AN ANALYSIS OF BREAKEVEN PRICES AND YIELDS BETWEEN DRYLAND AND IRRIGATED CROPPING IN SASKATCHEWAN

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INTRODUCTION

The decision to convert all or part of a dryland Saskatchewan farm to irrigation is not easy. Irrigation undoubtedly reduces the severe effects of low yields during periods of drought. However, the important question for the farm manager is, "Does the on-farm cost of irrigation development outweigh the benefits?"

The primary objective of this paper is to compare the on-farm economics of irrigated versus dryland wheat farming in Saskatchewan. This objective will be accomplished by taking the results of a series of farmer workshops conducted from 1987 to 1989 and calculating breakeven prices and yields for hard spring wheat under irrigation and dryland farming conditions.

This paper is organized into four sections. The first section outlines reasons farmers give for adopting and not adopting irrigation. The method of data collection along with assumptions underlying the cost calculations are described in the second section. A summary of various cost and returns data with the breakeven price and yield analysis follows in the third section. Conclusions and implications of these results ensue in the fourth and concluding section of this paper.

Why Irrigate?

In 1987, 61 farms practising irrigation and 76 farms practising only dryland agriculture in the South Saskatchewan River Irrigation District #1 (SSRID#1) responded to a survey investigating why farmers adopt irrigation on their farms (Manning et al.). The average rating of factors influencing the adoption of irrigation, impeding the adoption of irrigation and constraining further irrigator expansion are outlined in Table 1. The most important factors influencing adoption were increased yields with irrigation, increased profitability, protection against drought and the availability of water. The most important factors impeding irrigation adoption were the high cost of irrigation equipment, poor crop prices, salinity concerns, capital availability, market availability and risk. The most important factors constraining further irrigation expansion were low crop prices, lack of profitability with irrigation, salinity concerns, capital availability, poor access to markets and C.W.B. delivery quotas. Most, if not all the important factors have a direct impact on the economics of irrigation versus dryland farming. It is also important to keep in mind that when farmers adopt irrigation they are basically switching from a two year hard spring wheat-fallow dryland rotation to continuous hard spring wheat irrigation rotation. The above statement can be substantiated by examining both dryland and irrigated crop mix patterns for the SSRID#1. Kulshreshtha et. al. report that on average 40 to 45% of the dryland is summerfallowed yearly and 35 to 45% is seeded to hard spring wheat (p. 435). They also report that 30 to 40% of the

Table 1: Rating of Factors Influencing Adoption of Irrigation, Impeding the Adoption of Irrigation and Constraining Further Expansion of Irrigation

Scale 1-Not Important, 4-Very Important

Factors Influencing Adoption	Average Score	Factors Impeding Adoption	Average Score	Factors Constraining Expansion	Average Score
Increased Yields	3.75	Equipment Cost	3.61	Low Crop Prices	3.82
Profitability	3.55	Low Crop Prices	3.48	Profitability	3.80
Drought	3.53	Salinity Concerns	3.46	Salinity Concerns	3.33
Water Availability	3.25	Capital Availability	3.34	Capital Availability	3.23
Stabilize Fodder	2.31	Market Availability	3.28	Markets	3.10
Capital Availability	3.03	Risk	3.23	CWB Delivery Quotas	3.08
Interest Subsidy	2.96	Increased Time	3.20	Different Varieties	2.52
Intensify Operation	2.91	Land Suitability	3.10	Water Availability	2.47
Equipment Price	2.91	Water Costs	3.06	Land Suitability	2.47
Grant $100/acretion	2.89	Conflicts with Goals	3.03	Crop Insurance	2.25
Water Subsidization	2.80	Personal Experience	2.70		
Improved Technology	2.66	Information Available	2.30		
Erosion	2.46				
Land Constraints	2.35				
Technical Assistance	2.38				
Stabilize Fodder	2.31				
Family Members	2.09				
Influence/Neighbors	1.67				
Influence/Relatives	1.50				

irrigated land is seeded to hard spring wheat with another 35 to 45% in other traditional crops such as barley, flax and soft wheat (p. 435). Alfalfa at between 20 and 35% of land use is the other major irrigated crop.

