Cost of Production and Equitable Leasing Arrangements for Center Pivot Irrigated Corn in Central Nebraska

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The focus of this paper is to provide an economic analysis of the profitability of center pivot irrigated corn enterprises in central Nebraska in 2007. An analysis of equitable crop share leasing arrangements and breakeven cash rental rates for irrigated corn producers follows from the estimates of irrigated corn enterprise profitability.

Currently (early February 2007) grain futures and expected 2007 harvest prices for U.S. corn are appreciably higher than at almost any other time since the early 1970s. The reasons for these high grain futures prices have to do with bioenergy-related market demand and other related factors affecting grain markets – but that is not the focus of this paper. Here, we are concerned about the impact of expected high corn prices upon not just the gross revenue but also the expected net profitability of the irrigated corn enterprise for 2007. This analysis is based on grain and fertilizer market prices and conditions as they existed in late January, early February, 2007.

With heightened expectations for corn prices in 2007and for gross/net revenues for irrigated corn enterprises, there is much interest on the part of both farm operator/tenants and landowners regarding the impact of these market factors upon cropland leasing arrangements. In this paper the equity and returns of irrigated crop share and cash rent leasing arrangements for landowners and tenants are examined for irrigated corn enterprises in central Nebraska.

2007 Irrigated Corn Production, Revenue and Cost Assumptions

Historically high expected corn prices for the 2007 crop have unquestionably raised expectations about the profitability of raising irrigated corn under center pivot sprinkler systems in central Nebraska (Tables 1 & 2). An expected harvest cash price of $3.50 per bushel for corn is used in this analysis. Other key assumptions and information sources used in this analysis are as follows:

Crop Yields and Direct Crop Production Costs: The UNL Extension publication "Nebraska Crop Budgets – 2006" (EC872), edited by UNL Extension Specialists Roger A. Selley and Robert N. Klein, was the primary source of yield and direct crop cost of production information used in these budgets (Tables 1 & 2). Three (3) alternative cost-return budgets are presented for irrigated corn in Nebraska:

A. Center pivot irrigated corn in a conventional-till continuous corn rotation: 175 bu/acre yield, 13 acre inches of irrigation water applied

B. Center pivot irrigated corn in a no-till continuous corn rotation: 180 bu/acre yield, 9 acre inches of irrigation water applied

C. Center pivot irrigated corn in a no-till corn-soybean rotation: 190 bu/acre yield, 9 acre inches of irrigation water applied

Assumptions about yield goals and actual yields, the amounts and costs of corn seed, herbicide and insecticide treatments, the amount of fertilizer applied, the number and types of field operations, and other management expenses are all taken from UNL Crop Production budgets. Drying, harvesting and hauling operation costs was also taken from this same source. Fertilizer prices are obtained from retail fertilizer sales contacts in Central Nebraska (Table 1).

Farm Program Payments: USDA farm program payments on irrigated cropland in central Nebraska are assumed to be $35 per acre (Source: Paul Burgener, UNL Extension) (Table 1).

Crop Revenue Coverage Insurance: Crop Revenue Coverage (CRC) insurance premium costs for irrigated corn in Buffalo County, Nebraska are estimated using the USDA Risk Management Agency online insurance premium calculator. Chicago Board of Trade December 2007 corn futures prices on January 31st were used in estimating the CRC insurance premiums (Table 1).

Custom Field Operation and Harvesting Costs: Expenses for field operations and harvesting are estimated using the most recent state-wide custom rate averages for Nebraska. This approach is a departure from field operation cost estimates in UNL Extension publication EC872, but consistent with the approach used in K-State Research and Extension crop budgets to estimate field crop cost of production. Labor cost estimates associated with field operation custom rates are calculated in the manner used in K-State budgets (Tables 1 & 2).

Irrigation Equipment and Pumping Costs: K-State Research and Extension estimates of irrigation equipment costs are used to represent the cost of the center pivot irrigation system (20 year life), power unit (7 year life), and well, pump and gearhead (25 year life). Straight-line (non-tax) depreciation methods are used to allocate the cost of the system over its lifespan. An interest rate of

