ECONOMICS OF CHANGEOVER FROM TRADITIONAL SUMMERFALLOW INTENSIVE CROP SYSTEMS TO LOW TILLAGE CROP INTENSIVE SYSTEMS - A CASE STUDY REPORT

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SUMMARY

The objective for the project was to carry out a farm business analysis of the changeover to a "conservation system" on a case farm in the Brown-Dark Brown Soil Zone.

A "cash flow analyzer" calculator program was used to compare the cash flow for the cropping systems in the short term and over a 15 year period.

In terms of short term cash flows, the traditional system was superior when:
- continuous crop yields were under 23 bushels/acre, or
- grain prices were under $5.00/bushel, or
- interest was charged for capital required for changeover.

For long term cash flow, the conservation system was superior when:
- continuous crop yields were at leat 25 bushels/acre, or
- wheat prices were over $5.20/bushel, or
- when projected productivity trends were included in the long term analysis.

Considering the short term and long term cash flow implications, no clear decision path was identified by the analysis, either in the short term or over a 15 year period.

If the real cost of nitrogen leached or otherwise lost during summerfallow is considered, then the conservation system should be much more energy efficient than the traditional system for this case farm.

More research is needed in order to generate the decision - making information needed for a changeover decision on the case farm. The key information needed is related to projected cost/price relationships, continuous crop yield potential for the area and more definite knowledge productivity trends which could be associated with the two systems on this particular soil in the case farm area.

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I BACKGROUND

This research project was completed as part of the Farm Energy Management Program. The objective was to establish a simple procedure for economic analysis on long term implications of rotation system planning decisions. The consulting objective was to undertake a feasibility analysis for changeover from traditional to conservation system based on the specific situation unique to the case farm.

Actual details of the present crop system were used to estimate production targets and cost budgets for the traditional summerfallow system now in place on the case farm.

The present traditional system can be described as maximum tillage, low-cost system which has been running close to the traditional ½ crop, ½ summerfallow. Phosphate fertilizer is used but generally no nitrogen is applied. The machinery, equipment and storage has been selected to maximize the economic performance of the traditional cropping system in the short term. The system would be high on a "soil mining" index.

The alternate continuous crop "conservation" system requires changes in machinery, equipment, operating capital and storage in order to reach maximum economic performance. This alternative can be described as a continuous crop system which is designed for maximum effectiveness in the use of available soil moisture. It is considered a "conservation system" in the sense that soil erosion is minimized, available soil moisture is used by crops, the major crop nutrients are provided by fertilizer instead of from the soil organic matter, and unnecessary tillage is avoided. The system would be very low on the "soil mining" index.

The input/output coefficients for the alternative conservation system were developed by FarmWest Management Ltd. acting as Agrologist Consultants for this case study.

1/ The Saskatchewan Farm Energy Management Program (FEMP) is jointly funded by Saskatchwan Energy and Mines and the Government of Canada.

The Case Farm

The case farm is located in West Central Saskatchewan in the Brown-Dark Brown transition. The soil is classed as a clay loam. Soil tests show very low organic matter, low nitrate, low conductivity and normal pH.

Precipitation in the growing season is about 10% below the provincial average. Summer high temperatures are about 10% above average for the province. Wind conditions are estimated to be above average.

Taking all climatic conditions into account the "effective precipitation" is probably about 90% of that for the Dark Brown Soil Zone as a whole.

Summerfallow yields are expected to average about 33 bushels/acre. For start-up of a continuous crop conservation system, yield targets for wheat should probably be in the 20-25 bushel/acre range.

The farm has 1,000 cultivated acres and has been operated on a profitable basis based on the traditional summerfallow intensive system.

II THE MANAGEMENT OBJECTIVES ON THE CASE FARM

It is important to make management decisions so that the cash flow performance of the farm business can be maintained in the short term.

At the same time, farm managers regularly make investment decisions which do not "cash flow" very well but which are expected to have a cash payoff in the long term. Accordingly, a changeover in cropping system can be viewed as an "investment" which has a long term payoff. A conservation system might have less cash flow than a traditional system. This short term "pain" may (or may not) represent a reasonable price to pay for a long term gain in economic terms. In this case the farm operator is willing to accept a short term sacrifice in cash flow in order to capture a long term gain in farm potential.

Whether any particular short term pain is " a reasonable price" to pay for any estimated long term gain, is a question for each individual decision maker to answer. The weight actually given to short term cash flow as opposed to long term payoffs depends on many social and economic factors which are expected to be more or less unique for each case farm. Accordingly, the present analysis only assumes that the decision criteria includes both short term and long term economic considerations. The analysis reveals the relevant economic relationships for both time periods.

III A PROGRAMMABLE CALCULATOR "ROTATION ANALYZER"

A farm business simulation model was developed by FarmWest Management Ltd. under contract to the Farm Energy Management Program.[1/] The model was developed for use on a TI-59 Programmable Calculator. The model is a simple one and the input and output can be readily understood by farmers. The model calculates net cash flow based on a random selection of yields from a yield distribution specified by the farmer together with an consulting Agrologist.

The simulated outcomes are presented in terms of cash surplus (or deficit) remaining after requirements for cash outlays are met. Cash outlays include all operating costs plus requirement for living and debt service.

The "surplus" of total revenue over these cash outlays represents funds available to pay income tax, replace machinery and equipment, and/or to make new investments.

