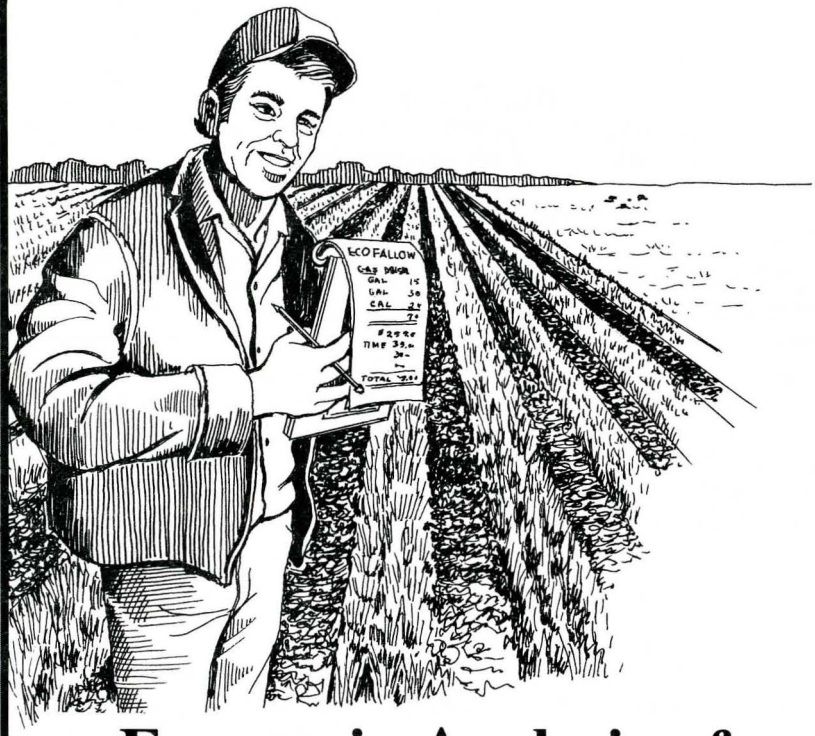
1980

EC80-873 Economic Analysis of Chemical, Ecofallow and Conventional Tillage System Wheat-Fallow Rotations

Robert Retzlaff



Economic Analysis of Chemical, Ecofallow and Conventional Tillage System Wheat-Fallow Rotations

EXTENSION WORK IN "AGRICULTURE, HOME ECONOMICS AND SUBJECTS RELATING THERETO,"
THE COOPERATIVE EXTENSION SERVICE, INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES,
UNIVERSITY OF NEBRASKA-LINCOLN, COOPERATING WITH THE COUNTIES AND THE U.S. DEPARTMENT OF AGRICULTURE
LEO E. LUCAS, DIRECTOR

Economic Analysis of Chemical, Ecofallow and Conventional Tillage System - Wheat-Fallow Rotations

Robert E. J. Retzlaff
District Extension Farm Management Specialist
University of Nebraska Panhandle Station

ACKNOWLEDGMENT

The cooperation and assistance of Charles Fenster, Agronomist at the Panhandle Station (University of Nebraska) and Gail Wicks, Agronomist at the North Platte Station (University of Nebraska), is gratefully appreciated.

Cooperation of the Wheat Industry Resource Committee—Farm Management and Financial Planning Sub-Committee—is also acknowledged. Committee members are L. N. Langemeir and Mark Schrock, Kansas State University; L. D. Luft, Montana State University; E. E. Nelson, Oregon State University; T. R. Nelson, Oklahoma State University; R. E. Retzlaff, University of Nebraska; B. B. Rice, North Dakota State University; and B. F. Lanpher, SEA-Extension, USDA.

INTRODUCTION

Interest in the use of chemicals to control weeds in wheat stubble has increased as accurate application of chemicals and high capacity residue grain drills have been developed.

Chemical fallow is the use of chemicals rather than tillage to control weeds during the fallow period. Wheat is seeded directly into the previous wheat stubble.

Ecofallow is the use of a combination of chemical application and machine tillage to control weeds throughout the fallow period.