Table 1. Irrigated Corn Cost Return Budget

Center Pivot Irrigated Corn Cost-Return Budget in Nebraska

Daniel O'Brien, Agricultural Economist - NW Kansas, K-State Research & Extension

Nebraska Crop Budgets for 2006 (Editors Roger Selley & Robert Klein), EC872

Tillage System:	Conv'l. Till	No-Till	No-Till
Crop Rotation:	Corn-Corn	Corn-Corn	Corn-Soyb.
INCOME PER ACRE	Yield Level, bu/ac		
A. Actual Yield - bushels per acre	175	180	190
Yield Goal - bushels per acre	*190*	*195*	*205*
B. Price per bushel	$3.50	$3.50	$3.50
C. Net government payment	$35.00	$35.00	$35.00
D. Indemnity payments	$0.00	$0.00	$0.00
E. Miscellaneous income	$0.00	$0.00	$0.00
F. Returns/acre ((A x B) + C + D + E)	$647.50	$665.00	$700.00
COSTS PER ACRE			
1. Seed	$58.90	$60.80	$63.65
2. Herbicide	27.03	27.59	38.45
3. Insecticide / Fungicide	4.65	4.64	1.86
4. Fertilizer and Lime	51.37	53.37	45.37
5. Crop Consulting	12.50	12.50	12.50
6. Crop Insurance	11.66	11.63	11.52
7. Drying	45.50	46.80	24.70
8. Miscellaneous	20.04	31.02	26.59
9. Custom Hire / Machinery Expense	119.33	85.80	88.29
10. Non-machinery Labor	13.48	9.70	9.98
11. Irrigation			
a. Labor	5.00	5.00	5.00
b. Fuel and Oil	64.61	44.73	44.73
c. Repairs and Maintenance	4.29	2.97	2.97
d. Depreciation on Equipment and Well	53.10	53.10	53.10
e. Interest on Equipment and Well	43.52	43.52	43.52
12. Land Charge / Rent	139.00	139.00	139.00
G. SUB TOTAL	$673.97	$632.17	$611.22
13. Interest on 1/2 Nonland Costs	17.68	15.74	15.79
H. TOTAL COSTS	$691.65	$647.91	$627.01
I. RETURNS OVER COSTS (F - H)	($44.15)	$17.09	$72.99
J. TOTAL COSTS/BUSHEL (H/A)	$3.95	$3.60	$3.30
K. RETURN TO ANNUAL COST (I+13)/G	-3.93%	5.19%	14.53%

TABLE 2. Production Inputs -- Center Pivot Irrigated Corn - Central NE

ITEM	Yield Level (bu) 175	180	190		
Seed, 1,000/acre* Bt Seed	31.0	32.0	33.5	$1.90	/1000
Fertilizer:					
N (anhydrous)	200	210	170	$0.20	/lb
N	7	7	7	$0.15	/lb
P	24	24	24	$0.43	/lb
Herbicide					
Bicep II Magnum	2.10	2.10	2.10	$11.25	/qt
Exceed	0.25	0.25	0.50	$12.40	/oz
+ Crop Oil Concentrate	0.50	0.50	0.50	$0.60	/pt
2,4-D Ester 4#	0.00	0.30	0.00	$1.88	/pt
Gramoxone Inteon	0.00	0.00	1.50	$5.03	/pt
NIS	0.00	0.00	6.00	$0.13	/oz
Insecticide / Fungicide					
Regent 4 SC	0.83	0.83	0.00	$3.46	/oz
Lorsban 15 G	0.10	0.10	0.10	$2.00	/lb
Capture 2 EC	0.51	0.51	0.51	$1.74	/oz
Mustang Max	0.40	0.40	0.40	$1.71	/oz
Capture 2 EC	0.00	0.00	0.05	$1.74	/oz
Irrigation water, inches	13	9	9	$4.97	/in

ITEM	Yield Level (bu) 175	180	190	Custom Rate	
Tillage/Planting/Chemical Applications:					
Chopping stalks	1	0	0	$8.77	/ac
Disk	1	0	0	$9.28	/ac
Field cultivate	1	0	0	$7.97	/ac
Row crop cultivation	1.25	0	0	$7.59	/ac
Hoe	0	0	0.1	$5.00	/ac
Planting - conventional row crop	1	0	0	$12.65	/ac
Planting - no-till	0	1	1	$12.81	/ac
Anhydrous application	1	1	1	$8.53	/ac
Fertilizer application	0	0	0	$5.29	/ac
Herbicide application	1	1.2	1	$5.13	/ac
Insecticide - ground rig application	0.25	0.25	0.5	$5.12	/ac
Insecticide - airplane application	0.32	0.32	0.34	$6.59	/ac
Harvest					
Base charge	1	1	1	$26.12	/ac
Grain cart custom charge	175	180	190	$0.060	/bu
Hauling with truck	175	180	190	$0.100	/bu
Non-machinery labor	1.35	0.97	1.00		$10.00
Land charge/rent	$139.00	$139.00	$139.00		
Interest on capital					9.0%

Irrigation Equipment	Investment, $/ac	Years	Salvage value
Well, pump and gearhead value	$398.00	25	0%
Power unit and meter	$94.00	7	0%
Irrigation system	$475.00	20	0%

9% is used on the irrigation equipment to represent the economic cost of paying for and eventually replacing the irrigation equipment. Pumping cost acre inch of water applied are calculated using current diesel fuel prices and irrigation system assumptions relevant to central Nebraska (Tables 1 & 2).