IV SIMULATION PROCEDURE

For this case farm, the analysis was restricted to comparisons between spring wheat on summerfallow, and continuous wheat on stubble. By examining the rotation extremes it was possible to assume that specialized technology would be used for each system on the case farm. This would allow summerfallow and stubble cropping technology to generate target yields according to the possibilities recognized by the farmer and agrologist for both alternatives.

The outcomes were generated using the same random feature applied to yield distributions for each system. Crop insurance is part of the revenue stream for the continuous crop conservation system. Summerfallow yields are not expected to drop below coverage levels however, so crop insurance does not generate revenue for the traditional system.

To make the changeover, about $60,000 in new capital investment was considered necessary to set up the conservation system on the farm. The changes included additional operating capital, moving to an airseeder, buying a packer-harrow, setting up more grain storage and more natural air drying capacity. (The extra cost of moving to a straight combine was considered prohibitive at the start of the analysis. It is therefore anticipated that swather modifications would be used for snow management.)

Three wheat prices were considered. The middle range corresponds to current 1984 prices. Examples of the input for the model are provided in Appendix A.

1/ See the "ROTATION/CASH FLOW ANALYZER - a TI-59 Calculator Program for the Assessment of Farm Management Strategies." FarmWest Management Ltd.

V COMPARISON OF CASH OUTLAYS OVER A 5 YEAR PERIOD

For this case farm , the changeover to a continuous crop conservation system would result in an increase in cash outlay of about $.40 per bushel of saleable production.

No increased debt service costs are included in this case because the required capital would be provided by the operator savings. (The sacrifice in interest income associated with this re-direction of family capital is considered in the analysis of the investment implications of the changeover. See Table 5.)

The changeover would result in a 370% increase in costs of fertilizer and chemicals. Operating costs as a whole would increase by 225%. Total cash outlay would increase by 43%.

TABLE 1(a): COMPARISON OF CASH OUTLAYS FOR A 5 YEAR PERIOD (See Figure 1 & 2)

	Traditional*		Conservation*	
Operating	Total	Per bu. Sold	Total	Per bu.Sold
Fertilizer & Chemicals	$ 47,500	$ .58	$177,416	$1.65
Fuel & Repairs	32,800	.40	30,657	.28
Other Operating	40,000	.48	60,000	.56
Fixed				
Living	125,000	1.51	125,000	1.16
Debt Service	100,000	1.21	100,000	.93
	$345,310	$4.18	$493,073	$4.58

* The yield distributions are 20-46, $\bar{x}$ =34 and 2-40, $\bar{x}$ = 22.5 bushels/acre.

TABLE 1(b): COMPARISON OF N, P AND CHEMICAL COSTS

	CASH OUTLAYS	
	5 Years	Per Year
Traditional System		
Nitrogen	0	0
Phosphate	$ 12,500	$ 2,500
Chemicals		
Grassy	20,000	4,000
Broadleaf	15,000	3,000
Round-up	0	0
	$ 47,500	$ 9,500
Conservation System		
Nitrogen	$ 72,400	$ 14,500
Phosphate	25,000	5,000
Chemicals		
Grassy	45,000	9,000
Broadleaf	30,000	6,000
Round-up	5,000	1,000
	$177,400	$ 35,500

CASH OUTLAYS (5 YEARS)