Conventional fallow is the use of machine tillage without chemicals to control weeds throughout the fallow period.

Both chemical fallow and ecofallow may (1) improve control of annual weeds, (2) increase soil water available to the wheat, (3) leave a maximum amount of residue on the soil surface to control wind and water erosion, (4) provide seedbeds that insure good plant development, (5) maintain permeable condition of the soil, and (6) minimize the number of tillage operations.

This publication will (1) answer the question of "Are favorable economics really there?", (2) make cost comparisons between chemical, ecofallow and conventional systems for the short run and long run, and (3) aid one in calculating the cost of a tillage operation and system in relation to total annual use when machinery is owned.

Wheat producers using the wheat-fallow rotation use two basic conventional systems in wheat production. These systems are stubble mulch and black fallow. Chemicals to control weeds provide the wheat producer with additional systems as alternatives to conventional tillage. Table 1 presents seven selected tillage systems and the sequence of operations that could be used in the production of wheat. Two systems were selected for *conventional,* two systems for *chemical* fallow, and three systems for *ecofallow.*

Table 1. Seven selected fallow systems, excluding seeding for wheat-fallow rotation.

	Conventional		
System A (Black Fallow)		*System B (Stubble Mulch)*	
Moldboard plow		Subsurface sweep	4 times
Field cultivate	3 times	Rodweed	2 times
Rodweed	2 times		
	Chemical		
System C		*System D*	
Paraquat + X-77		Paraquat + X-77 & Atrazine	
Atrazine & Cyanazine			
	Ecofallow		
System E		*System F*	
Paraquat + X-77		Atrazine	
Subsurface sweep	3 times	Subsurface sweep	2 times
Rodweed	2 times		
System G			
Atrazine + Paraquat Cyanazine			
Subsurface sweep	1 time		

Source: Charles Fenster, Professor of Agronomy - Panhandle Station.

COST OF THE SEVEN SYSTEMS - USING CUSTOM RATES

The 10-year yield data at the High Plains Agricultural Laboratory at Sidney, Nebraska shows no significant differences in yield for *chemical, ecofallow* and *conventional* systems. Thus, the economic consequence is one of estimating and comparing costs for each system. Current prices, application rates, and timing of application can be obtained from chemical dealers. Costs of the chemicals are based on active ingredient at the follow-

ing prices: Paraquat - $20.00 per pound ($44.09 per kg), Atrazine - $2.50 per pound ($5.51 per kg), and Cyanazine - $3.00 per pound ($6.61 per kg). The X-77 surfactant was estimated at $.30 per acre ($.74 per ha).

Table 2 shows the cost of the seven selected systems based on 1978 farm machinery custom rates paid in the Northwest Crop Reporting District of Nebraska. The 1978 rates were increased 20 percent to reflect rates appropriate for tillage charges in 1979.

Table 2 indicates that chemical fallow system D and ecofallow system F will reduce tillage costs about $8.90 to $14.70 per acre ($21.99 to $36.32 per ha) over black and stubble mulch systems A and B. System C, a chemical fallow system, reduces costs by $8.00 to $11.45 per acre ($19.77 to $28.29 per ha) over black and stubble mulch systems. Assuming that tillage costs are represented by custom rates, savings on 600 acres (242.8 ha) could range from $4,800 to $8,820 per year by adopting systems C, D, or F. The cost per bushel per acre (kg per ha) based on a 32-bushel yield (2151.6 kg per ha) would be lowered by $.25 to $.46 per bushel ($.009 to $.0169 per kg) by successful adoption of a system similar to C, D, or F.

Table 2. Cost per acre (per hectare) for selected conventional, chemical and ecofallow systems using adjusted 1978 custom rates[1] and 1979 chemical costs.

