Chapter 55: Developing a Field Soybean Profit Map

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One of the first steps in improving field profitability is to identify portions of fields making and losing money. The purpose of this chapter is to demonstrate a cookbook approach for developing a soybean profitability map.

**Estimating production costs**

Field profitability maps can be used to identify where and when not to invest your limited resources. To develop a field profitability map, the production costs and returns must be calculated. For many fields, the input costs are not variable (the cost for spraying an acre is the same everywhere in the field) and can be assigned equally for every acre in a field. The production input costs can be itemized into:

- **Annual input costs**
  1. **Known variable expenses**
     a. Seed
     b. Fertilizer
     c. Pesticide
     d. Insurance
     e. Crop consulting
  2. **Allocated expenses**
     a. Repairs
     b. Fuel
  3. **Capital Expenses**
     a. Machinery ($/acre, interest + depreciation to annualized, and allocated by acre)
     b. Land ($/acre, known market value for your area)
  4. Labor ($/acre)
  5. Interest and depreciation
Input costs detailed
The annual input costs are calculated from your records. The sample data set shown in Table 55.1 was estimated from students attending Plant Science Agronomy courses at South Dakota State University. For these calculations, the farm size is 778 acres. The annualized per acre machinery cost assumes 6% interest and 7% depreciation for a total annualized cost of 13% of the total machinery value. Divide the annualized cost by the number of acres covered to get annualized per acre cost. This data suggests that soybean inputs costs are $372.75/acre.

The production costs do not consider returns on the investment. For example, the soil sampling cost of $2.50/acre provides the basis for the fertilizer recommendations and provides critical information for where to apply the fertilizer inputs.

Table 55.1. Estimated soybean input costs for a typical South Dakota soybean grower. The farm size is 778 acres.

<table>
<thead>
<tr>
<th>Known Variable Expenses</th>
<th>Amount</th>
<th>Rate</th>
<th>Cost ($/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>1 bag of seed/acre</td>
<td>$52/bag</td>
<td>$52</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>51 lbs P₂O₅/acre</td>
<td>$0.41/lb</td>
<td>$21</td>
</tr>
<tr>
<td>Herbicide</td>
<td>2 Roundup® application/acre</td>
<td>$10/application</td>
<td>$20</td>
</tr>
<tr>
<td>Insecticide (Warrior®, aphids)</td>
<td>1 application of Warrior®</td>
<td>$22/application</td>
<td>$22</td>
</tr>
<tr>
<td>Crop Consulting</td>
<td>$4.50/acre</td>
<td></td>
<td>$4.50</td>
</tr>
<tr>
<td>Soil Sampling</td>
<td>$2.50/acre</td>
<td></td>
<td>$2.50</td>
</tr>
<tr>
<td>Insurance</td>
<td>$19/acre</td>
<td></td>
<td>$19</td>
</tr>
<tr>
<td>Interest</td>
<td>$4.25/acre</td>
<td></td>
<td>$4.25</td>
</tr>
</tbody>
</table>

Allocated Expenses
| Fuel and Lub (average = 5 gal diesel and lub per acre, [i.e., 5110 gal used on 1040 acres]) | 5 gal diesel and lub | $16.50/acre | $16.50 |
| Repairs and parts      | $6/acre            |          | $6         |

Capital Expenses
| Machinery ($227,000 to val, int + dep = 13% over 778 acre. If owned, this will be a cost to the crop but income to separate machinery ownership enterprise.) | $29,510/(farm year) | $38 |
| Land rent (If owned, use known value for similar soil type in area. Will be a cost to raising crop but income to a separate land ownership enterprise.) | $135/acre          | $135 |

Labor
| 70% to crops and 30% to part time job | $35,000/year on 778 acre, 70% to crop | $32 |

Total Cost
| $372.75 |

1. The Roundup Ready® seed was tested and found to contain 2800 seeds/lb. The 50 lb bag cost $52 and contained 140,000 seeds. The field was planted at a rate of 140,000 seeds/acre.
   a. Increasing the seeding rate to 160,000/acre would increase the seeding cost to $59.43/acre, reducing the seeding rate to 120,000 seeds/acre would reduce the costs to $44.57/acre. This cost is likely to increase in the future.

