

Comprehensive Cost-Benefit Analysis for the MixMate System

Introduction

The MixMate system represents a transformative investment for Jakub Brothers Farms. By automating chemical mixing and record-keeping, the system generates direct financial returns through cost savings while providing broader operational and strategic benefits that contribute to the farm's sustainability and Nebraska's rural economy.

Short-Term Analysis (1–5 Years)

1. Direct Financial Benefits:

- **Chemical Inventory Savings:**

By improving chemical mixing accuracy, Mixmate reduces chemical waste by 6%

- \$10,800 annually for 3 years (Years 1–3) on a \$180,000 chemical budget
- \$15,480 annually for 2 years (Years 4–5) on a \$258,000 chemical budget
- **Total Chemical Savings: \$63,360**

- **Labor Efficiency Gains:**

Automating mixing saves 33–44 hours annually.

- \$990 annually (Years 1–3) and \$1,320 annually (Years 4–5) at \$30/hour
- **Total Labor Savings: \$5,610**

- **Idle Time Savings:**

Faster loading reduces idle sprayer engine hours, saving \$0.80/acre

- \$5,600 annually (Years 1–3) for 7,000 acres
- \$8,320 annually (Years 4–5) for 10,400 acres
- **Total Idle Time Savings: \$33,440**

- **Total Quantified Benefits (1–5 Years):**

- \$63,360 (chemical) + \$5,610 (labor) + \$33,440 (idle) = **\$102,410**

2. Costs:

- **Initial Investment: \$54,114**

- **Maintenance: \$500 annually for 5 years = \$2,500**

- **Fuel Costs: \$57.60 annually for 5 years = \$288**

- **Total Costs (1–5 Years):**

- \$54,114 + \$2,500 + \$288 = **\$56,902**

3. **Cost-Benefit Ratio (5 Years):**

- $\$102,410$ (total benefits) / $\$56,902$ (total costs) = **1.80** (CBR)

4. **Key Takeaways:**

- The system generates **\$1.80 in benefits for every \$1 invested** over 5 years
 - Payback is achieved by **Year 4**
-

Long-Term Analysis (6–10 Years)

1. **Direct Financial Benefits:**

- **Chemical Inventory Savings:** \$15,480 annually for 5 years
 - **Total Savings (Years 6–10):** \$77,400
- **Labor Efficiency Gains:** \$1,320 annually for 5 years
 - **Total Labor Savings (Years 6–10):** \$6,600
- **Idle Time Savings:** \$8,320 annually for 5 years
 - **Total Idle Time Savings (Years 6–10):** \$41,600
- **Total Quantified Benefits (6–10 Years):**
 - $\$77,400$ (chemical) + $\$6,600$ (labor) + $\$41,600$ (idle) = **\$125,600**

2. **Costs:**

- **Maintenance:** \$1,000 annually for 5 years = \$5,000
- **Fuel Costs:** \$57.60 annually for 5 years = \$288
- **Total Costs (6–10 Years):**
 - $\$5,000 + \$288 =$ **\$5,288**

3. **Cost-Benefit Ratio (10 Years):**

- **Total Benefits (10 Years):** $\$102,410$ (Years 1–5) + $\$125,600$ (Years 6–10) = **\$228,010**
- **Total Costs (10 Years):** $\$56,902$ (Years 1–5) + $\$5,288$ (Years 6–10) = **\$62,190**
- **Cost Benefit Ratio (10 years):**
 - $\$228,010$ (total benefits) / $\$62,190$ (total costs) = **3.67** (CBR)

4. **Key Takeaways:**

- Over 10 years, the system generates **\$3.67 in benefits for every \$1 invested**.
- Net financial return after 10 years: $228,010 - 62,190 = +165,820$

Qualitative Benefits (Not Quantified)

1. **Error Prevention:** Avoiding misapplications could save thousands of dollars per occurrence.
2. **Enhanced Compliance:** Automated record-keeping ensures regulatory compliance, avoiding potential fines.
3. **Operational Resilience:** Faster mixing reduces downtime during critical spraying windows, ensuring timely applications and protecting yield potential.
4. **Adaptability:** Modular design positions the system for future integration with emerging technologies.

Conclusion

The MixMate system delivers measurable financial and operational value with a **Cost-Benefit Ratio (CBR) of 1.80 over 5 years** and **3.67 over 10 years**. The system achieves payback by **Year 4**, and over 10 years, it generates a **net financial return of \$165,820**. Its ability to reduce costs, improve efficiency, and enhance operational resilience makes it an invaluable investment for Jakub Brothers Farms while contributing to the economic vitality of rural Nebraska.