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The Economics of Hybrid Wheat

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This manuscript is part of the plan of action for 1976 of the Farm Planning, Financial Management, and Machinery Management Sub-Committees, and the Wheat Production Practices and Variety Improvement Sub-Committee of the Wheat Industry Resource Committee. This circular is designed to help Nebraska wheat growers, as well as wheat growers in the other 11 states of the National Wheat Growers Association, to evaluate the profitability of hybrid wheat.

CONTENTS

Introduction	3
Economic Considerations	3
Break Even Approach Considering Yield and Price	4
Partial Budget Procedure	8
Protein Premium Considerations	9
Grazing Considerations	10
Summary	11

The Economics of Hybrid Wheat

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INTRODUCTION

Hybrid wheat results from the cross pollination of a female parent with a male parent. The male is the pollen producing parent in hybrid seed production. The female is the seed bearing parent from which hybrid seed is harvested.

The plant breeder's objective is to develop a hybrid wheat that outyields variety wheats^{1/} by 25-30 percent, has a 1 to 2 percent higher protein level, costs no more than 4 times market price, and has a seeding rate of 30 pounds per acre. The goal of breeders of grazing hybrid wheats is to produce crosses which will outperform variety wheats by 50 to 70 percent.

Wheat hybrids currently are yielding 12.5 to 15.5 percent more than Centurk², protein levels range from 12.6% to 14.1%, and the seed costs from \$32.00 to \$38.00 per hundredweight. In other instances, hybrid wheat may perform no better than present top varieties. Thus, in actual wheat farm operations, the percentage increase in yield of hybrids could vary from area to area, and from year to year. Yield is a function of diseases, amount of rainfall, date of planting, seeding rate, and other cultural practices.

ECONOMIC CONSIDERATIONS

Hybrid wheat can be considered a new technology. The adoption of a new technology depends upon its profitability. The extra expense or the cost of the technology must be paid for by an increase in revenue from the sale of the extra wheat produced, protein premiums, and/or the added grazing value.

^{1/}Variety refers to a group of plants within a crop that are all alike and bred true by self-pollination. That is, each flower produces and receives its own pollen.

^{2/}Data obtained from Hybrid Wheat Field Day on May 22, 1975, at Wichita, Kansas.

There are three factors that affect a comparison of the profitability of hybrid wheat as compared to variety wheat:

1. The additional costs.
2. The market price of wheat.
3. The extra yield of grain and/or wheat pasture.

BREAK EVEN APPROACH CONSIDERING YIELD AND PRICE

To help wheat growers Tables 1-3 reflect conditions which growers face in different regions, each with a different set of assumptions. Tables show the net effect per acre of the adoption of hybrid wheat at alternative wheat prices, varying from \$2.00 to \$5.00 per bushel, and at alternative hybrid wheat yields ranging from 8% to 24% (2.8 bushels to 8.4 bushels) in excess of an assumed 35 bushel yield of the variety wheat.

Table 1^{3/} represents conditions typical in western Nebraska, western Kansas, and eastern Colorado. Differences in seeding rates and costs between hybrid wheat and variety wheat for this region are detailed in the table footnote. To use this table, select the market price expected to be realized for your area, then move across the row to the desired percentage increase or its bushel per acre equivalent. The plus or minus figure represents the net dollar effect from using hybrid wheat. For example, \$3.00 market price with a 16% increase (5.6 bu.) results in a \$1.11 per acre return from the adoption of the hybrid wheat.

Table 2 represents typical wheat production practices for eastern Nebraska and eastern Kansas. Differences in seeding rates and costs between hybrid and variety wheat for this region are given in the table footnote. Selecting a \$3.00 market price and a 16% increase in yield (5.6 bu.), the hybrid returns \$5.44 per acre.

Table 3 represents the objective of the industry, with respect to developing a hybrid that would be sown at 30 pounds per acre, and the hybrid seed costing 4 times the market price. Hybrid wheat has a

^{3/}For Tables 1, 2 and 3, the \$2.00, \$3.00, \$4.00 and \$5.00 per bushel price levels are boxed in so that the reader can readily determine the relationship between price and yield increase to net returns.

