



A nutrient management approach for Pennsylvania: Exploring performance criteria

The focus of nutrient management is rapidly evolving from optimizing agronomic production and economic returns of crop production to balancing farm production with environmental protection. Discovery of limiting factors, creativity in developing and delivering the needed materials or information, and confidence in the projected outcomes of improved soil fertility formed the basis for crop production and economic successes of the past. Scientists, farmers, educators, and industries must respond to the new expectations for environmental protection in many of the same ways.

Previous fact sheets in the series *A Nutrient Management Approach for Pennsylvania* (Penn State Agronomy Facts 38-A, B, and C) emphasize the need for a comprehensive approach to nutrient management. This approach is based on understanding the changes in the nutrient supplies that have occurred since World War II, and the potential role of contemporary management decision-making in accommodating the increasing array of expectations.

A key feature of this approach is a decision-making process by farmers that includes farm planning, plan implementation, implementation assessment, and management option selection for the next plan. This process is facilitated by the appropriate technical support, and its success is measured by performance criteria (Figure 1). By

using the full range of performance criteria formats to guide nutrient management, farmers and society can balance expectations for both farm production and environmental protection.

PERFORMANCE CRITERIA

Performance criteria emphasize nutrient management results. This results-oriented approach is more comprehensive than simply implementing specific practices that are presumed to fix the perceived problems, or strict adherence to prescribed procedures that are the “right” things to do. A performance criteria system can be a set of results for farm production and environmental protection.

A performance criteria system should be considered the ‘eyes’ of management. If it is not properly established, it will impair management’s ‘vision,’ thus reducing the probability of proper response for different circumstances.

S. Globerson, 1985
Business Management Specialist

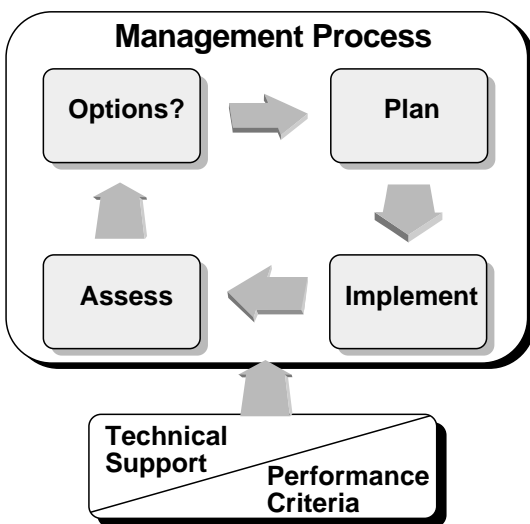
Although this specialist was referring to an industrial operation, his description can be adapted to nutrient management. He also stated:

Realization of potential improvement...depends on the existence of a feedback system that provides performance information.

A feedback system is part of the nutrient management approach described in this series. Any part of the process, such as planning, implementation, or assessment, can be evaluated and feedback created to improve the performance.

Opportunities for performance evaluation can occur at the input stage, during the process, or at the output stage of the process (Figure 2 next page). For instance, input information, such as manure analyses, may be missing when a nutrient management plan is being developed. It is generally possible to improve the planning process if that information is available. Successful evaluation at any stage relies heavily on the development of performance criteria and recognized standards for each criterion. These criteria and standards will tell the participants whether the process is on track. In the example of the nutrient management plan, accounting for the nutrients from manure to meet crop needs is an important criterion. The acceptability of a

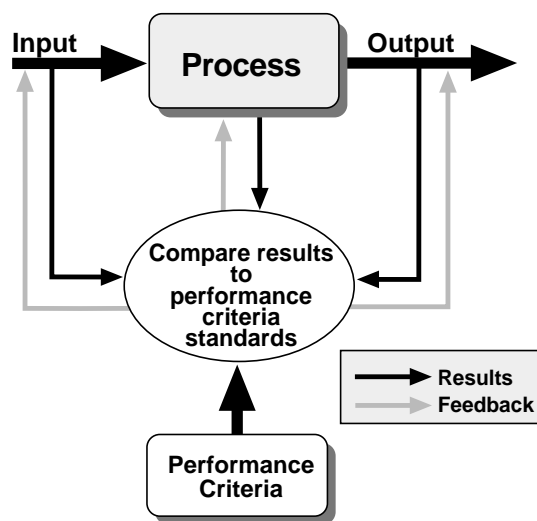
Figure 1. The basic management process that identifies the role of performance criteria.



reference or book value for the manure nutrient concentration instead of an analysis is a standard for that criterion.

