

Nutrient Management Examination Competency Areas

Commercial and Public Specialists

The competency areas in this listing were developed according to the requirements of Pennsylvania's Nutrient Management Specialist Certification Program. If a person understands the subject matter described in these competency areas and successfully completes the required trainings, examination and plan writing requirements, they will have demonstrated their technical knowledge and experience relating to nutrient management planning and plan development.

These competency areas function as a guide to assist persons in completing the examination and certification requirements of the program. Questions on the examination are developed from the competency area subjects. Candidates for certification have the responsibility to study the documents in addition to attending the required trainings to prepare themselves for the examination.

Each item in the competency area is cross-referenced to applicable trainings and reference sources offered by the Act 38 Nutrient Management Program. Most of the referenced publications are available on the Pennsylvania Nutrient Management Program website (<https://extension.psu.edu/programs/nutrient-management>).

Mandatory Certification Trainings: Nutrient Management Orientation (NMO), Managing Manure Nutrients Workshop (MMN), Plan Writing Workshop (PWW), ACA & Manure Storage Workshop (AMS), Stormwater & Soil Loss Workshop (SSL), P Index Workshop (PIW), Plan Review Workshop (PRW)

Non-Mandatory Background Trainings: Introduction to Livestock Production Systems (LPS), Soils, Hydrology and Liquid Manure Workshop (SLM)

Non-Mandatory Background Webinars: Understanding Horse Farms (HOR), AG 101: Understanding PA Farm Operations (PAF)

Pennsylvania's Nutrient Management Program

1. Understand the purpose and goals of Pennsylvania's Nutrient Management Act Program. (NMO)
 - Act 38 of 2005
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)
2. Understand who is affected by the Nutrient Management Act Program. (NMO, MMN)
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)
 - Agronomy Facts 40: Nutrient Management Legislation in Pennsylvania: A Summary of the 2006 Regulations
 - Agronomy Facts 54: Pennsylvania's Nutrient Management Act (Act 38): Who Is Affected?

3. Know the required components of a nutrient management plan. (NMO, PWW)
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)
 - Agronomy Facts 40: Nutrient Management Legislation in Pennsylvania: A Summary of the 2006 Regulations
 - Agronomy Facts 60: Nutrient Management Planning: An Overview
4. Understand Nutrient Management Plan approval and implementation requirements. (NMO, PRW)
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)
 - Agronomy Facts 40: Nutrient Management Legislation in Pennsylvania: A Summary of the 2006 Regulations
5. Understand the educational, technical and financial resources available under the Nutrient Management Act. (NMO)
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)
 - Agronomy Facts 40: Nutrient Management Legislation in Pennsylvania: A Summary of the 2006 Regulations
6. Understand the basic requirements of other related Pennsylvania laws and programs such as the Clean Streams Law, Concentrated Animal Feeding Operations (CAFO), Manure Management, Agriculture Erosion & Sediment Control, and their relationships with the Nutrient Management Act. (NMO)
 - Pennsylvania Nutrient Management Program Website: Manure Management Manual Program; Related Programs

Animal Agricultural Systems

1. Understand the different types of production and management systems for dairy, beef, swine, poultry, veal, and horses in Pennsylvania. (LPS, HOR, PAF)
 - The Joy of Farm Watching
2. Understand how manure is managed in these different livestock and poultry production systems. (LPS, HOR, PAF)
3. Understand the key environmental issues related to the Pennsylvania's livestock and poultry industries. (LPS, HOR, PAF)
 - Agronomy Facts 38B: Nutrient Management Approach for Pennsylvania: Plant Nutrient Stocks and Flows
 - Nutrient Budgets for Pennsylvania Cropland: What Do They Reveal and How Can They Be Used?

General Crop Production

1. Know the acceptable methods of determining crop yields. (NMO, MMN)

- The Penn State Agronomy Guide (current edition) – Soil Management: The Soils of Pennsylvania; Table 1.1-1
 - Estimating Forage Yields For Pastures
2. Understand the concept of diminishing returns to production inputs. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Plant Nutrients; Soil Testing
 3. Recognize the economic and environmental importance of choosing the appropriate planning crop yield. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Plant Nutrients; Soil Testing
 4. Understand the basic nutrient uptake patterns for common crops. (MMN)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
 - Agronomy Facts 13: Managing Phosphorus for Crop Production
 - Agronomy Facts 14: Managing Potassium for Crop Production