Land Charge / Rent: An irrigated farmland rental rate of $139 per acre for central Nebraska is assumed in these cost-return budgets, as reported in the 2006 Nebraska survey of farmland and rental values (Bruce Johnson, UNL Agricultural Economist) (Table 1).

Interest on Operating Costs: A 9% interest rate on operating costs is used in these budgets, consistent with K-State cost of production budgets (Tables 1 & 2).

Expected Profitability of Center Pivot Irrigated Corn in 2007 in Central Nebraska

Expected net returns over all costs except management for the 175 bu., 180 bu. and 190 bu. per acre yield scenarios are ($44.15), $17.09, and $72.99 per acre, respectively (Table 1). As stated earlier, these budgets are based on expected harvest cash corn prices of $3.50 per bushel and cash rental rates of $139 per acre for irrigated corn in central Nebraska.

Equitable Crop Shares for Irrigated Corn Leases

An analysis of equitable crop share leasing arrangements for irrigated corn illustrates the marked impact of alternative irrigation equipment ownership situations. Specifically, equitable irrigated cropland leasing arrangements differ depending on whether farm operator/tenants or landowners own the center irrigation systems and power units involved (Table 3). Two irrigation equipment ownership scenarios are examined for each of the three corn yield/crop rotation regimes in this analysis.

Scenario #1: The first irrigate crop share lease scenario represents situations where the farm operator/tenant owns the center pivot sprinkler system and the power unit, pays 67% of herbicide, drying and crop insurance costs, and contributes 100% of all other crop inputs. In this scenario, the landowner contributes the land, well, pump and gearhead, and pays 33% of herbicide, drying and crop insurance costs.

Scenario #2: The second lease scenario represents situations in which the farm operator/tenant pays 67% of herbicide, drying and crop insurance costs, and contributes 100% of all other crop inputs. The landowner contributes the land, center pivot sprinkler system, power unit, well, pump and gearhead, and pays 33% of herbicide, drying and crop insurance costs.

Table 3. Equitable Crop Shares for Irrigated Corn Leases

		Conventional Tillage *Corn after Corn*	**No-Till** *Corn after Corn*	**No-Till** *Corn after Soybeans*
		Actual Yield: 175 bu./acre	**Actual Yield: 180 bu./acre**	**Actual Yield: 190 bu./acre**
Scenario #1: **Operator' Contribution**: Pivot System + Power Unit; 2/3 Herbicides, Drying & Crop Insurance **Landowner's Contribution**: Land; 1/3 Herbicides, Drying & Crop Insurance				
Expenses ($/acre)	Operator $	$475	$432	$438
	Landowner $	$210	$211	$209
Calculated Equitable Crop Shares (%)	Operator %	69%	67%	68%
	Landowner %	31%	33%	32%
Returns to Management @ $3.50/bu Corn$ ($/ac)	Operator $	($26)	$15	$36
	Landowner $	($12)	$7	$17
Scenario #2: **Operator's Contribution**: 2/3 Herbicides, Drying & Crop Insurance **Landowner's Contribution**: Land, Pivot System + Power Unit; 1/3 Herbicides, Drying & Crop Insurance				
Expenses ($/acre)	Operator $	$413	$370	$375
	Landowner $	$273	$274	$272
Calculated Equitable Crop Shares (%)	Operator %	60%	57%	58%
	Landowner %	40%	43%	42%
Returns to Management @ $3.50/bu Corn$ ($/ac)	Operator $	($23)	$12	$31
	Landowner $	($15)	$9	$22

Landowner's and tenant's total expenses, equitable shares, and profit/loss are reported for these two scenarios for each of the three yield/cropping system regimes (Table 3). Equitable share percentages (%s) for crop share leases are the focus of these analyses.

University of Nebraska-Lincoln Extension personnel indicate that the most common terms for irrigated crop share leasing arrangements in central Nebraska are 1/3-2/3 leases (i.e. 33% of returns for the landowner, 67% for the tenant) with herbicides, crop insurance and drying costs shared or paid for (i.e. 33% of these specific expenses) by the landowner (source: Paul Burgener, UNL Extension). Ownership of the center pivot systems and pumping plants will likely vary from farm to farm and may affect the proportional revenue shares between operator/tenants and landowners in irrigated crop share leasing arrangements.