METHOD OF DATA COLLECTION

In 1987 and 1988, 19 farms participated in the data collection. Twenty-five farmers participated in 1989. Twelve of the 19 farms that participated in 1987 did so again in 1988. Some of the farmers that participated in 1987, but not in 1988, thought the circumstances on their farm had not changed significantly during the year and the information generated that year was still good for 1988. Eleven of the 19 farms that participated in 1988 participated again in 1989. Eight farms participated for the entire three years.

A profile of the workshop participants' average age, level of education, farm size, percentage of total land irrigated and financial information is presented in Table 2.

Table 2: Profile of Workshop Participants, 1987-1989

	Age	Education	Farm Size	Percentage of Land Irrigated	Assets	Debts	Equity	D/A
	Years	Years of Schooling	Acres	$	$	$	$	
1989	35.6	13.4	1,831	21.3	851,974	245,336	606,638	0.29
1988	34.8	13.2	1,839	23.0	791,468	291,396	500,072	0.37
1987	36.6	12.5	1,800	28.8	609,739	232,261	377,478	0.38

The average farm operator in 1989 was approximately 36 years old, had a high school diploma and over one year of post-secondary education, and farmed 1,831 acres of land. This makes the participants included in this report younger, better educated, and farming more land than the average farmer in Saskatchewan.[1]

Financially the 1989 participants had more assets and equity than previous years, with debt less than 1988 but greater than 1987 participants. The main reason for the variations is the different sample groups. This resulted in the debt-asset ratio decreasing from 0.37 in 1988 and 0.38 in 1987, to 0.29 in 1989. The average provincial debt-asset ratio for 1987 was 0.22 (Saskatchewan Agriculture, 1988) which is lower than all three years participants' average debt-asset ratio. The higher ratio for irrigation farmers, in part, is due to the investment required to adopt irrigation.

VARIABLE COSTS

Variable costs are costs that change with the level of output. The variable costs in this paper are divided into the following subcategories:

1) Direct operating costs, which include
   a) Materials - seed, fertilizer, chemicals, crop and hail insurance, and hired custom work.
   b) Power - fuel, oil, grease filters and electricity for motors.
   c) Repair - machinery, equipment, and building repair costs.
   d) Other - machine lease, water tax, hired labour, etc.

2) Operating capital costs are estimated using the total direct costs multiplied by a 12 percent annual interest rate for a six month

[1]In 1986, the average age of a Saskatchewan farmer was 47.3 years (based on personal communication with Bernard Houle of Statistics Canada, Ottawa, August 1988). According to Saskatchewan Agriculture (June 1988), an average farm in 1986 had 1,036 acres of which 781 were cultivated.

period. The operating capital charge for an enterprise with a total direct cost of $100 would be $100 x 0.12 x 0.5 for $6.00.

3) Unpaid Operator Labour Costs was standardized for all participants at a wage of $10.30 per hour.[2]

The variable costs of producing a bushel of hard wheat in 1987 was $2.22, in 1988 $2.32 and in 1989 $2.30 under all types of irrigation.[3] This corresponds with the level of yield which was estimated at 56.1 in 1987, 51.2 in 1988 and 53.9 bushels per acre in 1989. The variable costs of producing a bushel of hard wheat following a wheat-fallow dryland rotation were $1.90 in 1987, $1.74 in 1988 and $1.74 in 1989. This corresponds to yields of 23.8, 26.9 and 28.2 bushels per acres in 1983, 1988 and 1989 respectively.

FIXED COSTS

Fixed costs of production are costs that do not change with the level of output and include the following subcategories:

1. Equipment and building capital recovery charges,
2. Land charges,
3. Management charges and
4. Indirect overhead charges.