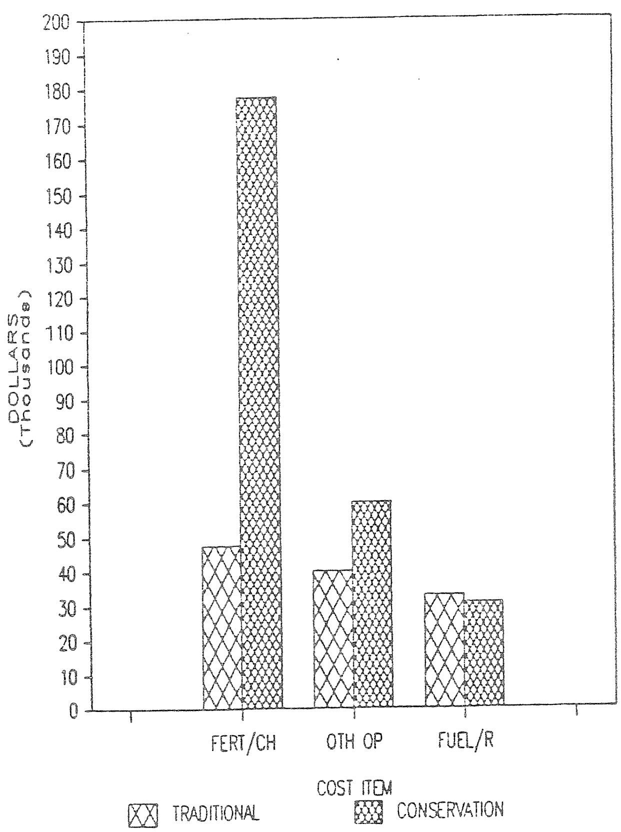

FIGURE 1

CASH OUTLAYS PER BUSHEL

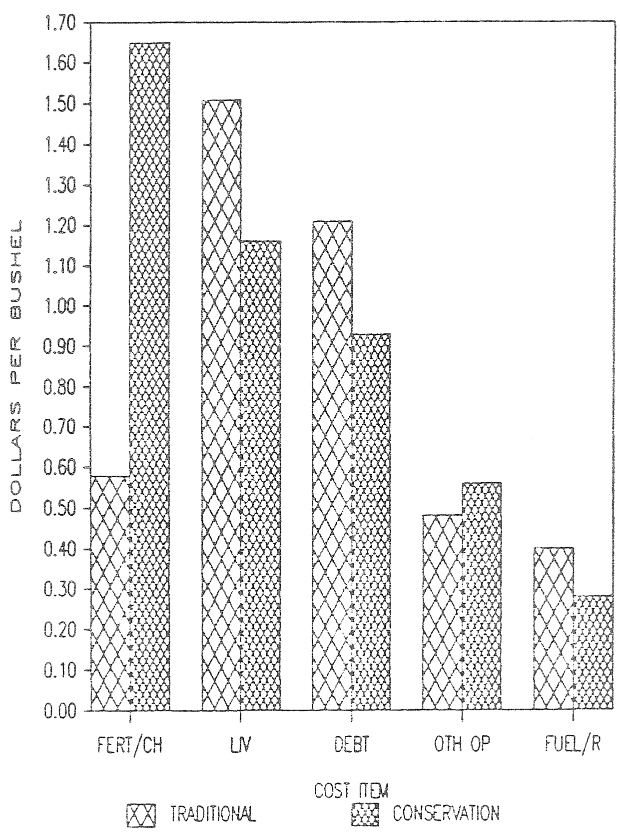

FIGURE 2

VI COMPARISON OF CASH SURPLUS OVER A 5 YEAR PERIOD

The cash surplus represents the amount of money available over a 5 year period to pay income tax, replace machinery and equipment and make new investments.

Table 2 reveals that both systems require new debt to cover necessary cash outflows over a 5 year period at prices below current levels. At $5.20, each system has similar potential for generating a cash surplus based on the costs and yield distributions used for the analysis.

TABLE 2: COMPARISON OF CASH SURPLUS FOR INCOME TAX, MACHINERY REPLACEMENT AND/OR NEW INVESTMENT (See Figure 3)

Traditional System (5 years, 85,000 bushels, $\bar{x}$ = 34 bushels/acre)

Grain Prices	Value of Production[1]	Cash Outlay	Cash Surplus
$4.20	$340,241	$345,310	$ (5,068)
4.70	380,424	345,310	35,114
5.20	420,607	345,310	75,297

Conservation System (5 years, 112,500 bushels, $\bar{x}$ = 22.5 bushels/acre)

Grain Prices	Value of Production[2]	Cash Outlays	Cash Surplus
$4.20	$466,215	$493,073	$(26,859)
4.70	521,012	493,073	27,939
5.20	575,812	493,073	82,739

1 Does not included investment income on savings which would be diverted into farm investment on changeover to a conservation system.

2 Includes crop insurance payments

VII COMPARISON OF YIELD VARIABILITY

The basic yield distributions used are 20-46 bushels/acre for the traditional system and 2-40 bushels/acre for the conservation system. The model applies the same random characteristic to each distribution.

The actual random yields used for this analysis is one where year 1 and year 5 are below average. The average over 5 years is slightly higher than expected.

TABLE 3: COMPARISON OF INDIVIDUAL YEARS @ $4.70/bushel

	YIELD DISTRIBUTION[1]	CASH SURPLUS (DEFICIT)	ACCUMULATED LINE OF CREDIT
Traditional			
Year 1	30	$ (1,429)	$ 1,429
2	36	(1,018)	2,447
3	38	14,187	0
4	45	28,256	0
5	22	(4,882)	0
		$ 35,114[2]	
Conservation			
Year 1	16	$(23,315)	$23,315
2	25	(2,732)	26,047
3	28	18,020	8,027
4	38	61,618	0
5	5	(19,965)	0
		$ 27,939[3]	

1 Traditional $\bar{x}$ = 34.0, Conservation $\bar{x}$ = 22.5 bushels

2 Does not include investment income on savings which would have to be diverted into farm investment for changeover to the conservation system.

3 Includes $32,000 in crop insurance indemnities in year 5 Without this cash inflow the year 5 deficit would be $51,965, and the accumulated line of credit outstanding at the end of the 5 year period would be about $4,000.

