

# Whole-Farm Economic Evaluation of Conservation Tillage Winter Small Grains Forage Production in Arkansas



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# Introduction

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- ◆ **Soft red winter wheat is the common wheat type grown in the southern United States and Arkansas.**
- ◆ **In Arkansas, soft red winter wheat is almost exclusively produced for grain; nearly 80 percent of planted acres in eastern Arkansas.**
- ◆ **Grazing stocker cattle on soft red winter wheat may provide wheat producers and cattle producers with an alternative income source.**

# Winter Wheat Forage Feasibility Study (Daniels et al., 2002)

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- ◆ A Batesville study conducted from 1996-2001 evaluated the feasibility of grazing stocker cattle on soft red winter wheat.
- ◆ The study demonstrated that stocker cattle could be productively grazed on soft red winter wheat during the winter.
- ◆ Conventional “clean till” planting methods were used exclusively in the research.

# Economic Considerations of Clean Till

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- ◆ Clean till is machinery-intensive (requires large, expensive pieces of equipment).
- ◆ Clean Till is both fuel and labor intensive.
- ◆ Conservation tillage practices that maintain surface residue may be more appropriate for many areas.

# Conservation Tillage Winter Forage Study (Gadberry et al., 2007)

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- ◆ **Used Partial Budget Analysis to evaluate the profitability of grazing stocker calves on soft red winter wheat and rye forage under Clean Till (CT), Reduced Till (RT), and No-Till (NT).**
- ◆ **Steer weight gain data and forage production data from two years of winter small grains forage research at Batesville were used to calculate costs and returns**
- ◆ **Study Years:**
  - **Year 1 (Fall 2003 - Spring 2004)**
  - **Year 2 (Fall 2004 - Spring 2005)**
  - **Year 3 (Fall 2005 - Spring 2006)**



# Results of 2007 Partial Budget Study

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- ◆ Conservation tillage systems outperformed clean till systems in profitability.

 NT System - \$69/acre

 RT System - \$40/acre

 CT System - -\$17/acre

- ◆ **Reasons for Greater Profitability of Conservation Tillage Systems:**
  - Lower forage production costs
  - Higher fall weight gains (for NT system).

# General Conclusions of the 2007 Study

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**Demonstrated that conservation tillage systems can be more profitable than clean till systems in the production of winter small grains forage**

**But**

**Provided no evidence that these systems would enhance profitability for typical cattle operations in Arkansas**

# Cattle Production in Arkansas

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- ◆ Cow-calf operations account for the majority of cattle operations in the state.
- ◆ Most calves are born in the spring and sold in the fall at weaning.



# Implications of Winter Small Grains Forage Production

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**Would allow some cow-calf operators to retain ownership of calves beyond the fall to be sold at higher weights in the spring.**

**But**

**Require additional machinery and equipment that may not be available on most Arkansas Cattle Farms.**

# Current Study

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- ◆ **Employs a Mathematical Programming (MP) model**
- ◆ **The MP model**
  - **Maximizes whole farm returns for a 100-head cow-calf operation with and without winter wheat forage production**
  - **Selects the optimal machinery complement for hay and winter forage production**
  - **Selects the optimal number of pasture acres, hay acres, stocker grazeout acres, and animal units sold.**
  - **Incorporates steer weight gain and forage dry mater yield data from the ongoing Batesville conservation tillage study.**

# Modeled Cow-Calf Operation

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- ◆ **Based on secondary data from two sources:**
  - *“Estimated 2006 Income and Costs of Production, Cow-Calf Budget-100 Cow Herd, Retain Replacement Heifers”* (Hogan et al., Fact Sheet #AG-970-4-6).
  - *“Beef Cow-Calf Production Budgets for Arkansas, 2002”* (King Brister et al., University of Arkansas, Department of Agricultural Economics and Agribusiness).
- ◆ **Operation owns hay equipment and harvests its own hay.**
- ◆ **Retains 25 replacement heifers each year, with best 18 kept and 7 sold.**

# Prices Used for the Cow-Calf Operation\*

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**Cull Cows (1000 lbs) - \$44/cwt**

**Cull Bulls (1800 lbs) - \$56/cwt**

**Open Replacement Heifers (850 lbs) - \$50/cwt**

**Weaned Steer Calves (530 lbs) - \$101/cwt**

**Weaned Heifer Calves (500 lbs) - \$96/cwt**

**\*Based on 5-year average price data for the period 2001-2005 from “Livestock Market News Roundup, 1985-2005”  
(Chaney and Troxel, 2006)**

## Number of Pasture Acres and Animal Units Sold for a 100-Head Cow-Calf Operation (Base Farm)

<b>Pasture:</b>	<b>Acres</b>
Spring - Fall (Fescue)	136
Summer (Bermuda)	82
Hay (Bermuda)	32
<b>Total Pasture</b>	<b>250</b>

<b>Number Animal Units Sold by Type:</b>	<b>Head</b>
Cull Cows (1000 lbs)	18
Cull Bulls (1800 lbs)	1
Open Replacement Heifers (850 lbs)	7
Weaned Steer Calves (530 lbs)	43
Weaned Heifer Calves (500 lbs)	18
<b>Total Animal Units Sold</b>	<b>87</b>

