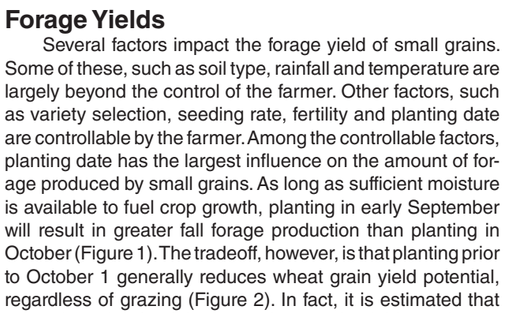

Figure 1. Wheat fall forage yield as affected by planting date at Lahoma, Okla. from 1991 to 1999.

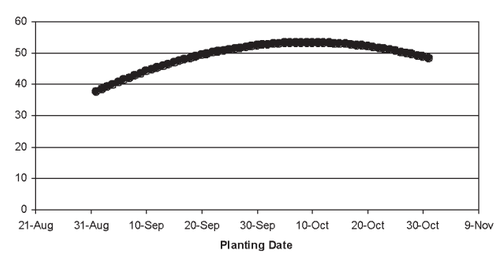

Figure 2. Wheat grain yield as affected by planting date at Lahoma, Okla. from 1991 to 1999.

Wheat varieties differ in their ability to produce fall forage and their ability to produce grain yield after grazing. To help decide among current varieties, OSU compiles forage production data on the most popular varieties each year. These data are published in OSU Current Reports 2141 and 2143 and are available at: www.wheat.okstate.edu under the "Variety Testing" tab.

A good fall fertility program will have great impact on the amount of wheat forage that is available for grazing. An accurate soil test just prior to sowing wheat is the best way to determine the amount of residual nitrogen present in the soil, which will dictate the amount of supplemental nitrogen needed to ensure adequate forage production. Wheat requires nitrogen for forage production and must be available for crop growth early in the fall and should ideally be applied prior to sowing wheat. Nitrogen intended for grain production can be supplied with a topdress application in late winter or at the time of cattle removal if the crop is not nitrogen deficient.

Due to the price of nitrogen fertilizer, it generally gets the most attention from wheat farmers, but phosphorus (P) fertility is just as important to wheat forage production. Phosphorus is even more important when the soil pH falls below 5.5. The most effective and efficient way to deliver P to the plant is through an in-furrow application with the seed. This can be accomplished using either dry or liquid forms of P, as the efficacy of each of these forms is similar. The most important factor is not the P source, but rather that P is applied and that it is banded with the seed, as this allows the young seedling to readily access P fertilizer and encourages early growth and tillering by the wheat plant.

Fall forage production by wheat varieties is only part of the equation when is comes to the total amount of forage available for cattle grazing. To optimize the dual-purpose wheat enterprise, cattle should be removed from wheat pasture by first hollow stem. The date which first hollow stem occurs varies according by year, location, planting date and variety. Varieties sown on the same date in the same location can vary by as much as three weeks in reaching first hollow stem, which equates to a three week difference in grazing time during early spring. This is generally at a time during which average daily gains for stocker cattle are at their highest, but added cattle gains for grazing past first hollow stem rarely offset the grain yield losses associated with extended grazing. Refer to OSU Fact Sheet PSS-2147 *First Hollow Stem: a critical Wheat Growth Stage for Dual-purpose Producers* for more information on first hollow stem and AGEC-265 *The Effect of Grazing Past First Hollow Stem on Wheat and Stocker Profits* for more information on the economics grazing past first hollow stem.

Conversion Efficiency

Forage utilization, or the conversion efficiency for grazing compared to clipping, is assumed to be less than 100%. Wheat producers stock conservatively — they do not stock at rates that are supported only by optimum growing conditions and/or may face credit constraints for purchasing cattle. Forage intake may be reduced by weather (for instance, snow cover). Forage growth is not continuous and could be limiting in some months while the stocking rate is fixed during the grazing period. Finally, some loss from trampling may occur. Research data are not currently available to compute economically optimal stocking rates for winter wheat pasture.