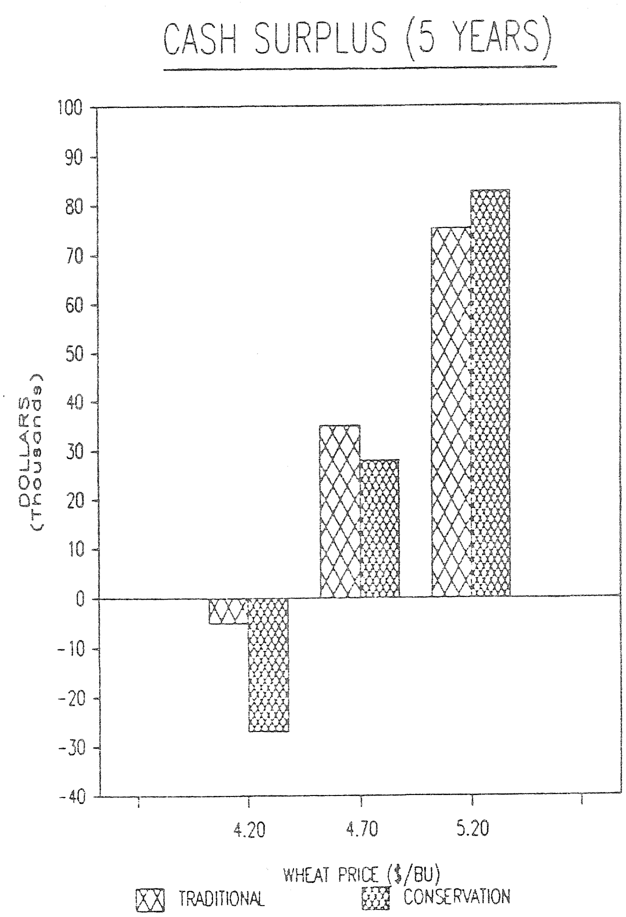

FIGURE 3

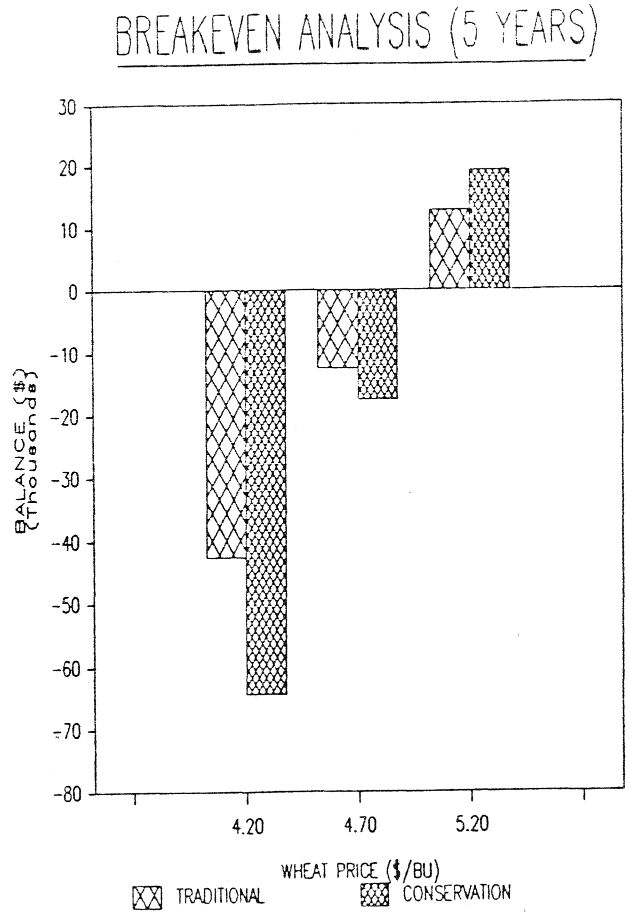

FIGURE 4

VIII BREAK-EVEN ANALYSIS

In order to "break-even", the rotation system must cover cash outlays for operating, living, debt service, income tax and replacement of machinery and equipment. If this cash is not forthcoming, then the farm must incur new debt just to maintain the base of operations. See Table 4 for a break-even analysis of the outcomes presented in Table 2.

TABLE 4: BREAK-EVEN SUMMARY AT DIFFERENT WHEAT PRICES (See Figure 4)

Traditional System

Prices	5 Year Surplus (Deficit)	Less Est. of Tax	Less Est. of Mach. Replacement	Deposit Balance (New Debt)*
$4.20	$(5,068)	$ 0	$37,500	$(42,569)
4.70	35,114	10,000	37,500	(12,386)
5.20	75,297	25,000	37,500	12,797

Conservation System

Prices	5 Year Surplus (Deficit)	Less Est. of Tax	Less Est. of Mach. Replacement	Deposit Balance (New Debt)*
$4.20	$(26,859)	$ 0	$37,500	$(64,359)
4.70	27,939	8,000	37,500	(17,561)
5.20	82,739	26,000	37,500	19,239

At $4.20 and $4.70/bushel the management options actually include not replacing equipment, reducing the standard of living in order to replace equipment, and new loans to finance replacements. The "break-even problem" associated with the conservation system is seen to be even more severe when the interest on the "dis-saved capital" is included in the analysis. This interest from non-farm investment sources is actually available cash (say $25,000 over 5 years) to the farm family under the present traditional system.

IX INVESTMENT ANALYSIS

The comparisons noted above regarding net cash flows over a 5 year period reveal that if management is to be committed to the changeover, then a shortfall in cash flow must be accepted at current price/cost relationships.

The operating surplus expected from each system is remarkable similar at $4.70/bushel. The difference is only slightly over $1,000/year in favor of the traditional system. (See Table 2)

However, additional capital in the order of $60,000 must be invested in the conservation system in order to achieve the changeover. Family income would actually be reduced by the amount of interest which this sum would generate. This means that the interest sacrifice has to be included in the investment analysis for the changeover.

For the investment analysis, some assumptions were made about possible long term productivity trends. Suppose for example that another 15 years under the traditional system would be associated with a trend to increased need for N fertilizer on summerfallow crops. (Soil tests show that this trend is already underway on the farm.) In addition, lack of organic matter could also damage yield potential because of poor soil tilth.

Also suppose that under the continuous crop conservation system, increased soil N, increased microbial activity, increased mineralization of organic matter, increased water penetration, and new technology designed specifically for continuous cropping would lead to an enhancement in expected yields.