Equipment and building capital recovery charges (CRC) are depreciation and interest charges incurred each year. The one-year CRC for a given machine is defined as follows:

$$CRC = (V_0 - V_1) + (i \times V_0) \qquad (1)$$

where: V_0 = beginning asset value,
V_1 = ending asset value,
i = opportunity cost of capital (standardized at 12 percent).

Equation 1 states that the CRC is the actual loss in value of the asset over the year plus interest foregone (the opportunity cost of the capital invested).

Land capital use charges are associated with owning, renting or leasing land. Rented land costs are the actual amount of rent paid either as a cash payment or as a crop share converted to a cash lease. Owned land cost includes a five percent opportunity cost on the current land value plus annual

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[2]This is used to place a value on the operator's labour in calculating an opportunity cost. It is the wage farm operators could expect if they were not working on the farm. Opportunity costs do not come out of cash expenses.

[3]All types of irrigation incorporates all of the irrigation systems reported by the participants for use in a particular enterprise.

property taxes.[4]

Management charges,[5] for an entire farm, were standardized at $15,000 in 1987 and 1988, and at six percent of total gross returns in 1989. Six percent of total gross returns was used as a management fee in 1989 as it more accurately reflects a comparable rate to what a professional farm management firm would charge as a fee. This amount was allocated to the various enterprises based on the direct operating costs for each enterprise.

Indirect overhead consists of fixed costs which cannot be assigned to a particular enterprise. They include general overhead items such as accounting and legal fees, power and repair charges, and building and machine charges for items such as pickup truck, among others. These costs were allocated to each enterprise based on the proportion of total direct cost for each enterprise to that of the total farm.

The total costs of producing a bushel of hard wheat under irrigation was $5.10 in 1987, $5.54 in 1988 and $6.59 in 1989. The total cost of producing a bushel of hard wheat following a two year wheat-fallow dryland rotation was $4.92 in 1987, $5.00 in 1988 and $5.01 in 1989. The major reason for the large increase in breakeven price in 1989 for irrigated hard wheat is the increase in the capital recovery charge for equipment. The high charge is influenced by the sample farms in 1989 and probably included farms with higher machinery and equipment investment per acre.

Only the cost of production for fallow, hard wheat on fallow, hard wheat and alfalfa on all types of irrigation are reported here. (Table 3) For a fuller discussion of the workshop results see Roy et al.

BREAKEVEN YIELDS AND PRICES FOR DRYLAND VS IRRIGATED HARD WHEAT

One of the most powerful, yet simple tools for calculating relative profitability and dealing with risk is the breakeven concept. The breakeven concept establishes the point at which two alternatives are equally profitable. In terms of risk analysis, it is then up to the decision maker to evaluate the chances of being above or below the breakeven yield and price required from continuous hard wheat under irrigation to make as much money as a two year summerfallow and hard wheat on fallow dryland rotation. To begin:

$$\Pi_D = \Pi_I \qquad (1)$$

where: Π_D = profits from two year wheat fallow dryland rotation, and
Π_I = profit from continuous wheat under irrigation rotation.

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[4]The opportunity cost of capital for land is what that land would rent for on a cash rent basis.

[5]The value a farm operator places on their management skills, i.e., the opportunity cost of one's management skills. The value is not a cash cost.

Table 3: Estimated Returns and Costs for Dryland Crops, 1987 - 1989.