Conventional

Acre *System A - Black Fallow*		**Hectare** *System A - Black Fallow*	
Moldboard plow	$ 7.80	Moldboard plow	$19.27
Field cult. 3x @ $3.10/acre	11.15	Field cult. 3x @ $9.19/ha	27.57
Rodweed 2x @ $3.30/acre	6.60	Rodweed 2x @ $8.16/ha	16.32
Total cost	$25.55	Total cost	$63.16
System B - Stubble Mulch		*System B - Stubble Mulch*	
Subsurface sweep 4x @ $3.90/acre	$15.60	Subsurface sweep 4x @ $9.64/ha	$38.54
Rodweed 2x @ $3.30/acre	6.60	Rodweed 2x @ $8.16/ha	16.32
Total cost	$22.20	Total cost	$54.86

Chemical

Acre *System C*		**Hectare** *System C*	
Paraquat .25 lb/acre @ $20/lb + X-77 surfactant @ $.30/acre	$ 5.30	Paraquat .28 kg/ha @ $44.09 /kg + X-77 surfactant @ $.74/ha	$13.09
Atrazine .5 lb/acre x $2.50/lb.	1.25	Atrazine .56 kg/ha @ $5.51/kg	3.09
Cyanazine 1.5 lb/acre x $3.00/lb.	4.50	Cyanazine 1.68 kg/ha @ $6.61/kg	11.10
Spray 1 application	3.00	Spray 1 application	7.42
Total cost	$14.05	Total cost	$34.70

[1]Source: Duey, Douglas D., NebGuide G75-207 Revised April, 1979 - "1978 Nebraska Farm Custom Rates Part I". Institute of Agriculture & Natural Resources, University of Nebraska, Lincoln, Nebraska, 1979, and calculations based on systems presented in Table 1. The 1978 custom rates were increased 20 percent to reflect appropriate charges for 1979 tillage costs.

System D	
Paraquat .25 lb/acre @ $20/lb. + X-77 surfactant @ $.30/acre	$ 5.30
Atrazine 1.0 lb/acre x $2.50/lb.	2.50
Spray 1 application	3.00
Total cost	$10.80

System D	
Paraquat .28 kg/ha @ $44.04 /kg + X-77 surfactant @ $.74/ha	$$13.09
Atrazine 1.12 kg/ha @ $5.51/kg	6.18
Spray 1 application	7.42
Total cost	$26.69

Ecofallow

Acre *System E*	
Paraquat .5 lb/acre @ $20/lb. + X-77 surfactant @ $.30/acre	$10.30
Spray 1 application	3.00
Subsurface sweep 3x @ $3.90/acre	11.70
Rodweed 2x @ $3.30/acre	6.60
Total cost	$31.60

Hectare *System E*	
Paraquat .56 kg/ha @ $44.09 /kg + X-77 surfactant @ $.74/ha	$25.43
Spray 1 application	7.42
Subsurface sweep 3x @ $9.64/ha	28.92
Rodweed 2x @ $8.16/ha	16.32
Total cost	$78.09

*System F**	
Atrazine 1.0 lb/acre @ $2.50/lb.	$ 2.50
Spray 1 application	3.00
Subsurface sweep 2x @ $3.90/acre	7.80
Total cost	$13.30

*System F**	
Atrazine 1.12 kg/ha @ $5.51/kg	$ 6.18
Spray 1 application	7.42
Subsurface sweep 2x @ $9.64/ha	19.28
Total cost	$32.88

*System G***	
Atrazine .5 lb/acre @ $2.50/lb. + Paraquat .25 lb/acre @ $20/lb. + X-77 surfactant @ $.30/acre	$ 6.55
Spray application	3.00
Cyanazine 2 lb/acre @ $3.00/lb	6.00
Spray application	3.00
Subsurface sweep 1 time	3.90
Total cost	$22.45

*System G***	
Atrazine .56 kg/ha @ $5.51 /kg + Paraquat .28 kg/ha @ $44.09/kg + X-77 surfactant @ $.74/ha	$16.18
Spray application	7.42
Cyanazine 2.24 kg/ha x $6.61/kg	14.82
Spray application	7.42
Subsurface sweep 1x @ $9.64/ha	9.64
Total cost	$55.48

*If weed free at time of application.
**Fall and spring application.

CALCULATING TILLAGE COSTS - WHEAT ONLY CROP - OWNED MACHINERY

A grower needs to calculate variable and fixed costs for his wheat enterprise. Variable costs include fuel, oil, filters, grease, repairs, and labor. Fixed costs include depreciation, interest, insurance, and shelter on machinery.