For the long term analysis of the conservation system, the yield distribution was raised by 4 bushels per acre for the analysis over a 15 year period. Increased soil fertility could be associated with 1-2 bushel yield enhancement over 15 years. Increased water penetration and increased acreage due to less surface water could be associated with another 1-2 bushels of yield enhancement. New technology should contribute at least 1 bushel of yield enhancement over a 15 year period.

For the long term analysis of the traditional system, the yield distribution was lowered by 2 bushels per acre for the analysis over a 15 year period.

Such a decrease is roughly equivalent in economic term to a requirement for 30-40 pounds of fertilizer N in order to maintain productivity.

It is clear that these yield trend assumptions lead to significant momentum in favor of the conservation system. But there is no significant difference in the accumulated cash flow systems. (See Table 6 and Figure 5 and Figure 6.

This means that if a changeover is to made based on the economic analysis, a payoff period farther into the future must be considered. The subjective discount of payoffs further than 15 years into the future is bound to be very severe, depending on the mind set and the "time preference" for income of the individual entrepreneur.

TABLE 5: COMPARISON OF CASH FLOW FOR 3 SUCCESSIVE 5 YEAR PERIODS

Traditional System @ $4.70/bushel

	First 5 Years	Second 5 Years	Third 5 Years	15 Year Total
Yield bu/ac	20-46	19-45	18-44	
Actual $\bar{x}$ bu/ac	34	33	32	
Cash Outlay/bu	$4.18	$4.30	$4.50	
Surplus	$35,000	$26,000	$16,000	$ 77,000
Interest Income[1]	25,000	25,000	25,000	75,000
Cash for tax and machine replacement	$60,000	$51,000	$41,000	$152,000

Conservation System @ $4.70/bushel

	First 5 Years	Second 5 Years	Third 5 Years*	15 Year Total
Yield bu/ac	2-40	4-42	6-44	
Actual $\bar{x}$ bu/ac	22.5	24.5	26.5	
Cash Outlay/bu	$4.58	$4.27	$4.01	
Surplus	$20,000	$53,000	$79,000	$160,000
Cash for tax and machine replacement	$20,000	$53,000	$79,000	$160,000

1/ Interest income represents actual family income now earned on savings which would have to be diverted to farm investment for changeover to the conservation system. Therefore when comparing the two systems in investment terms, an interest amount has to be considered as income under the present system. An alternative would be to consider an interest sacrifice as a "cost" under the conservation system. Considering yearly interest income as part of the traditional system in place now is the most appropriate procedure in this case.

