



# AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION

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## Economic Considerations of Pest Management BMPs

Concern about pesticides in drinking water has resulted in a search for pest management approaches that protect water quality. A number of practices (known as Best Management Practices or BMPs) have been identified which can help keep pesticides on the desired target.

Due to the economic risks inherent in agriculture, producers need incentives to change proven ways of doing business. These incentives may include increased profits, decreased costs, cost-share funding, enhanced environmental quality, or even improved public perception. Producers should evaluate the potential environmental benefits versus the costs and returns of BMPs as they determine which practices are most appropriate for their operation. Not all practices are equal in their environmental or economic benefit. This publication is intended to help producers think through some of the economic considerations associated with adopting BMPs.

The adoption of BMPs may require changes from existing management and cultural practices. Economic analysis of these changes involves calculation of the costs and benefits of the new system versus the old. Consideration of BMPs can be a complicated decision; there may not be a single factor by which to judge the appropriateness of any particular BMP. The economic and financial considerations of BMPs are important parts of the decision process.

The complexity of the economic analysis depends on the particular practice and situation being analyzed. The basic partial budgeting framework can be adapted

for any of the BMPs. The calculation of particular costs and returns will be specific to the BMP under consideration and the particular farming situation where it is to be applied. In all cases, only those costs and returns that will be impacted by the change will be relevant to the partial budget decision.

### Categories of BMPs

For purposes of economic analysis, BMPs may be divided into four categories. While the basic economic principles of calculating additional costs

#### BMP Categories

Best Management Practices for pest management may be divided into four categories, depending on which types of changes are involved.

1. Changes in pesticide usage or changes in pest management
2. Changes in crop mix/rotations
3. Changes in tillage practices
4. Changes in or additions of structures

and returns hold for each of the BMP categories, the application of these principles can be quite different. It could be as basic as calculating the cost and returns associated with changing crop variety, or as complicated as calculating the costs and benefits associated with investing in secondary containment structures. Secondary containment structures have a considerable lifetime and involve the economics associated with investment analysis. Economic analysis for each of these categories will be discussed.

■ **Category 1: Changes in pesticide usage or changes in pest management**

The economic assessment of these types of changes is relatively straightforward. The expected benefits for most of these BMPs will be realized fairly quickly, most often in the first production year. Thus, benefits from this type of BMP will be easy for the farm operator to calculate.

Likewise, the costs of implementing BMPs in this category will also occur in the first production year. The economic analysis involves comparing the added costs with the expected benefits in a straightforward application of the partial budgeting process.

**Example: Field Scouting For Pests**

Field scouting to assess pest and crop development is essential to any pest management program. Pest types and infestation levels can be identified before economic thresholds (levels of pest infestation at which it pays to take remedial action) are exceeded. While guidelines have been established for the primary crops and insects, actual economic thresholds vary by pest, crop, crop value, and control costs.

Crop consulting services are an excellent way for farmers to monitor pest levels and determine treatment actions on a field specific basis. Typical costs for such services (pest scouting and irrigation scheduling) in Colorado are \$8 to \$10 per acre. These costs can be recovered by increasing yields by 4.0 bushels of corn per acre (\$2.50 per bushel) or 0.13 tons of alfalfa per acre (\$75.00 per ton). *Pest scouting may allow for fewer pesticide applications while obtaining the same level of pest control; thus, saving the producer money.*

<i>Example Partial Budget for BMP:</i>		<u>Pest Scouting</u>
<b>BENEFITS:</b>		
1. Additional Income	\$	<u>-</u>
2. Reduced Expenses	\$	<u>15.50/A</u> (- 1 pesticide application)
3. Benefits Subtotal (1 + 2)	\$	<u>15.50</u>
<b>COSTS:</b>		
4. Reduced Income	\$	<u>-</u>
5. Additional Expenses	\$	<u>8.00/A</u> (Pest Scouting)
6. Costs Subtotal (4 + 5)	\$	<u>8.00</u>
<b>DIFFERENCE:</b> (Benefits - Costs)	\$	<u>7.50/A</u>

## ■ Category 2: Changes in crop mix/rotations

Crop rotation is one of the most effective pest management tools available to producers. Changes in the mix of crops grown on the farm or the rotation of crops grown will involve a more detailed economic analysis. If new crops are to be grown on the farm, a detailed enterprise budget that allows for the determination of net income from each crop will be required. Enterprise budgeting, while not difficult, can be tedious. CSU Cooperative Extension has procedures available to assist producers with enterprise budgeting. The farm manager will need to know very specific information about the production process and practices required for new crops. The results of the enterprise budgeting activity would then be used in the partial budgeting format to determine the economic impact of the BMP under consideration.

