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OSU Current Report

Cooperative Extension Service • Division of Agriculture • Oklahoma State University

Economic Evaluation of Wheat Varieties Grown for Forage Plus Grain

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Wheat for most producers in Oklahoma is considered a dual use crop, harvesting both forage and grain. If weather is favorable, it is planted in September, grazed during November through mid-March, cattle are removed and grain harvested in June.

This Current Report presents grain and forage yield data for 18 wheat varieties grown for dual use at two test plot locations, Purcell and Cherokee. Budgets listing the inputs, estimated costs, and estimated returns to the wheat enterprise without government payments are included. A worksheet to assist in calculating the returns to both grain and forage using wheat and stocker budgets is also presented.

Production

The trials were planted on September 2 and 3, 1987 at Purcell and Cherokee, respectively. Field operations were similar at both locations with disking after harvest in June, moldboard plowing in late June or July, disking again in July, anhydrous ammonia application with a field cultivator in August, another field cultivation just prior to planting but after fertilizer application, planting, Glean application in February and harvest in June. The Cherokee location had additional nitrogen applied in February. Soil tests were performed to ensure nutrients would not be a limiting factor. Producer practices were used except where additional herbicide or nitrogen were added in February to ensure lack of weed competition and adequate nitrogen for projected grain yields. Nitrogen needs were calculated based on a 50 bu/a grain yield and on the basis of 30 lb of N used for each 1000 lb of forage removed and 2 lb of N needed for each bushel of grain produced.[1]

Table 1 lists the test weights, grain yields and forage yields for eighteen varieties at each location.[2] Forage yields are based on clipping data, that is, the wheat pasture was clipped to a height of 3 inches each time it was determined enough forage was present to clip with a sickle bar forage harvester. All varieties were clipped on the same dates: October 23,

[1]See Current Report CR-2234 for more details on nitrogen fertilization.

[2]See CR-2101, "Performance of Wheat Varieties in Oklahoma - 1988" for additional variety grain yield information.

Table 1. Test Weights, Grain and Forage Yields For 18 Varieties Grown at Cherokee and Purcell in 1987-88.

	Cherokee			Purcell		
Variety	Bu/A	Test Weight	Forage[1] (lb/A)	Bu/A	Test Weight	Forage[1] (lb/A)
Agripo Abilene	32.5	57.3	3010	41.8	60.0	2474
Agripro Mesa	30.2	59.1	3006	35.8	60.7	2921
Agripro Stallion	27.7	56.8	2750	39.7	60.1	3065
Agripro Thunderbird	30.5	57.2	3336	43.8	60.0	3511
Agripro Victory	17.6	52.5	3560	36.2	57.1	3207
Agripro Wrangler	23.8	56.0	3253	30.2	56.6	3266
Arkan	23.0	52.8	3258	30.0	58.1	3281
Century	26.3	53.7	2802	40.7	58.7	2843
Chisholm	29.2	54.0	2276	39.5	59.3	2281
Cody	16.8	50.7	2245	39.7	59.3	3060
Pioneer 2157	26.1	57.3	2721	36.2	60.5	3352
Pioneer 2172	29.9	54.5	2881	36.3	57.8	3067
Pony	26.6	55.6	2483	33.0	57.8	2734
Rohm & Haas 7837	21.9	50.2	3199	24.9	53.9	2623
Rohm & Haas 7846	23.4	56.5	2548	30.4	58.2	2233
Siouxland	22.2	53.9	3398	34.6	58.4	2826
TAM W-101	24.9	55.8	2924	35.9	59.7	2631
TAM 200	29.0	58.4	3493	34.5	59.8	2795
Average	25.6	55.1	2952	35.7	58.7	2898

[1]Clipping data obtained by early joint stage of wheat growth.

November 20, and March 27 in Cherokee and October 6, November 6, and March 16 in Purcell. Final clipping occurred as the main stem growing points reached the soil surface or at early joint stage. After the early joint stage clipping, the wheat was allowed to grow and produce grain.

The wheat growing season in 1987-88 was unusual in that excellent moisture was available for forage production. As a result exceptionally high forage yields were obtained in the fall. Therefore, we emphasize that ideally wheat variety selection should be based on data from more than one year. A time series of data on grain and forage yields gives a more accurate picture of a given variety's potential under different conditions (weather, precipitation at critical times, soil fertility, etc.). Production risks can be diversified by planting several good varieties. Similar data will be collected in 1988-89.

Grain Returns

Table 2 is an enterprise budget summarizing the inputs, costs and returns per acre using the average yields for the Cherokee and Purcell test plots. Note that all wheat production costs are charged against the wheat grain budget and none against the stocker cattle budget. The budgets incorporate information about the specific resources, management practices and technology used in the production process. Federal government payments for participation in commodity programs are not included in receipts. A column labelled "Your Value" is included so that the budget can be tailored to fit a specific farm operation or used to evaluate other yield and cost scenarios.