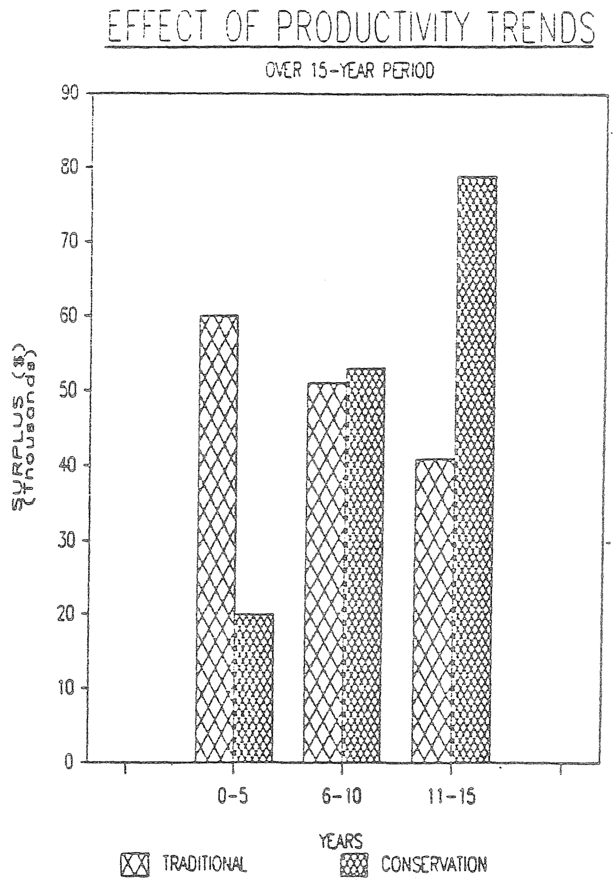

FIGURE 5

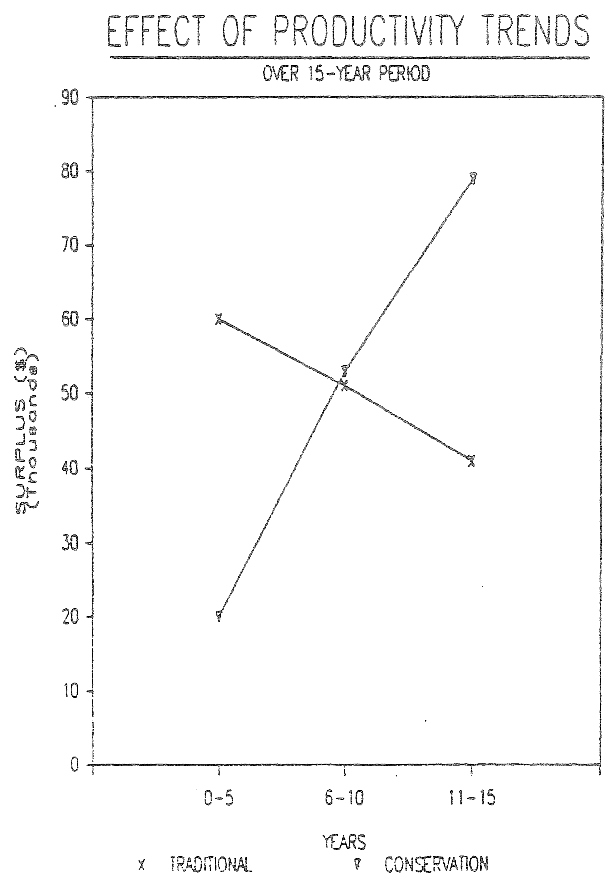

FIGURE 6

X FUTURE MARKET VALUE

An analysis of debt carrying capacity at the end of a 15 year time period reveals that conservation system land will be able to support twice as much debt per acre as land farmed under the traditional system. Based on the assumptions about productivity trends used for this analysis, the total revenue (at $4.70/bushel) less cash outlays for operating, living and depreciation, will be $33/cult. acre and $27/cult. acre respectively. At 12% interest over 20 years, these sums will support a loan for $256/acre for conservation system land and $127/acre for traditional system land.

In recent years, the land market has priced land at about 4 times the debt carrying capacity as estimated above. (This means that in order to have adequate cash flow to finance a new land debt, there should be three acres clear for each acre bought at market value and financed with new debt.)

Presuming that this relationship between market value and productive value will hold into the future, then the market prices could be as follows 15 years hence.

Traditional system land: $127/ac x 4 = $508/acre
Conservation system land: $250/ac x 4 = $1000/acre

It is not likely that the market would recognize any more than (say) 50% of this difference because traditional system land would still have the potential for changeover to the conservation system.

For this case farm, the possible increase in future net worth would be about $250,000 (1000ac x 500/ac x ½) for the farm, as a result of changeover to the conservation system 15 years earlier. Converting a future sum of $250,000 to a present value is calculated as follows:

P.V. = $250,000 x $\frac{1}{(1+i)^n}$, or assuming a 15% discount rate

Present Value = $250,000 x .123 = $31,000

This means that by accepting $31,000 now, the farm family would capture the projected benefit in equivalent to the future increase land value. Although benefits would obviously extend beyond 15 years, extending the accounting period farther into the future is of little analytical value because of the uncertainties involved. The main input for decision making on the case farm is the knowledge of the trends which could be set in motion in year 0-15. (See Figure 6.)

XI HIGHER CONSERVATION SYSTEM YIELDS

There is some uncertainty about the actual yields to be expected from a continuous crop conservation system on the case farm. Accordingly, a range of outcomes were examined to better understand the upside potential.

For this case, the conservation system yield distribution of 2-40 bushels/acre reflected the experience of the operator in the area. Years with no fall precipitation and little winter snowfall produced stubble crops which have been summerfallowed out the following year. Therefore a very low yield must be considered as part of the yield distribution. But suppose new technology could decrease the downside risk by increasing the poorest expected yield? (See Table 6 and Figure 7.)

TABLE 6: CASH SURPLUS FOR THE CONSERVATION SYSTEM AT SEVERAL YIELDS AT $4.70/bushel

Yield		Surplus		Cash Outlay/bu.
Distribution (bu/ac)	Actual $\bar{x}$ (bu/ac)	5 Years ($)	Per year ($)	Saleable Production ($/bu)
2-40	22.5	27,939	5,588	4.58
4-40	23.4	37,776	7,553	4.42
6-40	24.4	47,571	9,514	4.28
8-40	25.3	57,357	11,471	4.14 [1/]

[2/] Note that cash outlay/bushel under the traditional system at x = 34 is $4.18/bushel (see Table 2). This means that an average continuous crop yield of about 25 bushels/acre would be equal in cost effectiveness to the traditional system now in place on the farm. The "volume effect" under the conservation system would then generate short term cash surplus higher than under the traditional system by 4,000-5,000/year. This magnitude of difference is probably necessary to make the changeover to the new system sufficiently attractive in terms of short term cash flow.

XII ENERGY IMPLICATIONS OF CHANGEOVER

The changeover would make the farm business more vulnerable to changes in energy prices. Although energy costs are usually reflected in the cost of al inputs very quickly, the effect on fuel cost, nitrogen fertilizer cost and power for grain drying would be more dramatic.

	Traditional	Conservation
Fuel/bushel	$.22/bu	$.14/bu
N fertilizer/bushel	-	.53
Grain drying/bushel	-	.04
	$.22/bu	$.71/bu

There is s significant difference in cash outlays per bushel for these three cost items. A 50% increase in energy prices would result in twice as big an increase in cash outlays/bushel for the conservation system as it would for the traditional system.