Research data support the rule-of-thumb that a pound of gain requires approximately 10 pounds of dry matter intake for stocker steers. Dry matter intake requirements for other livestock may be higher or lower. Rates of gain vary with the weight, age and genetic potential of livestock. They can be influenced substantially by weather, management practices and husbandry skills of the producer as well as by the quantity and quality of the wheat forage.

Stocking Rate

The formula for calculating head per acre shows 2,400 pounds of dry matter (DM) is required per head during the grazing period and is based on 240 pounds of gain per head and livestock consuming 10 pounds of DM per pound of gain. The number of head per acre that can be maintained on pasture depends on forage production and is 0.75 head per acre assuming 1800 pounds of DM produced.

Stocking Rate (Head per Acre):

$$\text{Head/Acre} = \frac{\text{Lbs DM Produced per Acre}}{\text{(Lbs DM per Lb of Gain) x (Lbs of Gain per Head)}}$$

$$= \frac{1{,}800}{10 \times 240}$$

$$= .75$$

Table 6. Stocking Rate Calculation[1]

Minimum Forage Production	*Head/Acre*	*Acre/Head*
3,600 lbs. DM	1.5	0.67
2,400 lbs. DM	1.0	1.0
1,800 lbs. DM	0.75	1.33
1,200 lbs. DM	0.50	2.0

[1] Assumes 2,400 pounds of DM required per head

The minimum forage production figure can be compared to clipping data to determine the approximate number of head the pasture will support, given the assumed rates of gain and conversion efficiency. Again, remember to look at early forage production to ensure that stocking rates are justified, or plan to purchase feed or pasture to supplement weak early forage stands. A stocker on target to gain 240 pounds before March 15 will require 900 pounds of DM between November 15 and January 1.

Returns to Grain and Pasture

Table 7 is a worksheet for calculating the returns per acre to both grain and forage production. Information from the wheat and stocker budgets is combined with forage production data and assumptions about grazing efficiency and dry matter consumed per pound of gain. Grain costs and returns per acre and stocker returns per head are transferred directly from the appropriate enterprise budget with adjustments needed for dual-purpose wheat compared to wheat for grain only. Grain yields are assumed to be 82% of grain-only enterprises.

In this example, positive returns to the stocker operation offset the negative returns to the wheat enterprise. Stocker production includes other risks, both production and financial and removing cattle from wheat pasture prior to first hollow stem is critical to maintaining grain yields. If returns to the livestock enterprise are negative, they intensify any losses associated with wheat production. In Table 8, the sensitivity of total returns to both grain and cattle prices are demonstrated. Remember that these are based on a strict set of assumptions and conditions represented by the individual enterprise budgets.

Similar calculations could be made to evaluate the returns to grain and forage using other livestock budgets, such as cow-calf or sheep operations. Note that assumptions about grazing efficiency, pounds of dry matter per pound of gain and pounds of gain per head differ for different sizes and types of livestock.

Risk Management

Once the budgeting and planning process has been completed, a producer's attitude toward risk must be considered in deciding whether to implement a plan. Risk management strategies to use in dealing with uncertainty include:

1. Reduce uncertainty. With wheat pasture, leasing out the pasture for a fixed rental rate per acre may be an option.
2. Shift some of the risk. Risks can either be shifted to or shared with another firm, for instance through insurance, contracting, hedging, or share leases. Sharing risk comes at a cost through premiums paid or profit potential given up. Risks can also be shifted by planting several good varieties and staggering planting dates. In that way, a producer prevents the risk of failure.
3. Rely on reserves to carry one through low income or loss periods. Reserves might include feed, hay, or cash in a farm account.

Summary

Farm income can be earned from grain and forage utilization as well as governmental commodity programs. High yields, high prices or relatively low costs of production are needed to generate positive returns to wheat without government payments or forage utilization. Positive returns to livestock enterprises which utilize wheat pasture enhance the profitability of wheat production.

Producers should look at yield data over time from both experiment station plots and from their farm records in evaluating forage potential for different wheat varieties. Once the basic enterprise budgets are developed, they can be updated periodically to reflect new and different circumstances. By monitoring the farm operation and adjusting plans in response to changing production and price conditions, a producer can maximize profits earned for the farm.