<b>Net Return</b>	<b>\$5,041</b>
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# Modeled Stocker Enterprise

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- ◆ **The cow-calf operation may graze steers on winter wheat/rye pasture from mid-November through April.**
- ◆ **The model selects the forage production method (CT, RT, or NT) that maximizes profits.**



# Fall Steer Options

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- ◆ Steer calves from the cow-calf enterprise may be retained for the stocker enterprise.
- ◆ Additional 400 lb steer calves may be purchased in mid-September.
- ◆ Borrowed capital @ 9% interest is used to purchase additional fall steers.
- ◆ Fall steers (retained and purchased) are placed on winter wheat/rye pasture in mid-November and sold at the end of April (> 730 lbs each).

# Spring Steer Options

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- ◆ Additional 525 lb steer calves may be purchased in mid-January.
- ◆ Borrowed capital @ 9% interest is used to purchase additional spring steers.
- ◆ Spring steers are placed on winter wheat/rye pasture at the beginning of March and sold at the end of April (> 730 lbs each).

# Purchase and Sell Prices Used for the Stocker Enterprise

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**Additional fall steers (400 lbs) are purchased @ \$117/cwt.  
September**

**Additional spring steers (525 lbs) are purchased @  
\$98/cwt.  
January**

**Steer (> 730 lbs) are sold @ \$95/cwt.  
April**

**\*Based on 5-year average price data for the period 2001-2005 from “Livestock  
Market News Roundup, 1985-2005”  
(Chaney and Troxel, 2006)**

## Receiving Expenses (\$/Steer) for Purchased and Retained Steers (2005 Dollars).




Expense Item	Fall Steers Purchased	Spring Steers Purchased	Retained Steers
Death Loss <sup>1</sup>	16.34	18.07	0.00
Shrinkage <sup>2</sup>	21.06	21.04	21.06
Labor (Pasture Checking)	3.90	2.34	3.90
Minerals	4.28	3.55	1.47
Vet and Medical	12.00	8.00	0.00
Checkoff	1.00	1.00	1.00
Hauling	8.00	8.00	4.00
<b>Total</b>	<b>66.57</b>	<b>61.99</b>	<b>31.43</b>

<sup>1</sup> Death loss calculated as 3.5 percent mortality multiplied by steer purchase value.

<sup>2</sup> Shrinkage calculate as 3 percent steer sale value.

# Winter Forage Production Options Available in Model

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-  **Clean Till (CT)**: Grazeout land is chisel plowed, heavy disked, and light disked (cultivated) in the fall prior to planting. Seed is planted in a prepared seedbed using a grain drill.
-  **Reduced Till (RT)**: Applies one glyphosate application and makes no more than two light disking passes prior to planting. A broadcast spreader is used to plant seed, and a harrow is used to cover seed.
-  **No-Till (NT)**: Controls weeds exclusively using herbicide. One glyphosate application is made prior to planting, and seed is planted using a no-till grain drill.

## Machinery Complements and Annual Machinery Ownership Expense for Cow-Calf Operation With and Without Winter Small Grains Pasture

Tractor/Implement	Cow-Calf	With CT	With RT	With NT
2wd 75 Tractor	1	1	1	1
10 ft Hay Disk Mower	1	1	1	1
17 ft Hay Tedder	1	1	1	1
17 ft Hay Rake, Double	1	1	1	1
Hay Bailer, Large Round	1	1	1	1
20 ft Fertilizer Spreader	1	1	1	1
27 ft Sprayer, Broadcast			1	1
10 ft Disk		1	1	
12 ft Harrow		1		
12 ft Cultipacker		1	1	
12 ft Grain Drill		1		
10 ft No-Till Grain Drill				1
Ownership Expense (\$/year)	8,043	9,396	8,924	9,625



# Additional Model Assumptions

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- ◆ Machinery labor is purchased @ \$8.12/hour.
- ◆ Tractor (off road) diesel is purchased @ \$2.20/gallon. An additional \$0.33/gallon is added for oil expenses.
- ◆ Feed is purchased for the cow-calf and stocker enterprises @ \$0.081/lb:
  - Cow-calf pairs are fed 3 lbs/day during winter months
  - Steers are fed 3 lbs/steer/day during receiving

# Winter Grazeout

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- ◆ **The model takes grazeout acres from existing pasture available for the cow-calf enterprise. Two scenarios are modeled:**

 **Scenario 1: Available pasture land is held constant at 250 acres.**

 **Scenario 2: Additional pasture may be rented @ \$22/acre\* to maintain the total number of animal units sold (87 units) for a 100-head cow-calf operation.**