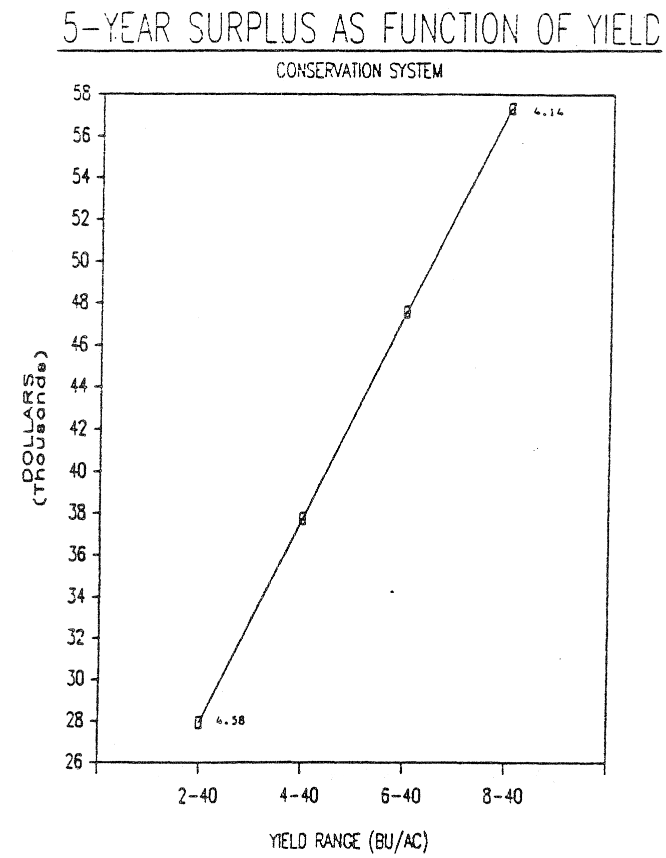

FIGURE 7

NOTE:

The potential for innovative management for the conservation system is clear. Removing some of the downside risk associated with conservation system yield has great impact on short term cash flows. Moving yield expectations from 2-40 bushels/acre to 8-40 bushels/acre is associated with an increase in cash surplus of $30,000 over 5 years for this case farm. Figure 7 shows that the cost effectiveness of the system can be improved dramatically.

Cash outlays per bushel of saleable production would drop from $4.58 to $4.14.

For a more complete analysis, the eventual added cost of replacing the nitrogen mined from the soil organic matter should be considered. It can be assigned as a cash outlay deferred into the future. When this is included, there is little difference in input costs/bushel between systems, for these three cost items.

The value of additional soil nitrogen leached or lost by erosion should also be assigned to the traditional system. Research shows that this could reach as high as $1.00/bushel produced. If this loss is included as a "cost", then the conservation system would be a much more effective system in terms of overall energy use.

XIII CONCLUSIONS FOR THE CASE FARM

The analysis has identified key areas of uncertainty which make the changeover decision into a very difficult one for this case farm.

First, the comparative advantage of one system over the other is highly dependent on prices.

At prices below $4.50/bushel, the conservation system (at $\bar{x}$ = 22.5 bushel/acre as a reasonable but conservative yield expectation) would have very negative cash flow consequences. However, at prices above $5.20/bushel, the conservation system would show a volume effect which would be very positive for short term cash flow, even at $\bar{x}$ = 22.5 bushels/acre.

Unfortunately future prices are not easy to predict, and a changeover to a higher cost, higher risk system is a difficult change to make when outcomes are so dependent on cost and market price trends.

Second, the economic performance of the conservation system is highly dependent on the potential continuous crop which could be achieved on this case farm. For example, at $\bar{x}$ = 25 bushels/acre, the conservation system actually has better short term cash flow that the traditional system at $\bar{x}$ = 34. Even at $4.70/bushel, a target of $\bar{x}$ = 25 bushels/acre represents the yield expectation which would make conservation pay even in the short term for this case farm.

Can this target be reached for continuous crop wheat in this area? Ongoing research will provide more solid information for the changeover decision on this case farm.

Third, the value of the changeover as a long term investment is highly dependent on productivity trends which could be associated with the two systems over time. Using a 6% (2 bushel/acre) deterioration in summerfallow crop yield potential over 15 years and a 10% (4 bushel/acre) enhancement in conservation cropping yield potential was shown to be very decisive in terms of profitability toward the end of the period.

Fourth, the overall energy implications are complicated and difficult to bring into the decision framework. If the value of the nitrogen "mined" under the traditional system is treated as a real cost (although deferred to some date in the future), then the energy cost per bushel produced would be very similar for the two systems. However, if the cost of nitrogen leached or otherwise lost from the rooting zone during the summerfallow period is considered, then the conservation system would have to be considered as a much more effective system in terms of overall energy use per unit of production.

XIV LIMITATIONS OF THE STUDY

There are several limitations associated with the model and method of analysis used for this study.

First, it is presumed that changes in the cost of particular inputs will not affect the cropping systems differently over time. This would not be the case if fertilizer costs increased faster than other costs for instance. Such a trend would work to the disadvantage of the conservation system over time.

Second, the assumptions about the relationship between grain price and input costs is open to question. The "cost price squeeze" may intensify over time. Such a trend would work to the clear advantage of the lower cost traditional system over time.

Third, the assumption about productivity trends used for the analysis lack the necessary backup support in terms of research findings. Nevertheless, this is a key element of information for decision making.

Fourth, the simulation model used is limited in order to maintain the simplicity needed to meet extension education and Agrologist consulting goals. The model is adequate for these purposes but lacks the development needed to adequately serve research objectives.

ACKNOWLEDGEMENT

This project was carried out as part of a research contract for the Saskatchewan Research Council. The SRC is Manager of the Saskatchewan Farm Energy Management Program, Directed by the Family Farm Improvement Branch, SDA. The program is funded by Energy, Mines and Resources Canada, and by Saskatchewan Energy and Mines.