Scenario #1 Results: Under Scenario #1 (ownership of the center pivot system and power unit by the operator/tenant) the calculated equitable crop shares for the tenant for the 175 bu., 180 bu. and 190 bu. scenarios are 69%, 67% and 68%, respectively. These calculated equitable crop share percentages are nearly identical to the most common 33%-67% landowner-tenant crop share arrangement for irrigated crop share leases in central Nebraska.

Scenario #2 Results: Under Scenario #2 (ownership of center pivot system and power unit by the landowner) the calculated equitable crop shares for the tenant for the 175 bu., 180 bu. and 190 bu. scenarios are 60%, 57% and 58%, respectively. These downward adjustments in equitable crop share percentages for the operator/tenant reflect greater contributions of financially valued resources by the landowner to the irrigated crop share leasing arrangement in the form of the center pivot irrigation system and power unit.

Cash Lease Equivalents and Breakevens

This part of the analysis is intended to address some of the current questions raised by farm operator/tenants and landowners about cash rental rates in the current environment for grain prices. Two measures of financial returns in cropland leasing arrangements are calculated (Table 4). The first measure is "risk adjusted crop share equivalent returns to landowners". The second is "tenant's breakeven returns to land and management".

Risk Adjusted Crop Equivalent Returns: The landowner's risk adjusted crop equivalent returns are calculated in the following manner. The returns per acre a landowner would receive with an equitably adjusted crop share lease arrangement are reduced by a risk adjustment or percentage. This risk adjustment is applied to account for the additional financial risk assumed by tenants in cash rental arrangements as opposed to crop share lease arrangements where tenants and landowners share more financial risk from the irrigated corn enterprise. A 3% risk adjustment factor is used in this analysis.

Breakeven Returns to Land: The farm operator/tenant's breakeven returns to land indicate the maximum amount that could be paid for irrigated cash rent under these corn production and irrigation equipment ownership scenarios before the operator/tenant begins losing money. Returns to management are not quantified or specifically accounted for in this crop budget analysis. If a tenant is paying the breakeven / maximum cash rent amount for irrigated cropland as indicated in this analysis, then they are not allowing for any return to management from this irrigated corn enterprise.

Two alternative corn prices ($3.00 and $3.50 per bushel) are used to illustrate the impact of higher grain price and revenue expectations for irrigated corn in 2007. The impact of alternative irrigation ownership scenarios (see the previous section) is also illustrated (Table 4).

Results - $3.00/bu. Corn / Tenant Owns Center Pivot and Power Unit: The landowner's equivalent risk adjusted financial returns under an equitable crop share rent arrangement is $131 /acre for the 175 bu/acre irrigated corn scenario, $146 /acre for the 180 bu/acre scenario, and $155 /acre for the 190 bu/acre scenario. The operator/tenant's breakeven returns to cover land and management are $48 /acre for the 175 bu/acre irrigated corn scenario, $105 /acre for the 180 bu/acre scenario, and $131 /acre for the 190 bu/acre scenario.

Results - $3.00/bu. Corn / Landowner Owns Center Pivot and Power Unit: The landowner's equivalent risk adjusted financial returns under an equitable crop share rent arrangement is $180 /acre for the 175 bu/acre irrigated corn scenario, $200 /acre for the 180 bu/acre scenario, and $211 /acre for the 190 bu/acre scenario. The operator/tenant's breakeven returns to cover land and management are $111 /acre for the 175 bu/acre irrigated corn scenario, $167 /acre for the 180 bu/acre scenario, and $194 /acre for the 190 bu/acre scenario.

Results - $3.50/bu. Corn / Tenant Owns Center Pivot and Power Unit: The landowner's equivalent risk adjusted financial returns under an equitable crop share rent arrangement is $156 /acre for the 175 bu/acre irrigated corn scenario, $175 /acre for the 180 bu/acre scenario, and $184 /acre for the 190 bu/acre scenario. The operator/tenant's breakeven returns to cover land and management are $135 /acre for the 175 bu/acre irrigated corn scenario, $195 /acre for the 180 bu/acre scenario, and $226 /acre for the 190 bu/acre scenario.

Results - $3.50/bu. Corn / Landowner Owns Center Pivot and Power Unit: The landowner's equivalent risk adjusted financial returns under an equitable crop share rent arrangement is $214 /acre for the 175 bu/acre irrigated corn scenario, $237 /acre for the 180 bu/acre scenario, and $250 /acre for the 190 bu/acre scenario. The operator/tenant's breakeven returns to cover land and management are $198 /acre for the 175 bu/acre irrigated corn scenario, $257 /acre for the 180 bu/acre scenario, and $289 /acre for the 190 bu/acre scenario.