All performance criteria do not have the same format. Some, such as specifications, focus on the details; others, often referred to as outcomes, can be quite general. An intermediate performance criteria format is the design criteria. This range in characteristics of performance criteria is similar to the range in the types of management from the broad perspective of strategic management to the very focused operational management (Table 1). In many cases, the different formats correspond to different management levels (Table 2).

Figure 2. Comparing process results to performance criteria standards.



PERFORMANCE CRITERIA FORMATS

Specifications

Specifications are very focused, precise, detailed prescriptions for performance. These will generally apply to tasks for managers or staff when there is little uncertainty about the expectations, the probability of success is high, or there is widespread agreement among all the stakeholders in the specifications. In nutrient management, specifications can be applied to prohibit the application of manure within 100 feet of an open sinkhole if the water flow is toward the sinkhole, or within 100 feet of a private drinking water source, etc. However, other nutrient management activities may not be as certain, or may depend on unique factors that influence the appropriateness of a particular specification. For instance, requiring immediate incorporation of field-applied manure may not be a specification that contributes to the reduction of nitrate leaching from farm fields and may be unnecessarily restrictive.

Since specifications are so detailed, compliance with the criteria requires correspondingly detailed information and follow-through. The mechanism to assure society that its interests are being met can be similar to a command and control situation where little flexibility is allowed for the on-site manager (Table 3). If specification criteria are

perceived to be unrealistic when all the other factors that determine successful farm management are considered, achieving voluntary compliance with them may be difficult. Enforcing compliance under these circumstances may require some type of inspection or surveillance process that could be burdensome or technically difficult.

Table 1. General description of the various management levels.

MANAGEMENT LEVEL	DESCRIPTION OF MANAGEMENT LEVEL
Strategic	Top management focuses on the goals of production using external information to make decisions for the future.
Tactical	Middle management develops implementation plans for annual or multiple-year periods to allocate the available resources for meeting the strategic goals.
Operational	Supervisors and staff implement tactical management plans through daily to annual activities by using internal resources based on historically successful actions.

Table 2. The relationship of the various management levels to the comparable performance criteria formats.

MANAGEMENT LEVEL FORMAT	PERFORMANCE CRITERIA FORMAT
Strategic	Outcome
Tactical	Design
Operational	Specification

Table 3. The relationship of performance criteria formats to assurance mechanisms.

PERFORMANCE CRITERIA	ASSURANCE MECHANISM
Outcome	Change in "ethic"
Design	Regulatory review
Specification	Command and control

Design

Design criteria provide regulatory guidelines for a process or activity without prescribing in detail what should be done. Design criteria allow management flexibility in meeting guidelines for a process. Following design criteria implies that if the process occurs according to the expected guidelines, the results will be achieved without additional specification. Managers will generally try to develop tactical plans that rely on appropriate tasks to meet the guidelines. For instance, "nitrogen shall be applied only in amounts necessary to achieve realistic crop yields" (from the "Pennsylvania Nutrient Management Rules and

Regulations,” issued by Pennsylvania Nutrient Management Advisory Board, Harrisburg, Pennsylvania) is a guideline to be used in the development of nutrient management plans. It reflects the goal of balancing available nitrogen with potential crop utilization. When nitrogen is managed this way, the losses to the environment through nitrate leaching are reduced from the situation in which available nitrogen exceeds crop use.

Guidelines often are more accommodating to individual situations than are specifications. Further, a guideline can accommodate some creativity by those involved in a management activity rather than constrain them to a preset condition. But a guideline such as nutrient balance may not always be incorporated into a complete business plan by an individual farmer.

Ensuring compliance with guidelines can involve monitoring of the management planning process. Reviewing plans or requiring them to be available upon request are corresponding mechanisms for enforcement of the planning process (Table 3). However, there can be a limit to the success of a nutrient management program in achieving the anticipated outcomes if it relies on plans that are not implemented. There can be a tendency to prioritize activities that favor optimizing agronomic production and economic returns from crop production rather than activities balancing farm production with environmental protection. The goals to protect the environment often are unrewarded in the existing business climate, especially when increased production is necessary for survival.