Table 2. Wheat Grain and Pasture Budget (per acre) for Cherokee and Purcell.

			Quantity		Value		
Production	Units	Price	Cherokee	Purcell	Cherokee	Purcell	Your Value
Wheat (Avg. for location)	bu	$3.50	25.6	35.7	$89.60	$124.95	
Sm. Gr. Past. (Avg. for location)	lbs		2952	2898	0.00	0.00	
Dock for low test weight (Avg. for location)	dol/bu	0.00	$0.05/bu	$0.005/bu	-1.28	-0.18	
Total Receipts					88.32	124.77	
Operating Inputs							
Wheat Seed	bu	$4.50	1.5	1.5	$6.75	$6.75	
18-46-0 Fert	cwt	9.80	1.0	1.0	9.80	9.80	
Nitrogen (N)	lbs	0.17	100.0	0.0	17.00	0.00	
Fert. Applic.	acre	2.00	2.0	1.0	4.00	2.00	
Anhydrous	lbs	0.11	44.0	200.0	4.84	22.00	
Herbicide	oz	16.00	0.165	0.165	2.64	2.64	
Custom Harvest	acre	16.00	1.0	1.0	16.00	16.00	
Custom Hauling	bu	0.14	25.6	35.7	3.58	5.00	
Annual Operating Capital	dol	0.09	38.985	43.652	3.51	3.93	
Labor Charges	hr	3.22	2.924	2.924	9.40	9.40	
Machinery Fuel, Lube, Repair	acre				15.63	15.63	
Total Operating Cost					93.15	93.15	
Fixed Costs							
Machinery							
Interest at 9.0%	dol					$10.96	
Depr., Taxes, Insur.	dol					16.95	
Land							
Interest at 0.0%	dol					0.00	
Taxes	dol					0.00	
Total Fixed Costs						27.91	
Returns Above Total Operating Costs					$-4.83	$31.57	
Returns Above All Costs Except Overhead, Risk and Management					-32.74	3.66	

Price dockages for low test weight wheat are listed in Table 3. Sixteen of eighteen varieties had test weights below 60 lb/bu at Cherokee and would have been docked when sold; five of eighteen varieties at Purcell had low test weights (Table 1). When applicable, price docks are deducted from returns in the wheat budget to accurately depict enterprise returns.

Table 3. Price Dock for Low Test Weights

Test Weight (lbs/bu)	Discount($/bu)
60 and above	0
above 58 but less than 60	$0.005
above 56 but less than 58	$0.03
above 54 but less than 56	$0.05
less than 51	$0.12

Sensitivity of grain returns (excluding government payments) to grain yields and prices are shown in Table 4. Projected profits per acre for grain production are positive for high yields and relatively high prices,

Table 4. Sensitivity ($/A) of Grain Returns (excluding Government Payments) to Yield and Price Received per Bushel.*

	Price per Bushel			
Yield (bu)	$2.50	$3.00	$3.50	$4.00
16	$-76.06	$-68.06	$-60.06	$-52.06
24	-56.06	-44.06	-32.06	-20.06
32	-36.06	-20.06	-4.06	11.94
40	-16.06	3.94	23.94	43.94
48	3.94	27.94	51.94	75.94

*Total costs before custom hauling equal $116.06 (Table 2).

even without government payments, given production costs at the Purcell location.

Forage Returns and Total Returns

If forage, that is, wheat pasture, is not grazed or is underutilized, then it results in forgone income (an opportunity cost) to the wheat producer. To estimate the value of forage, a producer should assess: 1) the returns to a livestock enterprise which could utilize forage, or 2) 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 stockers may lease grazing rights to others.[3]

Here, a stocker steer enterprise budget is used in estimating forage value (Table 5). A return to land, overhead, risk and management of $30.80 per head is projected when 400 pound steer calves are purchased at $77 per hundredweight and sold at 580 pounds for $71 per hundredweight.[4] Again, a "Your Value" column is included so that the budget input, cost and return assumptions can be easily modified and the returns easily recalculated.

The producer should be aware that stocker returns per head are quite sensitive to steer calf and steer prices. A $5 per hundredweight difference in either the price received or price paid for calves results in approximately $30 per head variation in returns.[5] Table 6 demonstrates the sensitivity of stocker returns to land, overhead, risk and management to steer calf and steer prices.