The calculations are not extremely difficult for a farm that raises only wheat. If more than one crop is produced, the producer needs to allocate the portion of machine use to each crop. Following is a step-by-step procedure to determine tillage costs where machinery is owned, using the method used by CROP BUDGET[1/] and the MACHINE program. These costs will be compared to systems A (black fallow) and B (stubble mulch) where custom rates were previously used to determine tillage costs.

Step 1. Describe your farm in relation to cropland, acres of wheat, acres of stubble mulch, and acres of black fallow. Let's assume that the farm consists of 1,200 acres (485.6 ha) of cropland, of which 600 acres (242.8 ha) are growing wheat and 600 acres (242.8 ha) are fallow. The fallow is handled as 300 acres (121.4 ha) of black fallow and 300 acres (121.4 ha) of stubble mulch. The black fallow is plowed, field cultivated three times, and rodweeded two times. The stubble mulch is subsurface swept four times, and rodweeded two times. The tractor was assumed to be used an equivalent amount of use on each system.

Step 2. Inventory the tillage machinery and power unit(s) along with their acquisition prices. The value of traded equipment is included. The following 1979 prices are list prices.

150 hp tractor	$40,000
6 bottom 18" plow	$ 4,800
35' field cultivator	$ 8,900
36' rodweeder	$ 4,400
22' subsurface sweep	$ 7,500

Step 3. Determine the annual charge for machinery fixed costs by multiplying fixed cost coefficient by acquisition price. The fixed cost coefficient found in Table 3 allows for depreciation, interest, insurance and shelter.

Table 3. Machinery fixed and repair coefficients, field efficiency, and field speed.

Machine	Coefficients (%) Fixed	Repairs	Field Efficiency	Range in speed (mph)
Plow	13.6	6.7	75-80	4.5-5.5
Subsurface sweep	13.4	8.7	70-90	4.0-6.0
Field cultivator	13.4	8.7	75-85	3.7-4.7
Rodweeder	13.6	6.0	70-90	4.0-6.0
Tractor	12.4	4.5	-	-

Source: Phil Henderson - Crop Budgeting Procedure - FM 1973.

1/ The AGNET computer system has the programs called CROPBUDGET and MACHINE that will estimate cost of tillage operations. It is recommended that the MACHINE program be used for calculating tillage cost. The MACHINE program is based on NebGuide G75-208 -"Cost Estimation - Field Operations". This NebGuide has a worksheet which a producer can fill in to determine cost of tillage operations.

The annual fixed cost for the plow, subsurface sweep, field cultivator, rodweeder, and tractor are $653, $1,005, $1,193, $598, and $4,960, respectively. The fixed costs expressed on a per acre (ha) of annual fallow system use are plow - $2.18 ($5.39), subsurface sweep - $3.35 ($8.28), field cultivator - $3.98 ($9.83), rodweeder -$1.00 ($2.47), and tractor -$8.27 ($20.44). The plow, subsurface sweep and field cultivator fixed costs were spread over 300 acres (121.4 ha). The rodweeder and tractor fixed costs were spread over 600 acres (242.8 ha). The black fallow has fixed costs of $15.43 per acre ($38.13/ha) and the stubble mulch $12.62 per acre ($31.18/ha).

Step 4. Machinery repairs are calculated by multiplying the acquisition price of the machine by the repair coefficient found in Table 3. Using the same procedure as in step 3, the repair costs per acre for the plow, field cultivator, rodweeder, subsurface sweep and tractor are $1.07, $1.78, $.44, $2.18, and $3.00, respectively (per ha - $2.64, $4.40, $1.09, $5.39, and $7.41, respectively). The repairs per acre for black fallow total $5.85 ($14.46/ha) and stubble mulch totals $5.62 per acre ($13.89/ha).