Crop and Rotation	Average Value ($/Acre) 1987	1988	1989
1. Hard Wheat on Fallow			
Number of Farms Reporting	15	18	16
a) Total Return			
Yield (bushels)	23.80	26.90	28.20
Price[2]	3.11	2.74	4.03
Other Returns[3]	----[4]	11.24	5.42
Gross Returns	74.02	84.95	119.07
b) Variable Costs			
Direct:			
Seed	4.42	4.57	5.97
Fertilizer - N	1.16	0.27	0.11
- P_2O_5	3.56	4.37	5.61
- Other e.g. Blend	----	0.91	0.00
Chemicals - Broadleaf	3.89	2.91	2.32
- Grassy	0.90	3.10	2.00
- Broadleaf and Grassy	----	0.26	1.87
Crop and Hail Insurance	3.32	3.56	3.63
Machinery and Equipment - Fuel	6.23	5.71	5.06
- Repair	4.39	4.11	4.33
Custom Work Hired	1.40	0.42	0.00
Other e.g. Machine Lease	0.00	0.12	0.00
Total Direct Costs	29.27	30.31	30.97
Returns Above Direct Costs	44.75	54.64	88.10
Operating Capital Charges	1.46	1.81	1.81
Operator Labor	6.74	6.68	7.75
Total Variable Costs	37.47	38.80	40.53
Returns Above Total Variable Costs	36.55	46.15	78.54
c) Fixed Costs			
Equipment and Buildings CRC	15.89	25.18	25.37
Land	22.26	23.89	24.56
Management	7.70	7.44	6.66
Indirect Overhead	6.92	8.90	12.38
Total Fixed Costs	52.77	65.41	68.97
Returns Above Total Variable and Fixed Costs	-16.22	-19.26	9.57

See dryland crop notes on page 23.

Continued ....

Table 3: Continued.

Crop and Rotation	Average Value ($/Acre) 1987	1988	1989
9. Fallow			
Number of Farms Reporting	15	17	21
a) Total Return			
Other Returns	----	1.88	0.00
Gross Returns	----	1.88	0.00
b) Variable Costs			
Direct			
Chemicals - Broadleaf	0.09	0.25	0.61
- Grassy	0.07	0.00	0.00
- Broadleaf and Grassy	----	0.07	0.14
Machinery and Equipment - Fuel	2.94	2.94	2.65
- Repair	1.78	1.74	1.61
Custom Work Hired	0.00	0.00	0.01
Other e.g. Machine Lease	0.00	0.00	0.00
Total Direct Costs	4.88	5.00	5.02
Returns Above Direct Costs	-4.88	-3.12	-5.02
Operating Capital Charges	0.25	0.30	0.30
Operator Labor	2.68	2.80	3.30
Total Variable Costs	7.81	8.10	8.62
Returns Above Total Variable Costs	-7.81	-6.22	-8.62
c) Fixed Costs			
Equipment and Buildings CRC	4.94	5.78	6.00
Land	11.31	13.31	13.55
Management	1.47	1.58	1.17
Indirect Overhead	1.35	1.48	2.30
Total Fixed Costs	19.07	22.15	23.02
Returns Above Total Variable and Fixed Costs	-26.88	-28.37	-31.64

Continued ....

Table 3: Continued

Crop and Type of Irrigation	Average Value ($/Acre) 1987	1988	1989
1. Hard Wheat - All Types of Irrigation			
Number of Farms Reporting	10	9	4
a) Total Return			
Yield (bushels)	56.10	51.20	53.90
Price	3.03	2.68	4.44
Other Returns	----	17.28	11.72
Gross Returns	169.98	154.50	251.04
b) Variable Costs			
Direct			
Seed	7.18	6.34	6.83
Fertilizer - N	19.22	16.99	14.82
- P_2O_5	13.45	9.97	11.16
- Other e.g. Blend	----	5.89	0.00
Chemicals - Broadleaf	11.08	2.60	2.92
- Grassy	4.21	8.22	0.00
- Broadleaf and Grassy	----	3.51	5.70
Crop and Hail Insurance	6.03	4.15	7.28
Irrigation Machinery and Equipment - Fuel	10.74	10.88	22.80[2]
- Repair	4.69	3.54	7.06
Other Machinery and Equipment - Fuel	11.21	8.31	6.88
- Repair	4.85	6.29	6.46
Custom Work Hired	0.00	0.78	0.00
Water Tax	----	7.70	5.55
Other e.g. Machine Lease	8.97	0.55	1.09
Total Direct Costs	101.63	95.72	98.55
Returns Above Direct Costs	68.35	58.78	152.48
Operating Capital Charges	5.39	5.77	5.82
Operator Labor	17.79	17.16	19.42
Total Variable Costs	124.81	118.65	123.80
Returns Above Total Variable Costs	45.17	35.85	127.24
c) Fixed Costs			
Equipment and Buildings CRC	73.68	78.14	100.58
Land	29.47	27.37	42.32
Management	30.65	26.93	28.75
Indirect Overhead	27.20	32.63	59.82
Total Fixed Costs	161.00	165.07	231.47
Returns Above Total Variable and Fixed Costs	-115.83	-129.22	-104.23

See irrigated crop notes on page 32.

