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Introduction

Comparisons of costs and returns for different cropping and tillage systems are difficult to estimate. There are many different variables of production to consider with the amount and timing of rainfall at a particular farm being the most critical. Soil health is also different for each of these alternative tillage and cropping systems, which plays a role in differing results of production.

Six different farmers in northeastern Montana were interviewed to determine their production methods and costs. Based on these interviews a generic typical farm was developed. This generic farm was used to estimate the different costs and returns for various cropping and tillage systems.

The six farmers interviewed had various production practices in their agricultural crop rotations. Conventional till, minimum till and zero till farming were utilized to raise cereal grains, pulse crops and annual legumes. Average annual precipitation ranged from 11" - 14". Spring wheat, lentils, sunflowers, peas, flax, and mustard were grown.

Seeding rates in lbs/acre ranged from 60 - 90 for spring wheat, 66 - 80 for lentils, 1.3 - 3 for sunflowers, 180 - 212 for peas, 12 for yellow mustard, and 35 - 56 for flax.

Roundup was used for weed control in the spring before planting on many of the no/zero till acres. Other herbicides used for weed control were Discover, Bromac, 2,4-D LV 6, Clarity, Spartan, Bronate, Assure, Sonalan, and Weedmaster.

The three operators who had conventional till summer/black fallow had limited their cultivations to four per year or less. One operator used a fallow system with one spray operation followed by two or three tillage operations.

Some fertilizer was applied and incorporated in the fall, incorporated or broadcast in the spring prior to planting and/or applied at seeding with the drill. The most common granular formulations were 46-0-0 urea and 11-52-0 super phosphate. Many operators also used a fertilizer blend.

A Soil Tillage Intensity Rating (STIR) was used to evaluate the effect of tillage on soil health in each of the different systems. A STIR with a low value has the least adverse effect on soil health. Over time, a system with a low STIR value will have the least effect on soil structure and overall soil health. Generally a low STIR will improve organic matter, fertility, productivity, water holding capacity and soil structure. For example, a no-till continuous cropping system can have a STIR rating as low as 3. A minimum till cropping system composed of two crops and one minimum till fallow will have a STIR rating ranging from 70-80. A conventional tillage crop-fallow system can have a STIR rating of 100 or higher.

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Uses of the Report

The costs and returns shown in this report are averages and should only be used as a guide in decision making. Costs and returns vary from farm to farm because of geographical location, soil types, type and condition of machinery, weed and insect problems, management skills, and other factors. Actual farm records, if available, provide the best source of information for making decisions.

Ownership costs are based on specified amounts of annual use for each machine. Ownership costs tend to be inversely related to amount of use. Consequently, the ownership costs are applicable only to situations where the amount of annual use is the same as that assumed in this report.

Operating costs tend to be constant with respect to use. It costs a certain amount for repairs, fuel, etc., per hour or per acre regardless of the total amount of use. Since per unit operating costs do not vary with size of farm, they can be applied to any farm using similar equipment under similar conditions.

This cost-return report may be helpful:

1. In selecting enterprises and crop rotations which will yield the highest return to the farmer's resources.

2. In determining rental shares each party is making to a farm business. Each party's contributions may consist of a combination of production costs, capital investment, and labor.

3. In making up cash flow budgets.

4. In estimating income necessary to cover costs when one is considering future investments.

A Cautionary Note

The costs of production shown in this report do not include all costs of production. Costs for labor, management, and land are not included. The returns shown in this report are used to cover the costs of these three inputs of production.

Assumptions and Procedures for a Generic Farm

1. Total farm crop acreage amounts to 3,000 acres. This is the average of the producers interviewed with some having crop acres above and below the average.

2. Three different cropping and tillage systems were evaluated.

    a. No Till−Spring Wheat (1,200 acres) with alternative crops such as Sunflowers (450 acres), Lentils (600 acres), Peas (300 acres), and Flax (450 acres)

b. No Till–Spring Wheat (900 acres), re-crop Spring Wheat (1,100 acres) with alternative crops Peas (100 acres), and Flax (200 acres), and 700 acres of Chemical Fallow

c. Conventional Till–Spring Wheat and Fallow (1,500 acres of each)

3. Other cropping systems and crops were used by producers interviewed, but are not listed in this report.

4. Average yields for each crop:

Spring Wheat	32 bushels
Spring Wheat after Fallow	38 bushels
Sunflowers	1,700 pounds
Lentils	30 bushels
Peas	32 bushels
Flax	21 bushels

5. Seeding rates for each crop:

Spring Wheat	70 pounds
Spring Wheat after Fallow	70 pounds
Sunflowers	2.2 pounds
Lentils	80 pounds
Peas	180 pounds
Flax	48 pounds

6. Fertilizer rates for each crop:

Spring Wheat	150 pounds of 46-0-0 50 pounds 11-52-0
Spring Wheat after Fallow	50 pounds 11-52-0
Sunflowers	100 pounds of 50-30-10-5
Lentils	25 pounds 11-52-0
Peas	35 pounds 11-52-0
Flax	100 pounds 17-20-0-15 50 pounds 46-0-0

7. Fuel costs were $2.50 per gallon for diesel and $2.30 per gallon for gasoline.

8. Repairs were based on the following formula:

   Repairs = (Repair Factor x List Price of Machine x Hours of use per year) divided by the estimated life of the machine.

