

Project Title: Economic Analysis of North Plains PROFIT Initiative

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Non-Technical Report

Project Description and Expected Results:

The focus of this project is to provide an economic evaluation of the PROFIT demonstrations and experiments being conducted on the Northern Plains. A second long-term objective is to identify the potential economic benefits to the region associated with adapting improved practices identified through the North Plains PROFIT. A third long-term objective is to quantify the adoption rate of identified practices.

How will producers benefit?

This project is and will benefit producers in a number of ways. First, individual economic evaluation of experiments/demonstrations will help identify which are the most feasible and which do not hold promise and should possibly be discontinued. Thus, improving the efficiency of the research dollars invested.

Second, identifying the potential value of adopting an “improved” practice to the region assists in targeting limited educational resources to those that provide the most economic promise to the region. Finally, measuring the level of adoption helps identify when adoption efforts should be terminated or when they are ineffective and the educational approach modified.

PROFIT Accomplishments:

To date, the project efforts have centered on the development of a uniform methodology for evaluating projects; collecting regional data for impact analysis and initial evaluation of five PROFIT experiments/demonstrations that have been a part of the PROFIT project.

Most Important Outcome:

The major accomplishment is the development of the scope of work and methodology that provides a consistent plan to economically evaluate individual and regional short and long-term impacts of the PROFIT effort.

Technical Report

Kind of Projects: Economic Evaluation of Alternative Sorghum Production Practices

Project Objectives:

Provide economic evaluation of the northern plains PROFIT Initiative project. A project that received funding and was selected for a detailed analysis was: Forage Sorghum Response to Irrigation Level.

Methodology:

Partial budgeting was selected as the tool to evaluate the economic feasibility of the experiment. In partial budgeting, the change in returns and costs resulting from a proposed practice are compared. In this demonstration, the profitability of varieties of forage sorghum and levels of irrigation are examined. In addition, the marginal value of an acre-inch of water applied was calculated using the partial budgeting approach.

Results and Discussion:

Forage Sorghum Response to Irrigation Level

Objective of Study:

Forage sorghum can produce a high quality product at low levels of irrigation. As much as one acre-inch of water applied at the opportune time can drastically increase profits. The objective of this one-year study is to analyze the marginal net revenue of an additional acre-inch of irrigation that is applied to different sorghum varieties.

Study Overview:

On an average year, corn for forage will produce 27 tons of silage on 18 inches of water. Decreasing the amount of water applied can severely affect corn silage yields. Declining water tables compounded with frequent periods of drought and volatile natural gas prices can at times make the profitability of corn silage highly questionable. On the other hand, it has been demonstrated that forage sorghum can be grown in dryland conditions, as well as, under irrigation.

In this demonstration, four sorghum hybrids were planted dryland and irrigated at three different levels. The hybrids were 1) MMR 366/23 BMR – a high yielding BMR forage sorghum, 2) MMR 366/36 BMR – a drought tolerant BMR forage sorghum, 3) MMR 310/45 – a conventional dual-purpose forage sorghum, and 4) MMR 366/70 BMR – a photoperiod sensitive sorghum-sudan. All plots were pre-watered with five acre-inches using conventional furrow. In addition to the dryland treatment, other plots either received one, two or four irrigations. Four inches of water was applied to the crop per irrigation.

Summary of Results:

A partial budgeting analysis was preformed evaluating the marginal net return per acre-inch of water applied. Total revenue on the dryland plots adjusted for harvest cost

ranged from \$122.53 to \$139.20 per acre depending on variety. The value of yield increases from the plots receiving one irrigation were not enough to cover the additional irrigation, harvest and seed expense for two of the varieties and marginally positive on the other two. The two irrigation level maximized the marginal value of the water applied regardless of the variety. Increasing to four irrigations yielded mixed results. Three of the varieties had a positive net economic response to the additional water but the fourth variety (366/36 BMR) could not generate enough revenue to cover the additional cost. All varieties receiving four irrigations had a lower marginal value per additional acre-inch of water applied relative to the two irrigation level. Actually, decreasing the levels of irrigation increased the percentage of protein, and digestibility while decreasing the percentage of lodging.

A number of implications can be drawn from this demonstration. First, one irrigation has very little impact on net returns. However, the net returns for adding a second irrigation is relatively substantial. Additional irrigations can add to net returns, however, the magnitude of their impact decreases with each subsequent irrigation. Readers should be cautioned that these results are preliminary and based on only one year of data.