Table 4. Cash Lease Equivalents & Breakeven Land Costs

	Conv. Tillage *Corn-Corn*	**No-Till** *Corn-Corn*	**No-Till** *Corn-Soybeans*
	175 bu./acre	**180 bu./acre**	**190 bu./acre**
I. Cash Rent Equivalents & Breakevens @ $3.00 / bushel Corn Price:			
Scenario #1: Operator: Pivot System + Power Unit, Crop Expenses / **Landowner**: Land*			
Landowner's Equivalent Share Rent *(3% Risk Adj.)*	$131 /ac	$146 /ac	$155 /ac
Tenant's Breakeven Land Cost *(Less Mgmt Charge)*	$48 /ac	$105 /ac	$131 /ac
Scenario #2: Operator: Crop Expenses / **Landowner**: Land, Pivot System + Power Unit*			
Landowner's Equivalent Share Rent *(3% Risk Adj.)*	$180 /ac	$200 /ac	$211 /ac
Tenant's Breakeven Land Cost *(Less Mgmt Charge)*	$111 /ac	$167 /ac	$194 /ac
II. Cash Rent Equivalents & Breakevens @ $3.50 / bushel Corn Price:			
Scenario #1: Operator: Pivot System + Power Unit, Crop Expenses / **Landowner**: Land*			
Landowner's Equivalent Share Rent *(3% Risk Adj.)*	$156 /ac	$175 /ac	$184 /ac
Tenant's Breakeven Land Cost *(Less Mgmt Charge)*	$135 /ac	$195 /ac	$226 /ac
Scenario #2: Operator: Crop Expenses / **Landowner**: Land, Pivot System + Power Unit*			
Landowner's Equivalent Share Rent *(3% Risk Adj.)*	$214 /ac	$237 /ac	$250 /ac
Tenant's Breakeven Land Cost *(Less Mgmt Charge)*	$198 /ac	$257 /ac	$289 /ac

* Assume operator/tenant pays 67% fertilizer, drying and crop insurance expenses, 100% remaining crop costs.

Discussion of Results: For $3.00 /bushel corn, a landowner's equivalent risk adjusted financial returns under an equitable share rent arrangement are greater than operator/tenant's breakeven returns to cover land and management for all scenarios considered. For $3.50 /bushel corn, this remains true for the 175 bu/acre scenario, but not for the 180 bushel and 190 bushel per acre budgets, although the returns are similar. The tenant's breakeven returns to land and management in the $3.50 per bushel examples are markedly higher than the current or highest historic cash rental rates charged for irrigated cropland in the Nebraska-Kansas region. The comparable returns to landowners under equivalent equitable irrigation share leases with higher corn prices offer a reasonable alternative to cash rental arrangements in these examples.

Conclusions

The expected profitability of irrigated corn and the expected returns to operator/tenants and landowners in alternative crop leasing arrangements are markedly affected by expectations of higher corn prices for 2007. Whether all the adjustments in 2007 crop input prices for irrigated corn production have been fully realized to date is an open question. It is also unknown to what degree the higher selling price expectations for the 2007 corn crop will be actually realized at harvest time, although corn futures prices are other industry and governmental policy indicators are supportive of that perspective at the current time.

This analysis indicates that landowner's returns under risk adjusted crop share leasing arrangements are expected to be of similar to operator/tenant's breakeven cash rental rates for irrigated cropland in 2007. Given the uncertainty about both corn selling prices and the cost of production inputs for corn in 2007, it may be advisable for farm operator/tenants and landowners to consider equitably designed crop share leasing arrangements as opposed to cash rent leases for irrigated cropland in the coming year. Alternatively, existing cash rental arrangements could be adjusted to include both fixed (with a cash rent base payment) and flexible (with crop share adjustment for higher realized net revenues) components to share higher crop revenues should historically high actual 2007 harvest prices for corn and expected crop yields (or better) actually come to fruition in fall 2007.

A focus on grain prices in this analysis and these decisions is only partially adequate. Instead, the focus of local crop leasing arrangements for any particular farm operation or piece of irrigated farmland would more appropriately placed on net crop enterprise revenues instead of on crop prices alone. In the risky, uncertain environment for irrigated corn production in 2007, crop share leasing arrangements are a viable and reasonable option to cash lease arrangements. They are a mechanism that may help farm operator/tenants manage their financial risk in high cost irrigated corn enterprises while allowing landowners to means to participate is potentially 2007 higher crop revenues.