Continued ....

Table 3: Continued

Crop and Type of Irrigation	Average Value ($/Acre) 1987	1988	1989
8. Alfalfa Hay - All Types of Irrigation			
Number of Farms Reporting	7	14	17
a) Total Return			
Yield (ton)	3.83	4.10	4.00
Price	72.84	71.19	78.16
Gross Returns	278.98	291.88	312.64
b) Variable Costs			
Direct			
Seed	5.03	----	----
Fertilizer - N	1.74	0.00	1.44
- P_2O_5	9.39	13.93	11.74
- Other e.g. Blend	----	3.00	2.20
Chemicals - Broadleaf	0.00	0.00	0.00
- Grassy	0.00	0.64	0.51
- Broadleaf and Grassy	----	0.00	0.07
Crop and Hail Insurance	0.00	1.96	0.86
Irrigation Machinery and Equipment - Fuel	15.19	24.45	18.54
- Repair	4.03	5.82	7.16
Other Machinery and Equipment - Fuel	6.17	10.51	13.13
- Repair	5.19	5.29	8.91
Custom Work Hired	11.22	12.54	0.23
Water Tax	----	1.31	3.71
Other e.g. Machine Lease	5.90	0.28	1.69
Total Direct Costs	63.86	79.73	70.19
Returns Above Direct Costs	**215.12**	**212.15**	**242.45**
Operating Capital Charges	**3.05**	**4.82**	**4.44**
Operator Labor	**17.45**	**25.06**	**29.41**
Total Variable Costs	**84.36**	**109.61**	**104.04**
Returns Above Total Variable Costs	**194.62**	**182.27**	**208.60**
c) Fixed Costs			
Equipment and Buildings CRC	**56.24**	**68.46**	**79.98**
Land	**20.86**	**26.03**	**25.72**
Management	**17.95**	**16.46**	**20.09**
Indirect Overhead	**17.89**	**18.03**	**30.47**
Total Fixed Costs	**112.94**	**128.98**	**156.26**
Returns Above Total Variable and Fixed Costs	81.68	53.29	52.34

Profits for the two year dryland wheat-fallow rotation can be defined as:

$$\Pi_D = 1/2\ (P_W * Y_D - TVC_F - TFC_F) - 1/2\ (TVC_{5F} + TFC_{5F}) \quad (2)$$

where: Subscripts F and SF stands for crop on fallow and summerfallow.

P_W = price of hard wheat ($/bu.)
Y_D = yield of hard wheat (bu./acre) on dryland
TVC = total variable costs ($/acre)
TFC = total fixed costs ($/acre)

Profits for continuous irrigated hard wheat can similarly be defined as:

$$\Pi_I = (P_W * Y_I - TVC_I - TFC_I) \quad (3)$$

where: Subscript I stands for irrigation.

All other variables have been defined previously.

To determine the breakeven yield and price, the two profit equations are set equal to each other and solved for the appropriate variable. In the case of hard wheat, the breakeven yield under irrigation is calculated using equation 4.

$$Y_I = \frac{\Pi_D + (TVC_I + TFC_I)}{P_W} \quad (4)$$

where: all variables have been defined previously.

Similarly, the breakeven wheat price can be calculated using equation (5).

$$P_W = \frac{2(TVC_I + TFC_I) - (TVC_F + TFC_F) - (TVC_{5F} + TFC_{5F})}{2Y_I - Y_D} \quad (5)$$

where: all variables have been defined previously.

