Analysis of Practices Influencing Management Factors of Selected Crop Farmers in East Central North Dakota

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Management factors contributing to the profitability of a North Dakota crop farm include: (1) high crop yields, (2) low machinery cost, (3) effective marketing including use of government programs, and (4) low-cost resource acquisition. This article analyzes practices used by farmers to achieve these management factors.

The data for this analysis were based on farm record summaries from the North Dakota Vocational Agriculture Adult Program and interviews with 28 crop farmers in east central North Dakota. Comparison of practices utilized by farmers with high and low levels of each management factor was used to identify the most critical practices.

CROP PRODUCTION

Crop production practices were analyzed for wheat, barley, and sunflower. The 1984 crop yield per acre was used to divide farms into high and low yield groups. Practices examined included: (1) seed quality and variety selection, (2) nitrogen fertilizer use, (3) herbicide and insecticide use, (4) tillage trips, (5) timeliness of planting and harvesting, and (6) field inspection.

Wheat and Barley Yields

Nitrogen fertilizer and herbicide use were associated with yield levels of both crops. Barley yield also varied with September through July rainfall. Precipitation was not as influential to wheat yields in part because about one-third of the wheat was planted on summer fallow. Seed selection, tillage trips, and timeliness in planting and harvesting were not associated with 1984 yields. Measures of nitrogen fertilizer and herbicides used in wheat and barley production are summarized in Table 1.

Wheat yield goal of 47 bushels per acre (30 percent above 1984 average yield)[1] was assumed. The recommended quantity of total nitrogen available to achieve the yield goal would be 117 pounds per acre (Dahnke, 1985). The average and low wheat yield groups of farmers did not provide the recommended quantity of nitrogen. The high yield farms provided about 120 percent of the recommended nitrogen, and their average yield was 95 percent of the yield goal, indicating the influence of other factors on wheat yields. The data indicate the importance of adequate nitrogen, although some farms may not be able to attain the yield goal used.

A barley yield goal of 77 bushels per acre was established (30 percent above 1984 average yield). Total nitrogen recommended to produce 77 bushels malting and feed barley is 115 and 135 pounds per acre, respectively (Dahnke, 1985). Low barley yield farmers did not provide this much nitrogen. On average, farmers provided nitrogen near the recommended level for malting barley, but nitrogen available for feed barley was less than recommended. High yield farms provided 115 percent of recommended total nitrogen for malting and 98 percent for feed barley.

Table 1. Average Measures of Crop Production Practices for Farms with High and Low Wheat and Barley Yields in 1984.

Measures of Crop Production Practice	Crop Yield		
	Low 25%	All Farms	High 25%
Wheat:			
Yield (bu./ac.)	26.8	36.2	44.7
Percent of acres planted on fallow (%)	27.7	34.5	41.4
Nitrogen applied (lbs./ac.)	30.1	31.9	49.6
Nitrogen available (lbs./ac.)[a]	108.9	114.0	142.4
Percent of acres treated with:			
Broadleaf herbicide	138	114	101
Grass herbicide	85	51	57
Barley:			
Yield (bu./ac.)	43.9	59.5	76.0
Annual precipitation (inches)	13.9	14.6	16.1
Nitrogen applied (lbs./ac.)	32.0	52.0	58.4
Nitrogen available (lbs./ac.)[a]	95.0	117.0	132.6
Percent of acres treated with:			
Broadleaf herbicide	97	102	98
Grass herbicide	82	47	0

[a]Applied nitrogen plus average nitrogen in soil based on 1972-1981 county average soil test results.

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[1]A yield goal 30 percent larger than average crop yield is simply a measure useful in comparing fertilizer recommendations and actual use. A farmer chooses a yield goal that is appropriate for his operation.

The percentage of acres treated with broadleaf and grass control herbicides shows the relation between crop yields and herbicide practices. Farmers with low wheat and barley yields commonly treated a large proportion of their acres with grass control herbicides. Broadleaf control herbicides were sprayed routinely on all wheat and barley acres, while grass control herbicides were used to control a grass weed problem. Grass control herbicides are not always completely successful and can cause crop injury. The percentage of acres treated with grass control herbicides tended to indicate the degree of grass weed infestation rather than level of grass weed control.

Sunflower

Similar measures of production practices were used in the sunflower analysis. Use of nitrogen, herbicide and insecticide, field inspection, and tillage trips are summarized in Table 2.

Table 2. Average Measures of Crop Production Practices for Farms with High and Low Sunflower Yields in 1984.