9. Oil costs are estimated at 15 percent of the cost of fuel.

10. Depreciation costs are based on the following formula:

    Depreciation = (List Price of Machine x Hours of use per year) divided by the estimated life of the machine.

11. Interest on machinery = Average value of the machine times the interest rate.

12. Interest on operation capital was figured at seven percent for 12 months.

13. Crop insurance rates for each crop:

Spring Wheat	$4.25
Spring Wheat after Fallow	$4.25
Sunflowers	$4.25
Lentils	$4.25
Peas	$4.25
Flax	None

14. Weed control for each crop:

Spring Wheat	16 oz. Roundup 3.2 oz. Discover 12 oz. Bromax
Spring Wheat after Fallow	16 oz. Roundup 3.2 oz. Discover 12 oz. Bromax
Sunflowers	16 oz. Roundup 2 pt. Sonalan 2 oz. Spartan
Lentils	16 oz. Roundup 8 oz. Assure 2 oz. Spartan
Peas	16 oz. Roundup 8 oz. Assure 2 oz. Spartan
Flax	16 oz. Roundup 11 oz. Bronate 8 oz. Assure

Results

Tables 1 to 3 summarizes the difference in total farm income between the two tillage methods and three cropping systems. The no till continuous cropping system with four alternative crops (Table 1) had total net farm income of $189,104. The second no till cropping system (Table 2) that included chemical fallow, had total net farm income of $66,385 (Spring Wheat re-crop, Spring Wheat/Peas/Flax/Chemical-Fallow rotation). The no till continuous cropping system had more than twice as much total farm income as compared to the cropping system that included chemical fallow. This difference in total farm income occurred because income generated from lentils and sunflowers was offset by income from more acres of spring wheat and the cost of chemical fallow.

The spring wheat-fallow rotation (Table 3) had total net farm income of $46,950. This income was four times less than the no till continuous cropping system. This difference was due to the large number of fallow acres and the lack of income from alternative crops such as lentils, sunflowers, or flax.

The cost of chemical fallow versus tilled fallow was similar. Three producers had both chemical fallow and till fallow acres. One producer had a minimum till fallow system which included one spray operation followed by two or three tillage operations.

This report shows the value of alternative crops in a crop rotation. Availability of markets for the alternative crops as well as distances to transport the crop can be problematic. The amount of the Loan Deficiency Payment (LDP) also impacts the total income received for the crop. The variation in seeding rates and different chemicals required for the alternative crops requires a higher level of management. The seeding and spraying equipment must also be capable of easily changing the application rate and applying the rate accurately.

Table 1. Income from No Till Continuous Cropping System in Northeastern Montana

	Spring Wheat	Alternative Crops			
		Lentils	Peas	Sunflowers	Flax
Yield	32	30	32	1700	21
Price	$3.00	$7.25	$3.30	$0.12	$6.35
Total Income	$96.00	$217.50	$105.60	$204.00	$133.35
Operating Costs	$67.93	$70.15	$64.30	$79.38	$51.46
Ownership Costs	$12.08	$15.73	$13.42	$11.80	$11.20
Returns over Operating Costs	$28.07	$147.35	$41.30	$124.62	$81.89
Returns over Total Costs	$15.99	$131.62	$27.88	$112.82	$70.69
Acres each Crop	1,200	600	300	450	450
Total Income from Crop	$19,188	$78,972	$8,364	$50,769	$31,811
Total Income from Farm					$189,104

Table 2. Income from No Till Cropping System in Northeastern Montana

	Spring Wheat	Recrop Spring Wheat	Peas	Flax	Chemical Fallow
Yield	38	32	32	21	
Price	$3.00	$3.00	$3.30	$6.35	
Total Income	$114.00	$96.00	$105.60	$133.35	
Operating Costs	$52.48	$67.80	$67.41	$51.46	$10.08
Ownership Costs	$13.66	$13.63	$19.67	$12.73	$1.92
Returns over Operating Costs	$61.52	$28.20	$38.19	$81.89	$(10.08)
Returns over Total Costs	$47.86	$14.57	$18.52	$69.16	$(12.00)
Acres each Crop	900	1100	100	200	700
Total Income from Crop	$43,074	$16,027	$1,852	$13,832	$(8,400)
Total Income from Farm					$66,385

Table 3. Income from Crop Fallow Cropping System in Northeastern Montana

	Spring Wheat	Tillage Fallow
Yield	38	
Price	$3.00	
Total Income	$114.00	
Operating Costs	$51.91	$9.39
Ownership Costs	$16.29	$5.11
Returns over Operating Costs	$62.09	$(9.39)
Returns over Total Costs	$45.80	$(14.50)
Acres each Crop	1500	1500
Total Income from Crop	$68,700	$(21,750)
Total Income from Farm		$46,950