Table 7 is a worksheet for calculating the returns per acre to both grain and forage production. Information from the wheat and stocker budgets can be combined with forage production data and assumptions about grazing efficiency and dry matter (DM) consumed per pound of gain. Grain costs, grain returns per acre and stocker returns per head can be transferred directly from the appropriate budget. Stocker returns per head must be converted to stocker returns per acre so that 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). Research data are not currently available to compute economically optimal stocking rates for winter wheat pasture. The stocking rate is a function of pounds of dry matter (DM) produced per acre, livestock efficiency in grazing forage, pounds of DM consumed per pound of gain, and pounds of gain per animal. The formula for calculating head per acre is listed in Table 7.

Conversion efficiency for grazing is assumed to be less than 100 percent. Wheat producers stock conservatively (they don't 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

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[3]Producers who have pasture to lease may benefit from SWAP, a Cooperative Extension program to help match pasture producers with people wanting to lease pasture. An electronic bulletin board and periodic mailing of printed information profiles help advertise available pasture. Contact your County OSU Extension Center for more information.

[4]These steer prices are based on three year averages. Cost of forage production are included in the wheat budget, rather than in the stocker budget.

[5]For information on managing price risk, see OSU Facts F-434, "Pricing Alternative for Livestock Producers", F-436, "Using Futures Markets for Hedging: Forward Pricing Cattle", F-453, "Cattle Cycles, Profits, and Risks" or F-876, "Marketing Beef in Oklahoma: A Home Study Course."

Table 5. 100 Head Stocker Steer Budget (per head)*

Production	Units	Quantity	Weight	Price	Value	Your Value
Steers (500-600)	cwt	1.00	5.80	$71.00	$411.80	
Total Receipts					411.80	
Operating Inputs	Units	Rate Per Unit	Number of Units	Total Units	Price	Value	Your Value
Str Calves (4-5)	cwt	1.02	4.0	4.08	$77.00	$314.16	
Sm Gr Past	aums	1.89	1.0	1.89	0.00	0.00	
Prairie Hay	tons	0.15	1.0	0.15	35.00	5.25	
Salt & Minerals	lbs	11.25	1.0	11.25	0.09	1.01	
21-25% Prot. Sup.	lbs	45.00	1.0	45.00	0.07	3.15	
Starter Ration	cwt	0.60	1.0	0.60	8.00	4.80	
Vet Medicine	hd	1.00	1.0	1.00	5.00	5.00	
Trucking	cwt	9.50	1.0	9.50	0.50	4.75	
Sales Commission	hd	1.00	1.0	1.00	3.50	3.50	
Tractor Fuel & Lube						4.39	
Tractor Repair Cost						1.77	
Equipment Fuel and Lube						0.25	
Equipment Repair						0.30	
Total Operating Cost						348.33	
Capital Cost							
Annual Operating Capital				133.67	$0.09	$12.03	
Tractor Investment				39.71	0.09	3.57	
Equipment Investment				9.75	0.09	0.88	
Total Interest Charge						16.48	
Ownership Cost (Depreciation, Taxes, Insurance)							
Tractor	dol					$5.59	
Equipment	dol					2.11	
Total Ownership Cost						7.69	
Labor Costs							
Machinery Labor	hrs			0.908	$3.25	$2.95	
Equipment Labor	hrs			0.150	3.00	0.45	
Livestock Labor	hrs			1.700	3.00	5.10	
Total Labor Cost						8.50	
Returns to Land, Overhead Risk and Management						$30.80	

*Buy Nov 15, Sell March 15, 400# in and 580# out, small grain grazing.

growth is not continuous and could be limiting in some months while the stocking rate is fixed over the grazing period, clipping data may overestimate forage availability, and finally some loss from trampling may occur. In our estimates the grazing efficiency and pounds of DM consumed by livestock per pound of gain are combined into one

Table 6. Sensitivity ($/head) of Stocker Returns per Head to Steer Calf Prices (400#) and Steer Prices (580#)

Purchase Steer Calves ($/cwt)	Sell Steers ($/cwt)		
	66	71	76
72	$21.14	$50.14	$79.14
77	0.74	29.74	58.74
82	-19.66	9.34	38.34

Table 7. Worksheet For Calculating Per Acre Returns to Grain and Forage Production.*

Grain Returns to Land, Overhead, Risk, and Management
(Without Government Payments)

	Example	Your Value	
Total Receipts	$124.95	_____	
-Total Operating Costs	- 93.15	_____	
-Total Fixed Costs	- 27.91	_____	
Wheat Returns per Acre	$3.89	_____	(A)

Stocker Returns to Land, Overhead, Risk and Management

Total Receipts	$411.80	_____	
-Total Operating Costs	- 348.33	_____	
-Total Capital Costs	- 16.48	_____	
-Total Ownership Costs	- 7.69	_____	
-Total Labor Costs	- 8.50	_____	
Stocker Returns per Head	$30.80	_____	(B)

Stocking Rate (Head per Acre):

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

$$= \frac{2898}{10 \times 180} \qquad \text{_____}$$

$$= 1.61 \qquad \text{_____ (C)}$$

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

$$= \$30.80 \times 1.61 \qquad \text{_____}$$

$$= \$49.59 \qquad \text{_____ (D)}$$

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

Wheat Returns (A)	$3.89	_____
+ Stocker Returns (D)	+49.59	_____
Total Returns	$53.48	_____

*This example uses the Purcell wheat budget (Table 2), stocker budget (Table 5), 2800 lbs. DM produced, 10 lbs DM per lb. of gain, 180# gain per head.

factor, pounds of DM per pound of gain. The rate of daily gain assumes that sufficient forage or supplemental feed is available each day of the 120 day grazing season.