Measures of Crop Production Practice	Sunflower Yield		
	Low 25%	All Farms	High 25%
Yield (lbs./ac.)	797	957	1,207
Nitrogen applied (lbs./ac.)	39	39	45
Nitrogen available (lbs./ac.)[a]	103	102	115
Percent of acres treated with:			
Herbicides	100	107	95
Insecticides	120	102	99
Inspections per week	.71	.66	.52
Shallow tillage trips (for prod. cycle)[b]	2.3	2.8	3.9

[a]Applied nitrogen plus average nitrogen in soil based on 1972-1981 county average soil test results.
[b]Production cycle includes previous fall and current production year tillage.

Total nitrogen available was adequate for all sunflower yields based on a yield goal 30 percent above 1984 yields.[1] Herbicides used to control grass weeds were routinely applied by all farmers. Insecticide use was heaviest for the low yield groups. The use of insecticides tended to measure the degree of insect problem, which can adversely affect yield. Farmers in the low yield group were making an effort to control recognized production-limiting situations by increasing the frequency of inspections and insecticide applications.

Farmers in the high yield group used more shallow tillage trips. Two possible strategies would require more shallow tillage: (1) later planting in the spring and (2) row-crop cultivating once or twice during the summer.

MACHINERY MANAGEMENT

Factors used in the machinery management analysis were machinery cost per acre and repair cost per acre. Machinery cost included depreciation, fuel and lubrication, repair, and 90 percent of custom work expenses. Repair cost per acre included the amount spent for repairs of tractor and crop machines. Categories of machinery practices examined were: machinery investment, intensity of tractor use, tractor size and age, and shop facilities.

Machinery Cost Per Acre

Machinery management practices that were related to machinery cost per acre are summarized in Table 3. Tractor and combine investment are an estimate of 1984 market value. Implement values are the undepreciated balance on the farmer's depreciation schedule. Many implements that have been owned more than five years have an undepreciated value of zero because of rapid depreciation methods (ACRS). This tends to underestimate implement values and depreciation costs for equipment five or more years old. Farmers with high investment in machinery showed a higher machinery cost per acre because depreciation is an integral part of the machinery cost calculation.

Table 3. Average Measures of Machinery Practices for High and Low Machinery Cost per Acre in 1984.

Measures of Machine Practices	Machinery Cost per Acre		
	Low 25%	All Farms	High 25%
Machinery cost per acre	$20.25	$31.39	$47.19
Repair cost per acre	$ 2.75	$ 5.70	$ 8.58
Value:			
Implement	$ 1.53	$33.16	$81.64
Tractor	$26.09	$25.80	$31.60
Combine	$18.27	$15.80	$17.10
Tractor characteristics:			
Weighted horsepower (per acre)	.15	.13	.11
Tractor use (hrs./ac.)	.63	.91	.97
Accumulated tractor use (hrs./ac.)	7.44	12.46	12.01
Shop value ($/acre)	$ 9.71	$14.60	$16.11
Crop acres	1,058	1,113	954

Horsepower per acre weighted by annual hours of operation of each tractor had an inverse relationship with machinery cost per acre. Use of tractors as measured by weighted hours of annual operation per acre (weighted by individual tractor's horsepower) tends to be associated with high machinery cost per acre. Age of tractors as measured by accumulated hours per acre on the tractor fleet is also associated with higher machinery cost per acre. Shop value per acre seems to be associated with higher machinery cost per acre.

Repair Cost Per Acre

Measures of machinery management that were related to repair cost per acre are shown in Table 4. Farmers with high implement values have likely purchased implements within the past five years. This indicates that larger investments in implements does not reduce repair expenses as might be expected, but actually may contribute to higher repair cost per acre.

Farmers operating larger tractors (weighted horsepower per acre), fewer annual tractor hours, and able to heat their

Table 4. Average Measures of Machinery Practices for High and Low Machinery Repair Cost per Acre in 1984.

Measures of Machine Practices	Repair Cost per Acre		
	Low 25%	All Farms	High 25%
Repair cost (per ac.)	$2.15	$ 5.71	$10.33
Implement values (per ac.)	$5.28	$27.49	$59.99
Weighted horse-power (per acre)	.16	.13	.11
Annual tractor hours (hrs./ac.)	.54	.91	1.1
Labor (% of total repair costs)	15.2	13.4	14.7
Heating in shop (% of farms)	33	26	17
Crop acres	1,203	1,113	940

shop had lower repair cost per acre. The significance of labor to total repair cost was inconclusive in Table 4, but when all other variables were held constant in a regression model, a higher percentage of repair cost for labor increased repair cost per acre.

MARKETING PRACTICES

Marketing indexes for wheat, barley, and sunflower were developed to analyze marketing performance for these crops in 1984. The marketing indexes compared prices farmers received for their crops to the price available during harvest plus an interest charge, storage, and shrinkage costs from harvest to the date of sale. Storage costs were limited to the variable cost of maintaining facilities and handling the grain. A farmer selling grain at a price higher than the harvest price plus carrying costs was given a marketing index above 100. Conversely, a farmer selling grain below the harvest price adjusted for carrying cost received a marketing index below 100.