Step 5. Labor consists of direct field time plus 20% for overhead allowance. Direct field time is based on the speed of travel, field efficiency, and the size of equipment. The formula used to determine acres accomplished per hour is:

$$\frac{\text{(width of equipment in feet) (mph) x field efficiency coefficient}}{8.25}$$

Table 3 contains some guidelines for mph and field efficiency coefficients for the wheat tillage operations. The acres per hour accomplished by each machine is then converted to minutes required per acre. To this direct time, 20% is added for non-field time and multiplied by the value of labor. The labor rate per hour is assumed to be $4.00.

The plow operation would be calculated as follows:

$$\frac{9 \text{ ft. x } 5.0 \text{ mph x } .80 \text{ field efficiency}}{8.25}$$

= 4.36 acre per hour (1.76 ha/hr) or 13.76 minutes per acre (34 min/ha). The 20% overhead allowance increases the total (direct and overhead) to 16.5 minutes per acre (40.8 min/ha). Upon completion of the calculations the labor cost for black fallow is $2.39 per acre ($5.91/ha) and $2.34 per acre ($5.78/ha) for the stubble mulch.

Step 6. Fuel, oil, filters and lubricant must be calculated to complete the variable costs. For the tractor selected, 7.9 gallons per hour (29.9 liters/hr) was the assumed consumption rate. To the costs of the diesel fuel, 10% is added to cover the cost of oil, filters and lubricant. Fuel costs per acre (ha) are based on the sum of the minutes required to accomplish the tillage operations in a system. The black fallow system requires 36 minutes of total

time per acre (1.48 hr/ha) to complete the tillage operations. The calculation for black fallow fuel, oil, filters and lubricant cost per acre is:
.6 hr per acre x 7.9 gal. per hour x ($.80 per gal. x 1.1) = $4.17* ($10.31/ha). The stubble mulch fuel, oil, filters and lubricant is $3.94 per acre ($9.73/ha).

Step 7. Summarizing the previous six steps needs to be done to determine total tillage cost. Table 4 allows a comparison of conventional tillage costs to chemical and ecofallow system costs. The costs per acre (ha) for the black fallow and stubble mulch systems are $27.84 ($68.81/ha) and $24.52 ($60.58/ha), respectively. This compares with systems A and B using updated 1978 custom rates of $25.55 ($63.16/ha) and $22.20 per acre ($54.86/ha), respectively.

The ownership costs that have been calculated can be expressed on the cost per tillage operations based on NebGuide G75-208. The procedure described allocates the tractor's fixed costs and repairs to each tillage operation in relation to the tractor's total use. Labor is also charged separately to each tillage operation. Cost per acre per time would be as follows: plow -$11.07, field cultivate - $3.86, rodweed -$2.59, and subsurface sweep -$4.84. Cost per hectare per time would be as follows: plow - $27.35, field cultivate - $9.54, rodweed -$6.40, and subsurface sweep -$11.96.

Table 4. Fixed costs, repairs, labor, fuel, and total cost per acre and per hectare for black and stubble fallow systems using a selected inventory of machinery - (300 acres or 121.4 hectares for each system of black fallow and stubble mulch).

		Black fallow		Stubble mulch	
		per ac	per ha	per ac	per ha
Fixed costs	(Step 3)	$15.43	($38.13)	$12.62	($31.18)
Repairs	(Step 4)	$ 5.85	($14.46)	$ 5.62	($13.89)
Labor	(Step 5)	$ 2.39	($ 5.91)	$ 2.34	($ 5.78)
Fuel	(Step 6)	$ 4.17	($10.31)	$ 3.94	($ 9.73)
Total cost	(Step 7)	$27.84	($68.81)	$24.52	($60.58)

Source: Calculations using Steps 1 to 7.

LONG RUN CONSIDERATIONS

Assume a wheat producer is considering adoption of ecofallow or chemical fallow on his operation of 600 acres (242.8 ha) of fallow. The producer realizes that a major financial commitment in machinery will be made in the selection of a conventional system over ecofallow or chemical fallow.

*Increasing the cost of diesel fuel $.20 per gallon results in increasing the fuel, oil, filters and lubricant cost for black fallow and stubble mulch $1.74 per acre ($4.29/ha).