DATE: November, 1983 FARM: Brown Soil Zone RUN#: TRADITIONAL

NOTES: Wheat 1/2-1/2, P fertilizer, grassy plus broadleaf chemicals, $20,000 debt service. Three quota/non quota price combinations: $4.20/3.60; $4.70/4.00; and $5.20/440. Yield distribution of 20-46 bu. with an actual $\bar{x}$ of 34 bu/acre.

REG#	ITEM			DATA
09	RANDOM NUMBER SEED			
10	LOWER LIMIT ON YIELD	BU/ACRE		20 bu
11	UPPER LIMIT ON YIELD	BU/ACRE		46 bu
12	QUOTA	BU/ACRE		14.5 bu
13	CROP INSURANCE THRESHOLD	BU/ACRE		20.0 bu
14	CULTIVATED ACRES	ACRE		1000 ac
15	QUOTA ACRES	ACRE		1000 ac
16	STORAGE CAPACITY	BU		3,000 bu
17	BUSHELS IN STORAGE	BU		-0-
18	QUOTA PRICE	$/BU	4.20/4.70/5.20	$4.70
19	DISCOUNT PRICE	$/BU	3.60/4.00/4.40	4.00
20	NITROGEN FERTILIZER	$/CROP ACRE		-0-
21	PHOSPHORUS FERTILIZER	$/CROP ACRE		5.00
22	CHEMICALS	$/CROP ACRE		14.00
23	FUEL	$/CULT. ACRE		3.50
24	REPAIRS	$/CULT. ACRE		3.00
25	UTILITIES	$/CULT. ACRE		1.00
26	OTHER OPERATING COSTS	$/CULT. ACRE		7.00
27	LIVING EXPENSES	$		25,000
28	MORTGAGE PAYMENT	$		20,000
29	NUMBER OF YEARS			5

2a) DATA ENTERED BY HAND: A, R/S	
2b) DATA ENTERED FROM MAG. CARD: 4, insert card	
2c) DATA CHECKED/REVISED: RCL nn/"data", STO nn	
2d) DATA PRINTED: 9 INV 2nd List	
2e) DATA RECORDED ON MAG.CARD: 4 2nd Write, insert card	
3a) INITIALIZED: 2nd E'	
3b) FARM TYPE: CONSERVER (C) or STANDARD (D)	
3c) RANDOM YIELDS: SEED CHECKED/CHANGED: RCL 09 /	6789
"new seed", STO 09. "year 0 yield", B	33B
3d) YIELDS INPUT: "year 0 yield", 2nd B'	
"current years yield", R/S	

YEAR#	1	2	3	4	5	6	7	8	9	10	11	12
YIELD												

DATE: November, 1983 FARM: Brown Soil Zone RUN#: CONSERVATION

NOTES: Minimum Till continuous crop wheat. N and P, grassy plus broadleaf chemical. $20,000 debt service. $4.20/3.00; $4.70/4.00; $5.20/4.40. Yield distribution 2-40 with an actual $\bar{x}$ of 22.5 bu.

REG#	ITEM		DATA
09	RANDOM NUMBER SEED		
10	LOWER LIMIT ON YIELD	BU/ACRE	2 bu
11	UPPER LIMIT ON YIELD	BU/ACRE	40 bu
12	QUOTA	BU/ACRE	14.5 bu
13	CROP INSURANCE THRESHOLD	BU/ACRE	13.0 bu
14	CULTIVATED ACRES	ACRE	1000 acre
15	QUOTA ACRES	ACRE	1333 acre
16	STORAGE CAPACITY	BU	6,000 bu
17	BUSHELS IN STORAGE	BU	-0-
18	QUOTA PRICE	$/BU 4.20/4.70/5.20	$4.70
19	DISCOUNT PRICE	$/BU 3.60/4.00/4.40	4.00
20	NITROGEN FERTILIZER	$/CROP ACRE	12.00
21	PHOSPHORUS FERTILIZER	$/CROP ACRE	5.00
22	CHEMICALS	$/CROP ACRE	16.00
23	FUEL	$/CULT. ACRE	3.00
24	REPAIRS	$/CULT. ACRE	3.00
25	UTILITIES	$/CULT. ACRE	2.00
26	OTHER OPERATING COSTS	$/CULT. ACRE	10.00
27	LIVING EXPENSES	$ 25,000	25,000
28	MORTGAGE PAYMENT	$ 20,000	20,000
29	NUMBER OF YEARS		5

2a) DATA ENTERED BY HAND: A, R/S	
2b) DATA ENTERED FROM MAG. CARD: 4, insert card	
2c) DATA CHECKED/REVISED: RCL nn/"data", STO nn	
2d) DATA PRINTED: 9 INV 2nd List	
2e) DATA RECORDED ON MAG.CARD:4 2nd Write, insert card	
3a) INITIALIZED: 2nd E'	
3b) FARM TYPE: CONSERVER (C) or STANDARD (D)	
3c) RANDOM YIELDS: SEED CHECKED/CHANGED: RCL 09 /	6789
"new seed", STO 09. "year 0 yield", B	19B
3d) YIELDS INPUT: "year 0 yield", 2nd B'	
"current years yield", R/S	

YEAR#	1	2	3	4	5	6	7	8	9	10	11	12
YIELD												