Changes in crop rotations may also involve a two-step economic analysis. The first step would determine the impact on net income of changing rotations. Because rotations occur over time, the analysis needs to make the appropriate adjustments in costs and returns for different years so that they may be compared at the same point in time. The adjusting of time differences is usually referred to as compounding or discounting.

An important consideration in this process is the selection of the appropriate interest rate. The appropriate rate will be a “real” rate of interest rather than a “nominal” rate.

$$\text{Nominal Interest Rate} - \text{Inflation Rate} = \text{Real Interest Rate}$$

The nominal rate is typically considered to be the rate that lenders charge borrowers. A real interest rate of approximately five percent is often used in these calculations. These results would then be used in the partial budgeting analysis to determine the economic impact of BMPs.

## ■ Category 3: Changes in tillage practices

The economic assessment of BMPs in this category will involve the analysis of changes in equipment for most producers. Both economic and financial considerations need to be included in this analysis. The economic analysis will include the consideration of the investment requirements if a change in machinery will be necessary. The financial analysis

will include an evaluation of the cash flow impacts of changes in the machinery complement. Farm managers will want to weigh both of these analyses in their decision regarding the adoption of BMPs in this category. In many cases, changes in tillage practices will also result in changes in inputs such as nutrients and pesticides.

Machinery investment analysis involves the use of compounding and discounting principles in a manner similar to crop rotation decisions. The major difference is that with machinery investment decisions, there are often subsequent replacement decisions that must be considered. With rotations, once in place they may not change. The costs associated with the new machinery complement will be a major portion of the partial budget analysis for these BMPs. Farm managers can still use the partial budget framework for this analysis, but must carefully consider the benefits and the timing of those benefits.

It is essential to examine all inputs that may change when analyzing alternative tillage systems. Input changes may relate to purchased inputs within an enterprise, the addition or deletion of an entire enterprise, or a change in a machinery complement that will impact all crop enterprises on the farm.

### **Example: Band Herbicide Application**

Band application (versus broadcast application) of herbicides requires less total herbicide per crop row, and typically one to two additional tillage operations to achieve optimum weed control. For example, a 15-inch band on 30-inch rows would decrease the herbicide application by half the amount used on a broadcast basis. If one additional cultivation pass costs \$6.00/acre and the herbicide costs \$12.00/acre on a broadcast basis (\$6.00/acre banded), the band application would be “break-even”. More expensive herbicides would result in a cost saving. The herbicide savings must offset additional tillage costs and additional weeds must not reduce crop yields for this BMP to be cost effective.

*Example Partial Budget for BMP:* Band herbicide application

**BENEFITS:**

1. Additional Income	\$ <u>-</u>
2. Reduced Expenses	\$ <u>6.00/A</u> (1/2 rate of herbicide)
3. Benefits Subtotal (1 + 2)	\$ <u>6.00</u>

**COSTS:**

4. Reduced Income	\$ <u>-</u>
5. Additional Expenses	\$ <u>6.00/A</u> (1 additional cultivation)
6. Costs Subtotal (4 + 5)	\$ <u>- 6.00</u>

**DIFFERENCE:** (Benefits - Costs) \$ 0 (Break-even)

■ **Category 4: Changes in or addition of structures**

This category includes those BMPs that involve physical changes to the farm's land base. By their very nature, these are long-term changes and need to be analyzed in that context. There may be both direct and indirect costs associated with these BMPs. For example, the planting of grass buffer strips involves the cost of the seed, planting, and maintaining them. If these strips are planted on ground that was previously cropped, the foregone crop revenue is also a "cost" of grass filter strips and needs to be considered.

The partial budgeting analysis includes this foregone income. Again, for those changes that are expected to have long lifetimes, the principles of discounting and compounding need to be incorporated and the costs of these BMPs should be considered on an annual basis. Any yield increase or loss will need to be taken into account. Cost-share programs are often available for many structural practices. Check with your local USDA Natural Resources Conservation Service office to determine cost-share availability for practices you are considering.