Detailed Results:

An economic evaluation of a one-year demonstration involving dryland and three different irrigation practices and four different forage sorghum varieties was performed. The evaluation used the partial budgeting approach where the increase in revenues were adjusted for additional seed, harvest and irrigation costs to compare the different scenarios. Variables that differed in the study were acre-inches of water applied, seeds planted (100,000 seeds/acre irrigated and 50,000 seeds/acre dryland), tons harvested and sorghum varieties. Yields, costs, net returns and the net returns per acre-inch of irrigation applied by an average of the different irrigation levels, an average of the varieties, and the varieties themselves are given in Table 1. More detailed explanations are as follows:

1. Averaging over all varieties, plots receiving one irrigation had marginal net returns per acre-inch of $-\$0.77$, two irrigations $\$9.14$ and four irrigations $\$2.31$.
2. Varieties 366/36 BMR and 366/23 BMR exhibited a similar water response pattern. Both varieties had lower net returns per acre under dryland conditions compared to the top two varieties, higher and positive returns to a single irrigation, lower but positive response to two irrigations and a negative marginal net return response to full irrigation. This suggests that these two varieties should only be considered in a dryland or limited irrigation situation.
3. Variety 310/45 had the largest net returns of all varieties under both dryland and full irrigation treatments with $\$139.20$ and $\$225.99$ per acre, respectively. In addition, 310/45 continued to exhibit the strongest marginal returns per acre-inch at the full irrigation level at $\$6.51$ per ACIN.
4. Variety 366/70 BMR had the second best returns of all the varieties in both the dryland and full irrigation trials with $\$133.84$ and $\$186.40$ per acre, respectively. While the return per acre on the dryland was only marginally less than the top variety ($\$5.36/\text{acre}$), a significant difference occurred on the fully irrigated trial ($\$39.59/\text{acre}$).

5. This analysis used a natural gas price of \$4.45/mcf. This price is a three-year average of the peak irrigation months May, June, July, August, and September for the High Plains. Prices ranged from \$2.69 to \$6.03, indicating the extreme recent volatility in natural gas prices. This implies that more favorable consideration needs to be given to flexible water use crops such as sorghum silage in the future.

Table 1. Comparison of the effects of levels of irrigation on net returns and returns per acre-inch of water applied.

	Ton/Acre	Water Applied	Irrigation Costs ¹	Harvest Costs ²	Total Costs ³	Silage Revenue ⁴	Net Return ⁵	Marginal Net Return Per Acre Inch of Water
Irrigation Level Average								
Dryland	9.05	0	\$0.00	\$49.78	\$49.78	\$181.00	\$131.23	
1 Irrigation	11.61	4	\$28.68	\$63.86	\$92.54	\$232.20	\$128.17	-\$0.77
2 Irrigations	16.11	8	\$57.36	\$88.61	\$145.97	\$322.20	\$164.74	\$9.14
4 Irrigations	21.34	16	\$114.72	\$117.37	\$232.09	\$426.80	\$183.21	\$2.31
366/23 BMR								
Dryland	8.90	0	\$0.00	\$48.95	\$48.95	\$178.00	\$129.05	
1 Irrigation	12.75	4	\$28.68	\$70.13	\$98.81	\$255.00	\$144.70	\$3.91
2 Irrigations	16.51	8	\$57.36	\$90.81	\$148.17	\$330.20	\$170.54	\$6.46
4 Irrigations	19.86	16	\$114.72	\$109.23	\$223.95	\$397.20	\$161.75	-\$1.10
366/36 BMR								
Dryland	8.45	0	\$0.00	\$46.48	\$46.48	\$169.00	\$122.53	
1 Irrigation	11.58	4	\$28.68	\$63.69	\$92.37	\$231.60	\$127.73	\$1.30
2 Irrigations	16.53	8	\$57.36	\$90.92	\$148.28	\$330.60	\$170.83	\$10.77
4 Irrigations	19.66	16	\$114.72	\$108.13	\$222.85	\$393.20	\$158.85	-\$1.50
310/45								
Dryland	9.60	0	\$0.00	\$52.80	\$52.80	\$192.00	\$139.20	
1 Irrigation	11.88	4	\$28.68	\$65.34	\$94.02	\$237.60	\$132.08	-\$1.78
2 Irrigations	16.74	8	\$57.36	\$92.07	\$149.43	\$334.80	\$173.87	\$10.45
4 Irrigations	24.29	16	\$114.72	\$133.60	\$248.32	\$485.80	\$225.99	\$6.51
366/70 BMR								
Dryland	9.23	0	\$0.00	\$50.77	\$50.77	\$184.60	\$133.84	
1 Irrigation	10.23	4	\$28.68	\$56.27	\$84.95	\$204.60	\$108.16	-\$6.42
2 Irrigations	14.67	8	\$57.36	\$80.69	\$138.05	\$293.40	\$143.86	\$8.92
4 Irrigations	21.56	16	\$114.72	\$118.58	\$233.30	\$431.20	\$186.40	\$5.32

¹ \$7.17/acre-inch (Fuel₁ \$4.45 + LMR \$1.80 + Labor \$0.92) (three-year average, 2001 – 2003, during peak irrigation months of May, June, July, August, and September).

² Harvest and haul costs were assumed to be \$5.50/ton.

³ Total irrigation variable costs + harvest costs.

⁴ Sorghum silage was valued at \$20.00/ton.

⁵ Revenue – irrigation and harvest costs (irrigated treatments were adjusted -\$11.49 for added seed costs).

The difference in returns per acre-inch of irrigation applied at different levels of irrigation is illustrated in Figure 1. The average of net returns over all varieties is negative for one irrigation then rises rapidly to peak at eight acre-inches. The value of net returns per acre-inch falls for the four irrigation level relative to the two irrigation level but remains positive.

Figure 1. Marginal net returns per acre-inch of water applied on the four sorghum varieties.