Outcome

Performance criteria that emphasize outcomes focus on accountability rather than prescribed practices or regulatory guidelines. The goal of nutrient management to protect the environment refers to controlling the loss of nitrogen or phosphorus from agricultural soils. A performance outcome could be a certain number of pounds of either nutrient lost from a farm during a given time period. However, such an outcome would be difficult, if not impossible, to measure on a routine basis. An alternative would be to select another criterion that could represent the potential for the nutrient loss and could be monitored more successfully.

Agronomic research has shown that nutrient losses from agricultural fields usually increase as the nutrients supplied exceed what the crops use. Therefore, to protect the environment from excessive nutrient loading, an outcome of balanced nutrient loading could be established. The ways in which farmers would accomplish this balance would not be rigidly specified. This performance format can challenge and stimulate the creativity of those involved. One farmer might decide to manage the manure and other nutrient sources very closely and to consistently achieve crop yield goals. Another farmer might decide to sell all manure from the farm and purchase fertilizer that supplies only the needed nutrients and amounts. Both of these tactics would be consistent with the strategic management of the farm operation to balance farm production

and environmental protection. If a particular tactical plan developed under the strategic goal involved field application of manure, then following the specifications for spreading would be required. But the specifications would support the implementation of the farm strategy rather than constrain every operation.

Compliance with performance outcomes could involve some mechanism to assure society that actual farm activities are meeting the environmental goals. For instance, reporting nutrient inputs and outputs might be an appropriate compliance technique. This would avoid some of the detailed compliance requirements to meet specifications. It would reflect actual implementation rather than only intentions for nutrient management as described in a tactical plan. Outcomes could become part of strategic farm management so that as the actual activities are planned and prioritized during implementation, the broad goals of protecting the environment would be automatically balanced with the goals of farm production. Thus, achieving environmental protection outcomes would be just as much a part of strategic management as is profitable farm production. It would reflect a change in the business ethic that guides total farm management (Table 3). This environmentally sensitive ethic would be reinforced by the other management messages the farmer receives from society.

Strategic management is a responsibility of the farmer when operating in the role of top management. It is a goal-oriented function that relies heavily on external information to plot the future direction of the farm (Table 1). Selecting strategies also is very much an outward-looking activity. In contrast to these broad-based and externally focused activities, specifications depend much more on internal farm resources and capabilities. To influence strategic management, the conditions surrounding the farm must be consistent with the anticipated direction of change. Such change does not originate on the farm, but is an outgrowth of a new conditions in the surroundings of the farm. Thus, change at this level depends on many other stakeholders revising their perspectives and actions, not just a response by an individual farmer. Therefore, for farm managers to include strategic outcomes in their business plans, they must have effective information and incentives from off the farm. Whereas complying with specifications can require intensive monitoring, ensuring compliance with strategies that are routinely reinforced can require relatively little monitoring. The strategies become part of the performance portfolio as the overall farm business plan is developed, in contrast to design guidelines or specifications that may be in conflict with the plan.

INCENTIVES

Off-the-farm incentives to balance farm production with environmental protection must be developed and communicated to the top management of Pennsylvania farms if strategic changes in farm performance are expected. A variety of positive incentives through tax credits for specific accomplishments, market recognition for achieving particular performance standards, or even “green” pay-

ments for certain environmentally friendly activities could be developed. These would reflect the importance the citizens of Pennsylvania place on balancing farm production with environmental protection. They would communicate directly with the farm managers in a proactive way. Since many Pennsylvania farm products are not consumed in Pennsylvania, some of these incentives could be communicated through market assurance programs for the ultimate consumers. These programs would let others know about the effort Pennsylvania is investing in balancing farm production with environmental protection. Public resources could be invested in these positive activities rather than attempting to penalize farmers who have not complied with rigid specifications for individual operations.

SUMMARY

This fact sheet describes different types of performance criteria: specification, design, and outcome. The criteria are linked to the corresponding levels of nutrient management,

and to mechanisms for assuring society that the environment is being protected. By selecting the appropriate format of performance criteria for the desired change in farms to balance farm production with environmental protection, programs can be developed that are easy to monitor, that effectively control the impact of farm activities on the environment, and that involve off-farm stakeholders in the management process.

This fact sheet is an addition to the set entitled, Agronomy Facts 38-A, *Introduction to the Concepts*; Agronomy Facts 38-B, *Plant Nutrient Stocks and Flows*; and Agronomy Facts 38-C, *Nutrient Management Decision-Making*. These fact sheets are available from the Publications Distribution Center, 112 Agricultural Administration Building, University Park, PA 16802-2602.

Prepared by L.E. Lanyon, associate professor of soil fertility.

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