A number of breakeven yields and prices for hard wheat under irrigation for the years 1987, 1988 and 1989 are presented in Tables 4 and 5. The average wheat on fallow yields provided by the participant ranged from 23.8 and 28.2 bu./acre. This level of wheat on fallow yield combined with a wheat price of $4/bu. requires an irrigated yield of approximately 65 bu./acre in 1987 and 1988 and 84 bu./acre in 1989. The participants averaged 56.1, 51.2 and 53.9 bu/acre in 1987, 88 and 89 respectively. This level of irrigation yield requires wheat prices in the $5 to $6/bu. range for 1987 and 1988 and $6 to $7.50/bu. range for 1989 given a wheat on fallow yield of approximately 25 bu./acre (Table 4 and 5).

Alfalfa dryland was the only irrigated crop grown by a sufficient number of participants for publication purposes to cover both variable and fixed

Table 4: Breakeven Yields of Hard Wheat Under Irrigation (bu./acre)

Fallow Yield bu./ac.	1987 Wheat Price ($/bu.)				1988 Wheat Price ($/bu.)				1988 Wheat Price ($/bu.)			
	$3.00	$4.00	$5.00	$6.00	$3.00	$4.00	$5.00	$6.00	$3.00	$4.00	$5.00	$6.00
20.0	85.8	66.8	55.5	47.9	82.2	64.1	53.3	46.1	104.9	81.2	66.9	57.5
25.0	88.3	69.3	58.0	50.4	84.7	66.6	55.8	48.6	107.4	83.7	69.4	60.0
30.0	90.8	71.8	60.5	52.9	87.2	69.1	58.3	51.1	109.9	86.2	71.9	62.5
35.0	93.3	74.3	63.0	55.4	89.7	71.6	60.8	53.6	112.4	88.7	74.4	65.0

Table 5: Breakeven Price of Hard Wheat Between Various Irrigated & Dryland Yields ($/bu.)

Fallow Yield bu./ac.	1987 Irrigation Yield (bu./ac.)				1988 Irrigation Yield (bu./ac.)				1989 Irrigation Yield (bu./ac.)			
	40.00	50.00	60.00	70.00	40.00	50.00	60.00	70.00	40.00	50.00	60.00	70.00
20.0	7.58	5.68	4.55	3.79	7.22	5.41	4.33	3.61	9.49	7.12	5.69	4.75
25.0	8.26	6.06	4.78	3.95	7.87	5.77	4.56	3.77	10.35	7.59	5.99	4.95
30.0	9.09	6.49	5.05	4.13	8.66	6.19	4.81	3.94	11.39	8.13	6.33	5.18
35.0	10.10	6.99	5.35	4.33	9.62	6.66	5.09	4.12	12.65	8.76	6.70	5.42

costs in all three years of the study. Equation 6 calculates the breakeven irrigated alfalfa yield needed to make as much profit as a two year dryland hard wheat-fallow rotation.

$$Y_{IA} = \frac{\Pi_D + (TVC_{IA} + TFC_{IA})}{P_{IA}} \qquad (6)$$

where: Subscript IA stands for irrigated alfalfa.

All other variables have been defined previously.

Similarly the breakeven alfalfa price can be calculated by using equation (7).

$$P_{IA} = \frac{\Pi + (TVC_{IA} + TFC_{IA})}{Y_{IA}} \qquad (7)$$

where: all variables have been defined previously.

A number of breakeven yields and prices for irrigated alfalfa for the years 1987, 1988 and 1989 are presented in Table 6 and 7. The wheat on fallow yield combined with a wheat price and alfalfa price as outlined in Table 6 require breakeven irrigated alfalfa yield of between 2.5 to 3 tonnes/acre given the yields averaged by the participants breakeven prices for alfalfa ranged between $50 - $70/tonne. It should be noted the participants averaged 3.83, 4.1 and 4 tonnes/acre and prices of $72.84, $71.19 and $78.16/tonne in 1987, 1988 and 1989 respectively.