The latter systems, however, have a higher annual cash flow financial commitment. An element of risk is present with the use of chemicals in part, or entirely in a fallow system. Chemical effectiveness, chemical availability, and chemical costs are uncertainties that may make a producer hesitant to sell tillage machinery that could be used if mechanical tillage becomes necessary. Other farmers with considerable equity in equipment may be reluctant to liquidate as these producers tend to view costs differently than a producer with relatively low equity in equipment.

Assume that the systems are equally effective, and that there are no yield differences in the systems. If the chemicals should not perform due to weather and/or variations in soils where mechanical tillage becomes necessary, the situation is different than what is analyzed. The question is which system is more economical to use — chemical, ecofallow, or the conventional for a 10-year planning period? Machinery investments, labor requirements, cash costs, investment credit, income taxes saved, and the value of machinery at the end of 10 years needs to be considered. The time investment analysis will compare the systems on a common basis or denomination so that the least cost system can be determined. The present value approach offers the advantage of taking time into account. With only costs to be considered, the most desirable system of fallow will be that system generating the lowest net present value.

Machinery Inventory for the Three Systems

Careful consideration of the equipment requirements and their cost is the beginning of the analysis. Table 5 presents the equipment requirements and costs for chemical, ecofallow and conventional tillage. Custom application of chemicals is assumed to cost $2.50 per acre ($6.18/ha).

Table 5. Selected equipment and their costs for chemical, ecofallow and conventional tillage systems.

	Chemical	Ecofallow	Conventional
Tractor	$26,500	$38,250	$38,250
Drill 24'	13,800	11,900	9,800
Plow 7-16''	- -	- -	5,650
Field cultivator 28.5'	- -	- -	8,250
Rodweeder 36'	- -	- -	4,600
Sweep chisel 22'	- -	7,450	7,450
Total	$40,300	$57,600	$74,000

Source: Prices of Machinery for Crop Budgeting Purposes - Fall, 1978, Douglas D. Duey, District Extension Specialst, Southeast Station, Lincoln, Nebraska.

The chemical system requires custom chemical application, a 100-110 hp tractor, and a high residue capacity grain drill. The investment total is $40,300 for the chemical system. The ecofallow system requires custom chemical application, a 150-160 hp tractor, a grain drill with moderate residue capacity, and a sweep chisel. The machinery investment for ecofallow is $57,600. The conventional system consists of a 150-160 hp tractor, grain drill, plow, field cultivator, rodweeder and a sweep chisel. Both black and stubble mulch equipment are included in the conventional system, with 300 acres black fallowed and 300 acres stubble mulched. The investment for conventional machinery is $74,000.

The chemical system has a $33,700 lower machinery investment than the conventional system. The ecofallow system has a $16,400 lower investment when compared to the conventional system. The lower machinery investment in chemical fallow is not the only economic measure that needs to be considered in the selection of the system. Higher cash costs for chemicals (average chemical cost and application for systems C and D is $11.93 per acre or $29.48/ha) and interest on operating funds needs to be analyzed. There are the other economic considerations, such as the 10% investment credit, income taxes saved by using the depreciation and operating expense allowance, and the value of machinery at the end of 10 years. Additional assumptions include: (1) The taxpayer is in the 25% tax bracket. (2) The value of machinery at the end of 10 years is 25% of its initial cost. This will be treated as ordinary income in year ten. (3) Interest on borrowed money is for 9% per year for 18 months. Since chemical application and tillage begins soon after harvest is completed, a time period of 18 months elapses before wheat is harvested. (4) Depreciation will be 10 year straight line with no salvage value. (5) Repairs will be estimated at 6% per year on the machinery investment. (6) Labor will be charged at $4.00 per hour. (7) Insurance and shelter will be charged at 1.5% on the machinery investment. (8) Interest on machinery is calculated at 9% on the average investment over the 10-year period. The land charge, labor and associated costs involved in planting, fertilizing, combining and hauling are identical for the three systems, and are not included in the analysis.