**Information on Best Management Practices**

BMPs for pest management have been developed by CSU Cooperative Extension with help from Colorado producers. Some of these practices and the economic considerations associated with their adoption are listed on the following page. More information on BMPs for irrigation, fertilizer, manure, and pesticide management is available through the CSU Cooperative Extension Resource Center at (970) 491-6198. This fact sheet and the BMPs are also available online at [www.ag.state.co.us/pl\\_industry.html](http://www.ag.state.co.us/pl_industry.html).

**Available BMP Booklets:**

1. An Overview (*Bulletin #XCM-171*)
2. Nitrogen Fertilizer (*Bulletin #XCM-172*)
3. Irrigation Management (*Bulletin #XCM-173*)
4. Manure Utilization (*Bulletin #XCM-174*)
5. Phosphorus Fertilization (*Bulletin #XCM-175*)
6. Pest Management (*Bulletin #XCM-176*)
7. Pesticide Use in Field Crops (*Bulletin #XCM-177*)
8. Pesticide and Fertilizer Storage and Handling (*Bulletin #XCM-178*)
9. Wellhead Protection (*Bulletin #XCM-179*)

Economic Considerations of Best Management Practices for Pest and Pesticide Management	Additional Costs				Potential Returns*
	Management	Labor	Land	Capital	
<b>PEST MANAGEMENT</b>					
Integrated Pest Management (IPM)	✓	✓			+
Pest scouting		✓			+, 0, -
Crop rotation	✓			✓	0
Maintain pest and pesticide records	✓				0
Protect beneficial insects	✓				0
Control volunteer crops and pest over wintering sites		✓			+
Use cultural, biological, mechanical control methods	✓	✓			+
Incorporate economic thresholds into pest management decisions	✓				+
Use clean planting materials and pest resistant varieties				✓	+
<b>PESTICIDE MANAGEMENT</b>					
Read and follow all label instructions	✓				0
Select chemicals least likely to impact water or non-target species	✓				0
Mix, load, and store pesticides away from water supplies	✓				0
Rotate chemicals with different modes of action	✓				+
Band/spot pesticide application		✓			+
Avoid runoff and leaching during chemigation	✓				0
Establish pesticide application setbacks from water sources			✓		-
Purchase and mix only the amount of pesticide needed	✓				+
Do not dispose of pesticides or empty containers on the farm	✓				0
Construct secondary containment and mixing pads			✓	✓	-

\* Returns will be site, crop, pest, and climate specific

+ = potential positive return

0 = no additional return expected

- = additional costs with no additional returns expected

## Partial Budget Form

### BENEFITS:

1. Additional Income: \$ \_\_\_\_\_  
List the items of increased or additional income from the BMP plan
2. Reduced Expenses: \$ \_\_\_\_\_  
List the expenses that will be avoided by implementing the BMPs
3. Benefits Subtotal (1 + 2) \$ \_\_\_\_\_

### COSTS:

4. Reduced Income: \$ \_\_\_\_\_  
List the lost income that will not be received from the BMP plan
5. Additional Expenses: \$ \_\_\_\_\_  
List the additional items of expense from the BMP plan that are not required with the base plan. Cost-share or incentive programs may reduce some of these expenses.
6. Cost Subtotal (4 + 5) \$ \_\_\_\_\_
7. DIFFERENCE (Benefits - Costs) \$ \_\_\_\_\_

A positive difference indicates that the net income from the BMP plan exceeds the net income of the base plan by the amount shown. A negative difference indicates that the net income from the BMP plan is less than the net income of the base plan by the amount shown. Net returns in the partial budget analysis should not be confused with a full economic analysis. A negative difference does not necessarily mean the operation is not profitable, but rather the BMP plan is less profitable than the base plan.

In using the partial budgeting approach, it is not necessary to have entries in each of the partial budgeting categories. For example, some BMPs may only affect expenses, not gross income levels. Producers should not expect that all BMPs will have a positive effect on net returns, especially short-term returns. Economic considerations are among the many criteria in the decision to adopt any particular BMP. Thus, some BMPs that reduce income may be implemented if producers decide that other factors are "worth the cost."