The pounds of gain per head is built into the stocker budget -- 400 pound calves are purchased, 580 pound calves are sold, thus a gain of 180 pounds per head is assumed (1.5 pounds per day). 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. Table 8 indicates the sensitivity of stocker returns per acre to forage availability and conversion efficiency.

Table 8. Sensitivity of Stocker Returns ($/A) to Forage Availability and Conversion Efficiency*

Lbs of DM	Lbs of DM per lb of gain			
Produced	8	10	12	14
2400	51.33	41.07	34.22	29.33
2800	59.89	47.91	39.93	34.22
3200	68.44	54.76	45.63	39.11
3600	77.00	61.60	51.33	44.00

*Assumes stocker returns per head of $30.80 and 180 pounds of gain per head.

Similar calculations could be made to evaluate the returns to grain and forage using other livestock budgets, for instance, cow-calf operations or sheep. Note that assumptions about grazing efficiency, pounds of DM per pound of gain and pounds of gain per head would differ for different sized and types of livestock. Other livestock enterprise budgets are available at the county OSU Extension Center.

Returns to both grain and forage are estimated for the two trial locations in Table 9. Remember that these are based on a strict set of assumptions (see footnotes in Table 9) and that yield and forage data are for one year only. Yields next year under a different set of circumstances could vary greatly from those recorded this year. Also in Table 9, the total returns for the two locations are averaged by variety, then ranked in descending order. The ranking is sensitive to assumptions about wheat and livestock prices, rates of gain, conversion efficiency and forage intake. Varieties with high forage yields would move up in rank with higher returns to forage; varieties with relatively high grain yields would move up in rank with higher grain prices.

Summary

Farm income can be earned from both grain and forage, 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 potential profits for different wheat varieties.

Table 9. Varietal Total Returns to Grain and Forage, in 1987-88 at Cherokee and Purcell.*

	Grain ($/A)		Forage ($/A)		Total ($/A)		Total ($/A)
Variety	Cherokee	Purcell	Cherokee	Purcell	Cherokee	Purcell	Two Location Average
Agripro Thunderbird	$-15.92	$31.11	$57.05	$60.04	$41.13	$91.15	$66.14
Agripro Abilene	-9.26	24.39	51.47	42.31	42.22	66.69	54.45
Agripor Stallion	-25.24	17.33	47.03	52.41	21.79	69.74	45.76
Agripro Mesa	-16.16	4.23	51.40	49.95	35.24	54.18	44.71
Pioneer 2172	-18.51	4.82	49.27	52.45	30.75	57.26	44.01
TAM 200	-20.19	-0.31	59.73	47.79	39.55	47.48	43.51
Century	-32.27	20.49	47.91	48.62	15.65	69.10	42.38
Pioneer 2157	-30.57	5.57	46.53	57.32	15.96	62.89	39.43
Chisholm	-20.83	16.46	38.92	39.01	18.09	55.47	36.78
TAM W-101	-35.06	4.38	50.00	44.99	14.94	49.37	32.16
Siouxland	-45.55	0.02	58.11	48.32	12.55	48.35	30.45
Agripro Victory	-60.46	4.49	60.88	54.84	0.42	59.33	29.87
Agripro Wrangler	-38.23	-15.49	55.63	55.85	17.40	40.35	28.88
Pony	-29.43	-6.17	42.46	46.75	13.03	40.58	26.80
Arkan	-42.96	-15.41	55.71	56.11	12.75	40.70	26.72
Cody	-63.05	17.13	38.39	52.33	-24.66	69.46	22.40
Rohm & Haas 7846	-39.56	-14.07	43.57	38.18	4.01	24.12	14.06
Rohm & Haas 7837	-46.52	-35.38	54.70	44.85	8.18	9.47	8.82

*Assumptions used in the calculation of total returns include:

1. Wheat production costs indicated in Table 2.
2. Wheat price of $3.50/bu.
3. Wheat hauling costs of $0.14/bu.
4. Stocker returns of $0.0171/lb of DM, that is, stocker returns per head ($30.80) divided by lbs of DM consumed per head (1800).

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