2. When DAP was applied (to the corn prior to the beans) the yield goal was 60 bu/acre. The recommendation was based upon removal of 0.84 lb P₂O₅/bu. (P₂O₅ cost $0.41/lb).

\[
\frac{\$21}{\text{acre}} = \left( \frac{60 \text{bu}}{\text{a}} \right) \times \left( \frac{0.84 \text{lb P}_2\text{O}_5}{\text{bu}} \right) \times \left( \frac{\$0.41}{\text{lb P}_2\text{O}_5} \right)
\]
3. The local Coop applied two applications of generic glyphosate at a billed rate of $10/acre.

4. The local Coop applied one application of Warrior® at a billed rate of $22/acre.

5. The producer hires a crop consultant on an annual basis to make recommendations and to weekly scout his or her fields for $4.50/acre.

6. The crop consultant zone samples the field for $2.50/acre.
   a. 160-acre field, where 10 composite samples are collected.
   b. Total cost per field is $400 (160a × $2.5/a), for a cost of $40/sample, which is collected from a 16-acre area.

7. The producer’s crop insurance was $19/acre.

8. Crop inputs were prepaid with money borrowed from the local bank. The bank loan is at an interest rate of 6%, but the money was borrowed for six months so ½ year of interest was charged.

9. The total bill for all diesel and lubricant from the local BP fuel dealer was $12,840. Since there was no other user of the fuel and lubricants other than the 778 acres of cropland, the bill was divided out evenly across all acres. ($12,840/778 = $16.50)

10. All repairs and parts were purchased from the local John Deere dealer. The John Deere dealer’s year-end summary bill indicated what he spent for parts and repairs ($4670), so $4670/778=$6.00.

11. An inventory of the producer’s machinery that is used only on the 778 acres indicates that it is valued at $227,000. Assume that the farmer’s machinery is depreciating at a rate of 7% per year. Assume that the money to buy the machinery was borrowed at 6% per year, then interest and depreciation costs are 13% per year (7% + 6%). The annual cost for owning the machinery is (0.13×$227,000 = $29,510) and since this farmer uses this machinery to only farm the 778 acres (no livestock or custom work) this cost is evenly divided across the 778 acres. The annualized machinery cost per acre is ($29,510/778 = $37.93≈$38/acre). If owned, this will be a cost to raising the crop, but as income to a separate machinery ownership enterprise.

12. The field in question is rented and the farmer’s rent for the field is $135/acre. If owned, use known value for similar soil type in local area. Will be a cost to raising the crop but income to separate land ownership enterprise.

13. The farmer does all of the work himself. He has a part time job that he assumes accounts for 30% of his time. The rest of his time (70%) is devoted to farming. He feels he could make $35,000/year if he took a job other than farming so ($35,000 × 0.7/778 acres) = $31.50/acre (=32/acre.)

14. Add together each expense to get the total of $372.75/acre.

**Estimated return and profitability**

The estimated return is calculated by multiplying the soybean selling price times the yield. In this example, the soybean selling price was $9.50/bushel and the yield was 55 bushels/acre. Based on these values, the profit for the entire field was $149.75/acre (522.50−372.75=$149.75/acre).

**Developing a profitability map**

A soybean profitability map is developed using Ag Leader SMSTM Advanced Software with detailed map shots provided below. To do this analysis a yield monitor data file is needed.
Open the SMS Advanced program and select a soybean yield file (Fig 55.1). Start first by cleaning the data. A basic data filter can be set for the yield data by highlighting the yield data product under Grain Harvest, then right clicking with the mouse button. Select “Reprocess Data.”

Next, set the filter settings for a minimum and maximum yield (Fig. 55.2). Press “Next.”

Note: A more advanced filtering of the data can be conducted using the USDA Agricultural Research Service “Yield Editor©” software program. The exporting and importing of the yield data will be required between the SMS and Yield Editor programs.