Table 6: Breakeven Yields of Irrigated Alfalfa (tonnes/acre)

Assuming Alfalfa Price of: 1987 - $72.84/tonne, 1988 - $71.14/tonne and 1989 -$78.16/tonne.

2yr, rot. Fallow Yield	1987 Wheat Price ($/bu.)				1988 Wheat Price ($/bu.)				1989 Wheat Price ($/bu.)		
	$3.00	$4.00	$5.00	$6.00	$3.00	$4.00	$5.00	$6.00	$3.00	$4.00	$5.00
20.0	2.32	2.45	2.59	2.73	2.83	2.97	3.11	3.25	2.81	2.94	3.07
25.0	2.42	2.59	2.76	2.93	2.93	3.11	3.29	3.46	2.91	3.07	3.23
30.0	2.52	2.73	2.93	3.14	3.04	3.25	3.46	3.67	3.00	3.20	3.39
35.0	2.63	2.87	3.11	3.35	3.14	3.39	3.64	3.88	3.10	3.32	3.55

Table 7: Breakeven Price for Alfalfa ($/tonne)

Assuming an Irrigated Alfalfa Yield of 1987 - 3.83 tonnes/acre, 1988 - 4.1 tonnes/acre and 1989 - 4.0 tonnes/acre

Wheat on Fallow Yield bu./ac.	1987 Wheat Price ($/bu.)				1988 Wheat Price ($/bu.)				1989 Wheat Price ($/bu.)		
	3.00	4.00	5.00	6.00	3.00	4.00	5.00	6.00	3.00	4.00	5.00
20.0	44.06	46.67	49.28	51.89	49.11	51.55	53.99	56.43	54.93	57.43	59.93
25.0	46.02	49.28	52.54	55.81	50.94	53.99	57.04	60.09	56.81	59.93	63.06
30.0	47.97	51.89	55.81	59.72	52.77	56.43	60.09	63.75	58.68	62.43	66.18
35.0	49.93	54.50	59.07	63.64	54.60	58.87	63.14	67.40	60.56	64.93	69.31

CONCLUSIONS

Breakeven prices and yields cannot be calculated by covering the costs of producing the crop in question but rather have to include the profit that would have been realized by a crop no longer grown. A switch from a dryland wheat-fallow rotation to continuous hard wheat under irrigation has been shown not to be profitable in 1987 to 1989. The breakeven irrigation yields required are significantly higher than those attained by the participating farms. The breakeven price of wheat also has to be significantly higher than it was during 1987 to 1989. However, the results do not mean that irrigation does not compete favourably to dryland wheat. Government assistance programs for adopting or expanding irrigation can assist greatly toward making irrigation profitable. In addition, there are also other more profitable crops that can be grown under irrigation. Alfalfa has been shown to be a profitable alternative to dryland wheat production in 1987 to 1989. The breakeven alfalfa yields and prices were attainable by the study participants in each year from 1987 to 1989. It should be noted, however, that the machinery and labour requirements for growing irrigated alfalfa were calculated but the cash flow consequences of purchasing the new irrigation and haying equipment if required, was not.

REFERENCES

Kulshreshtha, S.N., K.D. Russell and K.K. Klein. Summary Report Social Evaluation of the South Saskatchewan River Project: Estimation of Economic, Social and Environmental Effects. Lethbridge: UMAE Engineering, June, 1988.

Manning, S.L.F., S.N. Kulshreshtha and W.J. Brown. Adoption of Irrigation in Saskatchewan - A Socio Economic Analysis. Saskatoon: Department of Agricultural Economics, University of Saskatchewan, Research Report #88-03, August, 1988.

Roy, R.G., W.J. Brown, S.N. Kulshreshtha, D.D. Featherstone. Economics of Irrigation in Saskatchewan: Results of Three Farm Workshops, 1987-1989. Saskatoon: Department of Agricultural Economics, University of Saskatchewan, Research Report #89-01, August, 1989.

Saskatchewan Department of Agriculture and Food. Agricultural Statistics, 1988. Regina: Economics Branch, Saskatchewan Department of Agriculture and Food, 1989