Table 1. Estimated net returns per acre of hybrid wheat for western Nebraska, western Kansas, and eastern Colorado for selected hybrid yield responses and alternative wheat prices.^{a/}

Hybrid wheat % yield increase	8%	12%	16%	20%	24%
Hybrid wheat bu/acre increase	2.8 bu.	4.2 bu.	5.6 bu.	7.0 bu.	8.4 bu.
Market price for wheat/bu.	Dollars/acre				
\$2.00	-10.64	- 7.78	- 5.27	- 2.76	- .25
2.20	- 9.57	- 6.78	- 3.99	- 1.21	+ 1.58
2.40	- 8.85	- 5.78	- 2.74	+ .35	+ 3.24
2.60	- 8.13	- 4.79	- 1.44	+ 1.91	+ 5.22
2.80	- 7.48	- 3.85	- .22	+ 3.40	+ 7.03
3.00	- 6.70	- 2.79	+ 1.11	+ 5.02	+ 8.93
3.20	- 5.98	- 1.80	+ 2.39	+ 6.58	+10.77
3.40	- 5.27	- .80	+ 3.67	+ 8.14	+12.60
3.60	- 4.55	+ .20	+ 4.94	+ 9.69	+14.44
3.80	- 3.83	+ 1.19	+ 6.22	+11.25	+16.28
4.00	- 3.12	+ 2.19	+ 7.50	+12.81	+18.11
4.20	- 2.40	+ 3.19	+ 8.75	+14.36	+19.95
4.40	- 1.68	+ 4.18	+10.05	+15.92	+21.79
4.60	- .97	+ 5.18	+11.33	+17.48	+23.62
4.80	- .25	+ 6.18	+12.61	+19.03	+25.46
5.00	+ .47	+ 7.17	+13.88	+20.59	+27.30

- ^{a/}Table 1 assumes:
- (1) Hybrid seed costs \$38/cwt, and the variety seed costs \$.75/bu. more than market price.
 - (2) Variety wheat sown at 45 lb/acre and the hybrid wheat sown at 40 lb/acre.
 - (3) Ten additional pounds of nitrogen (\$1.50/acre) is applied to the hybrid wheat.
 - (4) 10¢/bu. is added for each operation of harvesting and hauling for the additional yield.
 - (5) Variety wheat yields 35 bu/acre.

greater tillering capacity, which should enable reduced seeding rates under top management. Selecting a \$3.00 market price and a 16% yield, the estimated hybrid wheat return is \$10.73 per acre.

Table 2. Estimated net returns per acre of hybrid wheat for eastern Nebraska and eastern Kansas for selected hybrid yield responses and alternative wheat prices.^{a/}

Hybrid wheat % yield increase	8%	12%	16%	20%	24%
Hybrid wheat bu/acre increase	2.8 bu.	4.2 bu.	5.6 bu.	7.0 bu.	8.4 bu.
Market price for wheat/bu.	Dollars/acre				
\$2.00	- 2.04	+ .47	+ 2.98	+ 5.48	+ 7.99
2.20	- 2.11	+ .68	+ 3.47	+ 6.26	+ 9.04
2.40	- 2.17	+ .89	+ 3.96	+ 7.03	+10.10
2.60	+ 2.24	+ 1.11	+ 4.45	+ 7.80	+11.15
2.80	- 2.31	+ 1.32	+ 4.95	+ 8.58	+12.20
3.00	- 2.37	+ 1.53	+ 5.44	+ 9.35	+13.26
3.20	- 2.44	+ 1.75	+ 5.93	+10.12	+14.31
3.40	- 2.51	+ 1.96	+ 6.43	+10.89	+15.36
3.60	- 2.57	+ 2.17	+ 6.92	+11.67	+16.41
3.80	- 2.64	+ 2.39	+ 7.41	+12.44	+17.47
4.00	- 2.71	+ 2.60	+ 7.91	+13.21	+18.52
4.20	- 2.78	+ 2.81	+ 8.40	+13.99	+19.57
4.40	- 2.84	+ 3.02	+ 8.89	+14.76	+20.63
4.60	- 2.91	+ 3.24	+ 9.38	+15.53	+21.68
4.80	- 2.98	+ 3.45	+ 9.88	+16.31	+22.73
5.00	- 3.04	+ 3.66	+10.37	+17.08	+23.79

^{a/} Table 2 assumes:

- (1) Hybrid wheat seed costs 4 times market price, and the variety seed costs \$.75 per bushel more than market price.
- (2) Both the hybrid and variety wheat are sown at 60 lb/acre.
- (3) Ten additional pounds of nitrogen (\$1.50/acre) is applied to the hybrid wheat.
- (4) 10¢/bu. is added for each operation of harvesting and hauling for the additional yield.
- (5) Variety wheat yields 35 bu/acre.