Marketing practices related to the composite marketing index are shown in Table 5. The farmers that hired charting services, subscribed to more marketing publications, and hired marketing services attained a higher composite marketing index. Participation in the wheat and barley government program in 1984 was lower for farmers with a higher overall marketing index. Few farmers used hedging, options, and forward contracting.

Marketing practices for wheat, barley, and sunflower farmers with high and low marketing individual crop indexes are summarized in Table 6.

The single most important practice related to the 1984 marketing index for wheat, barley, and sunflower was the weighted average number of days from harvest (weighted by bushel volume of each sale) to date of sale. A profitable rule of thumb would have been to market these three crops prior to the end of the calendar year.

Wheat program participation was higher for farmers with a low wheat marketing index, but barley program participation was higher for those with a high barley marketing index in 1984. Forward contracting was a consistent practice for all sunflower producers.

Table 5. Average Measure of Marketing Practices Classified by Levels of Composite Marketing Index in 1984.

Measures of Composite Marketing Practices	Marketing Index		
	Low 25%	All Farms	High 25%
Marketing index	86	96	104
Number of marketing publications	.83	.93	1.1
	----------percent of farms----------		
Hire charting	17	36	57
Hire marketing services	0	18	29
Wheat program participation	83	86	71
Barley program participation	67	54	57

Table 6. Average Measures of Marketing Practices for Wheat, Barley, and Sunflower Classified by Levels of Marketing Index in 1984.

Measures of Marketing Practices	Marketing Index		
	Low 25%	All Farms	High 25%
Wheat marketing index	88	95	100
Weighted average days from harvest to sale	182	141	84
Program participation (percent)	100	90	75
Barley marketing index	89	107	125
Weighted average days from harvest to sale	192	113	118
Program participation (percent)	50	69	75
Sunflower marketing index	72	100	130
Weighted average days from harvest to sale	121	68	66
Forward contracted (percent of crop)	33	31	32

FINANCE PRACTICES

Weighted cost-of-debt was used to evaluate financial performance. Weighted cost-of-debt is a weighted average interest rate (weighted by debt in various classes, i.e., real estate, chattel, and notes). The structure of debt for farmers analyzed is summarized in Table 7.

Table 7. Average Measures of Financial Structure by Selected Level of Weighted Cost-of-Debt.

Measures of Financial Structure	Weighted Cost-of-Debt		
	Low 25%	All Farms	High 25%
Weighted cost-of-debt (percent)	7.7	10.3	13.4
Total debt	$179,000	$186,919	$110,782
Total assets	$494,307	$483,992	$441,180
Total debt-to-asset ratio	.53	.47	.24
Real estate debt-to-asset ratio	.52	.47	.12
Chattel debt-to-asset ratio	.64	.68	.33
Operation debt-to-asset ratio	.26	.41	.45

High weighted cost-of-debt farms had a much lower overall debt-to-asset ratio than low cost-of-debt farms. Examination of debt-to-asset ratios for real estate, chattel, and operation indicated that the high cost-of-debt farms had much lower ratios for real estate and chattel debt than the other farms. These high cost-of-debt farms, on the other hand, had a much higher operating debt-to-asset ratio. This relationship indicated that high cost-of-debt farms had more of their land and chattel (machinery) paid for, but were carrying a larger debt for operating expenses than the low cost-of-debt farms.

Data on lending institutions used by farmers interviewed were limited to real estate mortgages. Real estate typically was the major part of total debt, so comparison of real estate lending institutions utilized is useful. The financial institutions used for real estate financing and the characteristics of real estate purchases are summarized in Table 8.

Table 8. Average Measures of Real Estate Financing Institutions Used and Procurement Strategies Classified by Level of Weighted Cost-of-Debt.

Measures of Real Estate Financing	Weighted Cost-of-Debt		
	Low 25%	All Farms	High 25%
	percent		
Weighted cost-of-debt	7.7	10.5	13.4
Capital sources for real estate: (percent of financing)			
Private	44.2	30.7	20.4
Commercial	5.6	28.9	46.1
Subsidized	50.1	29.3	—
Refinanced real estate	6.6	21.1	19.5
Land purchasing strategies:			
Weighted average years from land purchase	9.9	9.3	10.6
Weighted average purchase price per acre	$339	$244	$85
Outstanding real estate debt per acre	$305	$217	$33

Weighted cost-of-debt is determined by interest rates charged by various lending institutions servicing a farm operation. Low interest cost farmers have utilized private (contract for deed) and subsidized (Farmers Home Administration) financial institutions more than the high cost-of-debt farms. High cost-of-debt farms have procured credit primarily from commercial sources. The percentage of real estate debt that is refinanced was three times larger for high cost-of-debt farms than low cost-of-debt farms.