The cash outflows, the cash inflows, and the present value of the chemical, ecofallow and conventional systems will weigh the differences in machinery investments, annual operating costs, income taxes on the salvage value of machinery at end of time period, the income taxes saved by using the investment credit, depreciation and operation expense allowance. The cash inflows and outflows are discounted at 9%. Cash outflows represent investment or cost, and consequently have a minus value. Cash inflows represent returns and have a positive value.

Two interest factors or formulas are necessary to determine the net present value for each system.[2/] These are the single payment present value

2/ For a complete explanation of present value see: Frey, Thomas L., "Time Value of Money and Investment Analysis: Explanation with Application to Agriculture." AET-15-76, Department of Ag Economics, University of Illinois at Urbana - Champaign, Illinois. June 1976.

(SPPV) and the uniform series present value (USPV) factors and formulas. The SPPV is used to determine present value of a single cost or return payment due in the future. The USPV is used to determine the present value of a uniform series of costs or returns due in the future. Present value (USPV factor) equals payment each year and must be multiplied by the number of years in the analysis.

Table 6 presents for the 600 acre (242.8 ha) wheat-fallow farm two chemical fallow systems (C and D), an ecofallow system (F) and a conventional tillage system (combination of A and B). Table 6 contains the cash outflows, the cash inflows, plus their respective present values for the 10 year period.

Cash outflows or costs are added (items 1 to 3) for the four systems. From the negative value the sum of the return (items 4 to 7) are subtracted to find the net present value. The negative value indicates that costs (outflows) exceed returns (inflows) from the investment viewpoint. The system with the lowest cost or net present value is the most economical. The two chemical fallow, ecofallow, and conventional systems have -$97,153, -$87,212, -$108,920, and -$122,151, respectively for their net present values.

Based on the present value analysis and assumptions, the wheat grower would select chemical - system D since system D has the lowest negative net present value, still abstracting from risk consideration. System D has the lowest cost (outflow) of production for the 10-year period. The wheat grower would save in discounted dollars $34,938 over the 10-year period by using system D instead of conventional tillage, and $21,708 over the ecofallow system.

The decisions of this analysis will be modified by changes in the investments of machinery used in each system, changes in the prices of chemicals and machinery, changes in fuel costs, repairs and interest rates, and if yield differential for the systems becomes apparent. It is highly probable that a different complement of machinery, chemicals, and income tax bracket could change the result to ecofallow or conventional tillage. Each individual's situation needs its separate or independent analysis.

Table 7 gives the direction of the effect of six selected cost items on the present value approach when chemical and conventional systems are compared to the selected base on an ecofallow system. A plus (+) indicates that system receives a favorable economic benefit for that cost factor when compared to ecofallow. A minus (-) indicates that the system incurs an economic cost when the cost factor is applied into the analysis. These cost factors are (1) an increase in price of tractors and tillage implements, (2) increases in the cost of fuel and oil, (3) increases in interest rates for operating capital and long time investments, (4) income tax changes that reduce the tax liability either on ordinary income or capital gains, (5) an increase in repair costs, and (6) changes in chemical costs, either higher or lower. With increases in energy cost, one can expect chemical prices to increase. However, as the quantity of production of a specific chemical increases there may be lower prices due to the volume manufactured.

Table 6. Present value cash outflow and cash inflow for chemical fallow, ecofallow, and conventional tillage, 600 acres (242.8 ha) of growing wheat, 10-year period, and interest at 9 percent.