Website: https://www.ars.usda.gov/research/software/?badid=1
Once the dataset has been filtered, a profitability map can be developed. First, open a soybean map in Ag Leader SMS™ Advanced version 12.0 software (Fig. 55.3). Developing the profitability map involves a number of steps that are explained below. Different commercial mapping programs will use different steps, but the purpose in this chapter is to highlight the process of developing a map. The profitability map is very useful for identifying problem areas. For example:

1. Should I install a tile drain?
2. Should I enroll my land in CRP?
3. Should I try precision farming?
4. Should I increase or decrease my cash rent?

Answers to these questions are determined by identifying if there are areas that routinely make or lose money. If they lose money, you can use the approach described below to develop approaches that will make money. In some situations, it may be most profitable to install tile drainage, put the land into pasture, or graze the land.
Figure 55.4. Open Analysis Wizard.

Select Analysis Wizard.

Figure 55.5. Select Equation Based Equations.

Select Equation Based Analysis: Press “Add.”
Enter a name for the Equation Based Analysis. Press “Next.”

Step 1: Press “Add” under Analysis Result 1.
Step 2: Enter: Result Name (Soybean Profit Map): Attribute Group (Expense/Income): Attribute (Profit/Loss): Units ($/ac).

Step 3: Set Result Operation (select Analysis Results).
Figure 55.10. Define Temporary Result variable 1 (Soybean Sell Price).

Step 4. Press Add under Temporary Results: Enter Result Name (Soybean Sell Price): Set Data Type to (Decimal Number): Checkmark (Prompt for Value When Analysis is Run): Press “OK.”
Step 5. Enter a second Temporary Result variable: Enter Result Name (Soybean Cost/Acre): Set Data Type to (Decimal Number): Checkmark (Prompt for Value When Analysis is Run): Press “OK.”

Step 6. Press “Next.”
Figure 55.13. Analysis Input Dataset Main Screen.

Step 7. Press "Add Dataset."

Figure 55.14. Input Dataset is selected from Tree menu structure.

Step 8. Select an appropriate soybean yield dataset from the Management Tree.

Step 10. Enter appropriate grid settings for your dataset.
Step 11. Press “Ok.”

Step 12. Press “Next.”
Step 13. Press “Next.”

Figure 55.21. Add/Edit Equation Variables and Spatial Functions.

Step 15. Select the Input Dataset (Grain Harvest): Attribute (Estimated Volume (Dry)): Attribute Statistic (Grid Value): Units (bu/ac): Press “Add”: Set the Alias name to Soybean_Yield: Press “OK.”
Figure 55.22. Result Equation is defined as shown. Enter using Equation Functions, Constant Values, and Variable Spatial Functions.

Step 16. To enter equation:
Press “Result =”
Press “(”
Press “Soybean_Yield”
Press “*”
Press “Soybean Sell $/bu”
Press “)”
Press “-”
Press “Soybean Cost Acre”

*Note:* “Result=” is the soybean profitability result at each grid area. Press “Finish” to exit Equation Editor.
Figure 55.23. Soybean Profitability Analysis is listed as a saved equation.

Step 17. The “Soybean Profitability” Analysis Function is now available for running on selected fields. Press “Single Field.”
Figure 55.24. Soybean Profitability analysis is started with selection of yield data.

Step 18. The Default yield map appears for profitability analysis. This can be changed to desired field. Press “Next.”
Step 19a. Analysis begins on the desired field. Enter the selling price for the soybean crop.

Step 19b. Enter the cost analysis for the soybean crop.
Step 20. The Soybean Profitability Map appears. Press “Save.”

Figure 55.29. Profitability Map shown with legend set at profitability levels.

Step 22. Set the Legend to your desired settings.

This process has converted a yield map into a map that accounts for financial inputs and outputs. Based on this map you can identify areas that make and lose money. As you travel from right to left across the map, the profitability decreases. In many fields, large portions of the field lose money. Maps such as these can be used to assess profitability across years. If areas consistently lose money, the management practices need to be modified so that they make money. Approaches that should be considered include: installing tile drainage, converting to CRP, increasing or decreasing the seeding or fertilizer rate, and converting to a pasture.

References and additional information
SMS Certified training manual. 2012. SMS Advanced version 12.0. Ag Leader Technology Inc.

Acknowledgements
Funding for developing this chapter was provided by the South Dakota Soybean Research and Promotion Council, USDA-AFRI, and South Dakota 2010 research program.

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