Table 3. Estimated net returns for conditions representing plant breeder goals per acre for hybrid wheat, with regard to seeding rate and hybrid seed cost for selected yield increases and alternative wheat prices.^{a/}

Hybrid wheat % yield increase	8%	12%	16%	20%	24%
Hybrid wheat bu/acre increase	2.8 bu.	4.2 bu.	5.6 bu.	7.0 bu.	8.4 bu.
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Market price for wheat/bu.	Dollars/Acre				
\$2.00	+ 1.42	+ 3.93	+ 6.44	+ 8.94	+11.45
2.20	+ 1.72	+ 4.51	+ 7.29	+10.08	+12.87
2.40	+ 2.02	+ 5.08	+ 8.15	+11.22	+14.29
2.60	+ 2.32	+ 5.66	+ 9.01	+12.36	+15.71
2.80	+ 2.61	+ 6.24	+ 9.87	+13.50	+17.12
3.00	+ 2.91	+ 6.82	+10.73	+14.64	+18.54
3.20	+ 3.21	+ 7.40	+11.59	+15.77	+19.96
3.40	+ 3.51	+ 7.98	+12.45	+16.91	+21.38
3.60	+ 3.81	+ 8.56	+13.30	+18.05	+22.80
3.80	+ 4.11	+ 9.14	+14.16	+19.19	+24.22
4.00	+ 4.41	+ 9.71	+15.02	+20.33	+25.64
4.20	+ 4.71	+10.29	+15.88	+21.47	+27.06
4.40	+ 5.00	+10.87	+16.74	+22.61	+28.47
4.60	+ 5.30	+11.45	+17.60	+23.75	+29.89
4.80	+ 5.60	+12.03	+18.46	+24.88	+31.31
5.00	+ 5.90	+12.61	+19.32	+26.02	+32.73

^{a/}Table 3 assumes:

- (1) Hybrid wheat seed costs 4 times market price, and the variety seed costs \$.75 more than market price.
- (2) Hybrid wheat sown at 30 lb/acre and the variety wheat at 45 lb/acre.
- (3) Ten additional pounds of nitrogen (\$1.50/acre) is applied to the hybrid wheat.
- (4) 10¢/bu. is added for each operation of harvesting and hauling for the additional yield.
- (5) Variety wheat yields 35 bu/acre.

These tables allow a producer to evaluate a range of possible conditions, and to estimate the yield increase necessary to make hybrid wheat a profitable crop on his farm. If a producer has a good estimate of the potential yield increase that a hybrid wheat would produce on his farm, he can determine wheat prices which would be necessary in order for hybrid wheat to break even, or be more profitable than a variety wheat.

PARTIAL BUDGET PROCEDURE

Partial budgeting is a tool producers can use to evaluate hybrid wheat production in relation to variety wheat production. The partial budgeting procedure consists of four steps:

1. *Statement of change:* Consider planting hybrid wheat in place of the variety wheat.

2. *Key information: Assume:*

1. Hybrid wheat seed costs \$38.00/cwt or \$22.80/bu.
2. Variety seed wheat costs \$4.00/bu. or \$.75 bu. more than market price.
3. Hybrid wheat yields 5.25 bu/acre more than variety wheat. Variety wheat yields 35 bu.
4. Price of wheat No. 1 HRW - \$3.25/bu. - no protein premium considered.^{4/}
5. Custom harvest @ \$9.00/acre plus 10¢/bu. over 20 bushel.
6. Custom haul @ 10¢/bu.
7. 10 lb additional actual N.^{5/}
8. Seeding rate 45 lb variety, 40 lb hybrid.
9. Interest on operating expenses at 9% for 6 months.
10. No grazing.^{6/}
11. No change in the tillage practices.