Because of reduced risk, one would expect the better financial risk farms, i.e., below .4 debt-to-asset ratio, would be paying lower interest rates. This was not the case for the farms analyzed. The low cost-of-debt farmers obtained lower cost credit from preferential sources because they had a high risk financial situation. The high cost-of-debt farms did not qualify for subsidized interest financing because they could obtain financing commercially.

Land purchasing strategies summarized in Table 8 help to explain the differences in real estate debt-to-asset ratios of low and high cost-of-debt farms (Table 7). The high cost-of-debt farms have owned their land only .7 more years than the low cost-of-debt farms. The average purchase price for high cost-of-debt farmers was $254 per acre less than for low cost-of-debt farmers. Much of this lower cost land was obtained through inheritances or gifts. The outstanding real estate debt is an estimate of unpaid principal on real estate mortgages. The low cost-of-debt farmers had nine times the outstanding real estate debt of high cost-of-debt farmers. This is an indication of the additional risk the low cost-of-debt farmers have when land values decline. Low cost-of-debt farmers would be insolvent in real estate if land values declined below $305 per acre. High cost-of-debt farmers could withstand an additional $272 per acre decline in land values before they would become insolvent in real estate.

Obtaining lower cost financing has been a financial strategy of the early 1980s. The low cost-of-debt farms analyzed have incorporated this strategy successfully. With declining land values, the concern of insolvency becomes important for the long-term survival of a farm operation. In this case, the high cost-of-debt farmers are in the best financial position because of lower outstanding real estate debt.

SUMMARY

Crop Production

Most of wheat and barley producers analyzed could have improved yields in 1984 by increasing nitrogen fertilizer use. Management practices, such as crop rotations, that minimize the need for grass control herbicides could also improve 1984 wheat and barley yields.

Delayed planting (to avoid insect infestation) and row crop cultivation (to control weeds and stimulate plant growth) are two practices that could have increased 1984 sunflower yields.

Machinery Management

Machinery cost and repair cost were contained best by farmers who had larger horsepower tractors with less historical use (total hours) and fewer annual hours of operation. Farmers who can heat their shop in the wintertime had a lower repair cost per acre.

Marketing Practices

Professional marketing assistance, i.e., charts, marketing services, and publications, was more prevalent among farmers with a high composite marketing index. A good practice was to market wheat, barley, and sunflower prior to the end of the calendar year.

Financial Practices

Farmers with high debt-to-asset ratios had the lowest cost-of-debt. The sources of capital, i.e., contract for deed and Farmers Home Administration, explained most of the lower cost. Low debt-to-asset ratio farmers obtained their financing commercially; consequently, their cost-of-debt was higher.

Farms with high debt-to-asset ratios have large outstanding real estate debt. Conversely, low debt-to-asset ratio farms have very small outstanding real estate debt. High debt-to-asset ratio farmers survive due to their lower cost of financing but will have serious problems with declining land values.

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The 70 percent D/A ranch would benefit the most with the debt reduction option. The $95,265 cost of debt reduction option would improve the D/A ratio to 25 percent and increase the net worth by $82,220 over the baseline or 86 cents per dollar of cost of the option. The interest reduction option does the least to improve the cash flow situation.

In conclusion, the renegotiation of debt with lenders would be useful strategy before considering a partial liquidation even for the 70 percent D/A ranch with a significant cash problem. Since forced sale and repossession costs are often greater than 20 percent of asset value, it is probably best for lenders to be willing to renegotiate debt if a viable economic unit would result.

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A positive correlation between pregnancy rates and body condition at breeding has been confirmed and it may explain why pregnancy rates were high in all groups, including controls (group D).

WEANING WEIGHTS

Cows dewormed with IVOMEC® - regardless of treatment schedule - weaned calves a mean of 15.5 pounds heavier than the control group. This statistically significant advantage was consistent for both years of the study indicating that in these herds, under similar conditions, this difference of 15.5 pounds may be anticipated to be approximately the same from year to year. Deworming cows influenced their calves' weaning weight but timing (spring vs. fall) and frequency (once vs. twice) of deworming did not. Under conditions in this study, progeny from dewormed cows were consistently heavier than calves in control groups; however, when or how often cows were dewormed did not significantly affect this difference.

Calves from all groups in all herds were lighter during the second year (1986), with no significant genetic changes occurring within herds. This difference was likely due to environmental changes; 1985 was characterized by drought throughout North Dakota but 1986 had above average rainfall during the entire grazing season. This excessive rainfall resulted in fast-growing, lush forages and may have decreased the nutritional value of the forage.

The advantage in average weaning weights of calves from dewormed cows over calves in control group cannot be attributable only to forage intake by the calves. Previous reports have documented increased milk yields in dairy and beef cows following deworming. In this study, increased weaning weights may be explained in part by an increase of milk production in the dewormed cows.

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