		Chemical Fallow				Ecofallow		Conventional	
		System C		System D		System F		(Comb. Systems A & B)	
	Year	Current V.	PV	Current V.	PV	Current V.	PV	Current V.	PV.
Cash Outflow									
1. Initial Investment	0	40,300	-40,300	40,300	-40,300	57,600	-57,600	74,000	-74,000
2. Tax on sale of mach.	10	2,519	- 1,064	2,519	- 1,064	2,600	- 1,521	4,625	- 1,954
3. Annual operating cost	1-10								
a) Repairs		- 2,418		- 2,418		- 3,456		- 4,440	
b) Custom appl.		- 1,500		- 1,500		- 1,500			
c) Chemicals[1]		- 6,630		- 4,680		- 1,500			
d) Fuel, oil, filters[2]		0		0		- 1,678		- 2,496	
e) Labor[3]		0		0		- 968		- 1,440	
f) Insurance & shelter @ 1.5% of mach. inv.		- 605		- 605		- 864		- 1,110	
g) Interest on oper. capital 18 mos. @ 9%		- 1,506		- 1,242		- 1,215		- 1,086	
h) Interest on mach.		- 1,814		- 1,814		- 2,592		- 3,330	
Total items a to h		-14,473	-92,884	-12,259	-78,675	-13,773	-88,392	-13,902	-89,220
Cash Inflow									
4. Tax savings Invest. credit	0	4,030	+ 4,030	4,030	+ 4,030	5,760	+ 5,760	7,400	+ 7,400
5. Value of mach.	10	10,075	+ 4,256	10,075	+ 4,256	14,400	+6,083	18,500	+ 7,815
6. Tax savings Depr. 10%/year	1-10	1,008	+ 6,469	1,008	+ 6,469	1,440	+ 9,242	1,850	+11,873
7. Tax savings Operation expense	1-10	3,481	+22,340	2,816	+18,072	2,728	+17,508	2,483	+15,935
Total cash outflow			-134,248		-120,039		-147,513		-165,174
Total cash inflow			+37,095		+32,827		+38,593		+43,023
Net present value			-97,153		-87,212		-108,920		-122,151

Source: Calculations

[1]Chemical costs were $11.05, $7.80, and $2.50 per acre ($27.30, $19.27, and $6.80 per hectare) for system C, system D, and system F, respectively.

[2]Diesel fuel was calculated at $.80 per gallon ($.21 per liter).

[3]Labor does not include drilling wheat. Labor represents tillage operation(s). The labor in minutes per acre is zero for chemical fallow, 24.2 minutes for ecofallow and 36 minutes for conventional tillage. (Zero minutes per hectare, 59.8 minutes per hectare, and 89 minutes per hectare.)

Table 7. The positive (+) or negative (-) effect of selected cost factors on the present value approach when chemical and conventional fallow systems are compared to the base system -ecofallow.

		Chemical	Ecofallow	Conventional
Item 1.	Increase in machinery prices			
	a) Initial investment	+	0	-
	b) Associated investment credit with increased prices	-	0	+
	c) Depreciation savings on associated increase in prices	-	0	+
	d) Value of machinery at end of 10-year period	-	0	+
Item 2.	Increase in fuel and oil prices assuming no change in chemical prices	+	0	-
Item 3.	Increase in interest rates			
	a) Operating on short term for cash cost	-	0	+
	b) Long term investment capital for machinery	+	0	-
Item 4.	Income tax changes to reduce tax liability			
	a) Ordinary income	-	0	+
	b) Capital gains	-	0	+
Item 5.	Repairs			
	a) Increase in repair costs	+	0	-
Item 6.	Changes in chemical cost			
	a) Higher	-	0	+
	b) Lower	+	0	-

SUMMARY

From the short term and long term analysis presented, the economics support chemical usage. The amount of chemical applied and tillage performed will, in part, be determined by the consistent performance of chemicals used as a substitute to tillage. Taking the risks of chemical performance, chemical availability, and the value of tillage equipment inventory as insurance to control weeds, the ecofallow system will probably be the system wheat producers adopt first, even though the economic analysis shows chemical fallow as the least cost system. There would be a judgment decision as to how much advantage there is to choosing the optimum fallow system D as compared to the next best alternative system such as system F.

Depending on the system a wheat producer selects, savings of $8.90 to $14.70 per acre ($21.99 to $36.32/ha) could be realized from system D (chemical fallow) or system F (ecofallow) over black and stubble mulch systems A and B, using custom rates. The wheat producer will need to understand and be able to calculate costs for machinery presently owned and operated for mechanical tillage. His tillage figures will allow comparisons of conventional costs to alternative systems available for tillage.

For a period of 10 years, the present value analysis will give guidance to his choice of system. The analysis presented has several assumptions but indicates chemical fallow has the economic advantage if yields are equal for the conventional, chemical and ecofallow systems.