^{4/}If protein premiums are paid, these should be added or subtracted, depending upon the protein level being higher or lower in the hybrid wheat compared to the variety wheat.

^{5/}In some wheat producing areas, additional N, P₂O₅, and K₂O may be necessary to obtain additional bushels per acre. For nitrogen, a general rule is that for each bushel of wheat, 1 to 1.8 pounds of actual nitrogen will be needed.

^{6/}If wheat is pastured, the value of the extra grazing should be added.

3. Analysis:

Additional receipts	Reduced cost	
5.25 bu. more/A x \$3.25/bu. = \$17.06/A		None
AUM of grazing = 0		
<u>Added cost:</u>	<u>Reduced receipts</u>	None
Extra seed	\$12.20/A.	
5¼ bu. extra harvest cost	.53/A.	
5¼ bu. extra trucking cost	.53/A.	
Extra nitrogen 10 lb	1.50/A.	
\$14.76 extra expenses		
@ 9% interest for 6 mos.	.66/A.	
Total added expenses	<u>\$15.42/A.</u>	
Net effect	\$ 1.64/A.	

4. Other considerations:

1. Allowance for grazing.
2. Allowance for protein premium.
3. Disease resistance to soil borne mosaic, stem and leaf rust, and Hessian fly resistance of the hybrid.

Based on key assumptions that hybrid wheat yields 15% (5¼ bu.) more than variety wheat, a market price of \$3.25 per bushel, and extra hybrid seed expense of \$12.20 per acre, the net effect is \$1.64 per acre. The wheat grower would then look at the other considerations listed in Step 4 that could increase or decrease the profitability in the adoption of hybrid wheat.

PROTEIN PREMIUM CONSIDERATIONS

The protein premium is an additional source of returns, provided the wheat producer can identify his grain. A producer who sells at harvest forgoes this source of returns, as his wheat is mixed with other grower's wheat and sold as ordinary wheat. Grain that can be identified, and has high protein, may be eligible for a protein

premium payment. A 12% protein wheat brings about \$.35 per bushel more than ordinary wheat. A 13% protein wheat normally sells for \$.30-.35 per bushel more than the 12% protein wheat. For the two extra percentage points, \$.65-.67 per bushel may be realized by wheat growers.

GRAZING CONSIDERATIONS

Grazing is an additional product of wheat that has value to a livestock operation. Grazing is a common practice in certain areas of Texas, Oklahoma, and Kansas. In evaluating hybrid wheat, the grower needs to determine the extra or added grazing production, and its value. One method is to measure production by animal unit months (AUM's). The value of grazing varies from year to year, depending upon the AUM's per acre, cost of substitute feeds, and the value of livestock.

An Animal Unit Month is the forage or feed necessary to maintain one animal unit for one month. One ton of hay will feed three animal units for one month. Table 4 gives the class of livestock and its animal unit equivalent so a producer can determine the AUM from wheat pasture.

Table 4. Class of livestock and its animal unit equivalent.

Class of livestock	Animal unit
Cow	1.00
Cow-calf	1.30
Weanling calf under 12 mos.	.50
Yearling 12-17 mos.	.65
Yearling 18-24 mos.	.80
Bull	1.40
Horse	1.25

For example, if you have 40 cows and calves on 40 acres for 50 days of grazing, the AUM per acre is calculated as follows: 40 cow-calf (1.30 AU) x 50 days = 2600 Animal Unit Days.

$$\frac{2600 \text{ AUD}}{30 \text{ days/mo.}} = 86.7 \text{ AUM from 40 acres, or } \frac{86.7 \text{ AUM}}{40 \text{ acres}} = 2.15 \text{ AUM/A.}$$

If an AUM is worth \$15, then the acre produced \$32.25 of grazing. The grower must then place a value on any extra or reduced grazing of the hybrid wheat in relation to the variety wheat.

SUMMARY

Hybrid wheat yield data for several years and areas of the wheat belt are not available at this time. Since plant breeders, economists, and producers don't have all the answers, producers can only explore "what if" situations, now, using the tools outlined in this publication. As more information becomes available about hybrid wheat, producers can plug the data into their partial budgets for a more accurate evaluation.