**\* Based on pasture cash rent data from “Land Values and Cash Rents 2005 Summary” (USDA, NASS, August 2005).**

# Optimal Pasture Acres by Type, Scenario 1 (No Rented Pasture)

Animal Units Sold by Type	Cow-Calf	Alternative Capital Levels (\$)					
		0	10,000	20,000	30,000	40,000	50,000
Spring Pasture	136	136	120	119	115	110	106
Summer Pasture	82	82	72	72	69	66	64
Hay Pasture	32	32	31	33	34	35	35
Winter Grazeout	0	0	27	27	33	39	46
Rented Pasture	0	0	0	0	0	0	0
<b>Total Pasture Used</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>
<b>Total Cow-Calf Units Sold*</b>	<b>87</b>	<b>87</b>	<b>77</b>	<b>76</b>	<b>73</b>	<b>71</b>	<b>67</b>
<b>Total Stocker Steers Sold</b>	<b>0</b>	<b>0</b>	<b>57</b>	<b>76</b>	<b>95</b>	<b>114</b>	<b>133</b>
<b>Net Return</b>	<b>5,041</b>	<b>5,041</b>	<b>5,882</b>	<b>7,394</b>	<b>8,314</b>	<b>9,191</b>	<b>10,068</b>

\* Inclusive of retained steers sold in the stocker enterprise.

# Optimal Animal Units Sold by Type, Scenario 1 (No Rented Pasture)

Animal Units Sold by Type	Cow-Calf	Alternative Capital Levels (\$)					
		0	10,000	20,000	30,000	40,000	50,000
Cull Cows	18	18	16	16	15	15	14
Cull Bulls	1	1	1	1	1	1	1
Cull Open Replacements	7	7	6	6	6	6	5
Weaned Steers	43	43	0	0	0	0	0
Weaned Heifers	18	18	16	16	15	15	14
NT Fall Retained Steers	0	0	38	37	36	35	33
NT Fall Purchased Steers	0	0	0	0	10	20	31
NT Spring Purchased Steers	0	0	19	39	49	59	69
<b>Total Stocker Steers Sold</b>	<b>0</b>	<b>0</b>	<b>57</b>	<b>76</b>	<b>95</b>	<b>114</b>	<b>133</b>
<b>Total Cow-Calf Units Sold*</b>	<b>87</b>	<b>87</b>	<b>77</b>	<b>76</b>	<b>73</b>	<b>71</b>	<b>67</b>
<b>Net Return</b>	<b>5,041</b>	<b>5,041</b>	<b>5,882</b>	<b>7,394</b>	<b>8,314</b>	<b>9,191</b>	<b>10,068</b>

\* Inclusive of retained steers sold in the stocker enterprise.

# Optimal Pasture Acres by Type, Scenario 2 (Rented Pasture Included)

Animal Units Sold by Type	Cow-Calf	Alternative Capital Levels (\$)					
		0	10,000	20,000	30,000	40,000	50,000
Spring Pasture	136	137	137	137	137	137	137
Summer Pasture	82	82	82	82	82	82	82
Hay Pasture	32	34	36	37	39	41	43
Winter Grazeout	0	30	30	30	35	42	49
Rented Pasture	0	33	35	37	43	52	60
<b>Total Pasture Used</b>	<b>250</b>	<b>316</b>	<b>320</b>	<b>323</b>	<b>335</b>	<b>353</b>	<b>371</b>
<b>Total Cow-Calf Units Sold*</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>
<b>Total Stocker Steers Sold</b>	<b>0</b>	<b>43</b>	<b>62</b>	<b>82</b>	<b>102</b>	<b>122</b>	<b>142</b>
<b>Net Return</b>	<b>5,041</b>	<b>5,496</b>	<b>7,067</b>	<b>8,637</b>	<b>9,991</b>	<b>11,214</b>	<b>12,438</b>

\* Inclusive of retained steers sold in the stocker enterprise.

## Optimal Animal Units Sold by Type, Scenario 2 (Rented Pasture Included)

Animal Units Sold by Type	Cow-Calf	Alternative Capital Levels (\$)					
		0	10,000	20,000	30,000	40,000	50,000
Cull Cows	18	18	18	18	18	18	18
Cull Bulls	1	1	1	1	1	1	1
Cull Open Replacements	7	7	7	7	7	7	7
Weaned Steers	43	0	0	0	0	0	0
Weaned Heifers	18	18	18	18	18	18	18
NT Fall Retained Steers	0	43	43	43	43	43	43
NT Fall Purchased Steers	0	0	0	0	6	16	26
NT Spring Purchased Steers	0	0	19	39	53	63	74
<b>Total Stocker Steers Sold</b>	<b>0</b>	<b>43</b>	<b>62</b>	<b>82</b>	<b>102</b>	<b>122</b>	<b>142</b>
<b>Total Cow-Calf Units Sold*</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>	<b>87</b>
<b>Net Return</b>	<b>5,041</b>	<b>5,496</b>	<b>7,067</b>	<b>8,637</b>	<b>9,991</b>	<b>11,214</b>	<b>12,438</b>

\* Inclusive of retained steers sold in the stocker enterprise.



# Conclusions

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- ◆ **Winter small grains forage production can enhance profitability for a cow-calf operation:**
  - **The cow-calf operation can retain weaned steers for sell in the spring**
  - **Additional steers may be purchased and grazed to fully utilize available small grains forage capacity**
- ◆ **Profitability is highly dependent on the amount of capital available for purchase of additional steers to fully utilize available winter forage capacity (may not be profitable for cow-calf operators lacking capital)**