Basic Soil Science

1. Recognize soil physical characteristics and how they relate to potential soil productivity and crop suitability. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Management: The Soils of Pennsylvania; Soil Health
2. Understand how to use soil survey data and maps in nutrient management planning. (SSL)
 - The Penn State Agronomy Guide (current edition) – Soil Management: The Soils of Pennsylvania
 - PAOneStop: Farm Mapping and E&S Planning System
 - County Soil Survey (PA NRCS Published Soil Surveys for Pennsylvania)
3. Understand how soil texture affects water infiltration and runoff. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Management: Soil Health
4. Understand cation exchange capacity (CEC), soil solution, and their relationships. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Management: Soil Health

Soil Sampling and Analysis

1. Know how to properly sample and submit soil samples for a soil test. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing
2. Know how to interpret the items on a soil test report and how nutrient availability of “Below Optimum, Optimum, and Above Optimum” relates to the likely crop response of applying a given nutrient. (MMN)

- The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing
3. Understand how soil test recommendations are made. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing
 - Soil Test Recommendations Handbook for Agronomic Crops
 4. Understand the Pre-Sidedress Soil Nitrate, Chlorophyll Meter, and Late Season Stalk Nitrate tests and the procedures for their appropriate use. (MMN)
 - Agronomy Facts 17: Pre-sidedress Soil Nitrate Test for Corn
 - Agronomy Facts 53: The Early-Season Chlorophyll Meter Test for Corn
 - Agronomy Facts 70: Late Season Cornstalk Nitrate Test
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing

Soil Fertility

1. Understand relative mobilities of nutrients in soils. (MMN)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Plant Nutrients
2. Understand the causes of soil acidity and how it affects crop growth. (MMN)
 - Agronomy Facts 3: Soil Acidity and Aglime
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Plant Nutrient Recommendations Based on Crop Removal
3. Recognize how pH affects nutrient availabilities. (MMN)
 - Agronomy Facts 3: Soil Acidity and Aglime
4. Know how to determine lime requirements from a soil analysis report. (MMN)
 - Agronomy Facts 3: Soil Acidity and Aglime
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Plant Nutrient Recommendations Based on Crop Removal
5. Know the major nitrogen forms and how they behave in the soil/plant/environment system, i.e. N_2 , NH_4^+ , NO_3^- , Organic N, NH_3^- (MMN)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
6. Know the main transformations between nitrogen forms and the conditions necessary for their occurrence, i.e. mineralization, nitrification, immobilization, denitrification, volatilization. (MMN)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
7. Understand relative atmospheric loss of various N fertilizer sources if surface applied. (MMN)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Plant Nutrient Recommendations Based on Crop Removal

8. Understand and describe ways that nitrogen is lost from the soil. (MMN)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
9. Understand the basic nitrogen management strategies for the common agronomic crops, i.e. rates, timing, application (placement, band, broadcast). (MMN, PWW)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
 - Agronomy Facts 76: Nutrient Management to Improve Nitrogen Use Efficiency and Reduce Environmental Losses
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing
10. Know the major phosphorus forms and how they behave in the soil/plant/environment system, i.e. organic P, mineral P, soluble P (ortho phosphate, PO_4). (MMN)
 - Agronomy Facts 13: Managing Phosphorus for Crop Production
 - Managing Phosphorus for Agriculture and the Environment
11. Know the main transformations between phosphorus forms and the conditions necessary for their occurrence, i.e. fixation, release, pH effects. (MMN)
 - Agronomy Facts 13: Managing Phosphorus for Crop Production
 - Managing Phosphorus for Agriculture and the Environment
12. Describe ways that phosphorus is lost from the soil. (MMN)
 - Agronomy Facts 13: Managing Phosphorus for Crop Production
 - Managing Phosphorus for Agriculture and the Environment
13. Understand the basic phosphorus management strategies for the common agronomic crops, i.e. rates, timing, application (placement, band, broadcast). (MMN, PIW, PWW)
 - Agronomy Facts 13: Managing Phosphorus for Crop Production
 - Managing Phosphorus for Agriculture and the Environment
 - The Pennsylvania Phosphorus Index: Version 2
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing
14. Know the major potassium forms and how they behave in the soil/plant/environment system, i.e. mineral K, exchangeable K^+ , and soluble K^+ . (MMN)
 - Agronomy Facts 14: Managing Potassium for Crop Production
15. Know the main transformations between potassium forms and the conditions necessary for their occurrence, i.e. cation exchange. (MMN)
 - Agronomy Facts 14: Managing Potassium for Crop Production
16. Understand the basic potassium management strategies for the common agronomic crops, i.e. rates, timing, application (placement, band, broadcast). (MMN, PWW)
 - Agronomy Facts 14: Managing Potassium for Crop Production
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing

17. Understand appropriate timing and placement of nitrogen, phosphorus and potassium fertilizers for environmental and agronomic reasons. ([MMN](#), [PIW](#), [PWW](#))
 - [Agronomy Facts 12: Nitrogen Fertilization of Corn](#)
 - [Agronomy Facts 13: Managing Phosphorus for Crop Production](#)
 - [Managing Phosphorus for Agriculture and the Environment](#)
 - [Agronomy Facts 14: Managing Potassium for Crop Production](#)
 - [Agronomy Facts 51: Starter Fertilizer](#)
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Plant Nutrient Recommendations Based on Crop Removal](#)
18. Understand basic fertilizer calculations relating grades and quantities to per acre application rates for N, P₂O₅, and K₂O. ([MMN](#), [PWW](#))
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Plant Nutrient Recommendations Based on Crop Removal](#)

Manure Production and Nutrient Characteristics

1. Understand the concept of "nutrient balance" on a given farm related to feeds, fertilizer, biosolids and export of crops and how this affects the planning process for a farm. ([NMO](#), [MMN](#), [PWW](#))
 - [Agronomy Facts 38B: Nutrient Management Approach for Pennsylvania: Plant Nutrient Stocks and Flows](#)
 - [Nutrient Budgets for Pennsylvania Cropland: What Do They Reveal and How Can They Be Used?](#)
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Manure Nutrient Management](#)
2. Calculate manure volume generated from animal inventories. ([MMN](#), [PWW](#))
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Manure Nutrient Management](#)
3. Understand factors that cause differing manure nutrient concentration between farms. ([MMN](#), [PWW](#))
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Manure Nutrient Management](#)
4. Recognize the relative macronutrient concentration of manures from varying livestock species (ex: swine vs. poultry vs. dairy). ([MMN](#), [PWW](#))
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Manure Nutrient Management](#)

Manure Sampling and Analysis

1. Understand the sources and extent of variation in a manure storage. ([MMN](#), [PWW](#))
 - [The Penn State Agronomy Guide \(current edition\) – Soil Fertility Management: Manure](#)

Nutrient Management

2. Know proper manure sampling techniques and the importance of proper handling and shipping of samples. (MMN)
 - Agronomy Facts 69: Manure Sampling for Nutrient Management Planning
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
3. Know how to interpret items on a manure analysis report. (MMN, PWW)
 - Using the Penn State Manure Analysis Report (MA-1)

Manure Allocation and Application

1. Calculate nutrient availability from manures using appropriate reference manuals. (MMN, PWW)
 - Using the Penn State Manure Analysis Report (MA-1)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
2. Know how to calculate spreading rates based on spreader calibration and manure test values. (MMN, PWW)
 - Agronomy Facts 68: Manure Spreader Calibration
 - Using the Penn State Manure Analysis Report (MA-1)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
3. Understand proper timing, placement and application methods of manures for land application. (MMN, PWW)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
4. Understand volatilization losses of manure nitrogen from differing application methods. (MMN, PWW)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
5. Understand how to prioritize fields for manure applications. (MMN, PWW)
 - Agronomy Facts 60: Nutrient Management Planning: An Overview
6. Calculate manure nitrogen residuals from previous manure applications. (MMN, PWW)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
7. Calculate legume nitrogen residuals. (MMN, PWW)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Soil Testing

8. Understand relative levels of nutrients in manures as compared to crop removal of nutrients. (MMN, PWW)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
 - Managing Phosphorus for Agriculture and the Environment
9. Understand agronomic and environmental advantages and disadvantages of manure incorporation. (MMN, PWW)
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
10. Understand the forms of nitrogen in manure as related to plant availability. (MMN)
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
11. Know how to calibrate both liquid and solid manure spreaders and the different acceptable methods used. (MMN)
 - Agronomy Facts 68: Manure Spreader Calibration
 - The Penn State Agronomy Guide (current edition) – Soil Fertility Management: Manure Nutrient Management
12. Understand soil factors affecting application limits of liquid manures. (MMN, PWW)
 - Irrigation of Liquid Manures (F-254)
13. List alternatives for dealing with excess manure. (NMO, PWW)
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)

Manure Storage and Handling

1. Understand benefits and drawbacks of manure storage. (AMS)
2. List the various types of manure storage facilities and the essential characteristics of each. (AMS)
 - Pennsylvania Farm-A-Syst: Worksheet 9 – Animal Waste Storage and Management
3. Understand how to evaluate the adequacy of existing manure storage facilities. (AMS)
 - Pennsylvania Farm-A-Syst: Worksheet 9 – Animal Waste Storage and Management
4. Understand the concept of setback distances, waivers, and how they are evaluated. (NMO)
 - Nutrient Management Rules and Regulations (25 PA Code Ch. 83)
 - Pennsylvania Farm-A-Syst: Worksheet 9 – Animal Waste Storage and Management
5. Know safety and risk concerns associated with manure storage facilities. (AMS, LPS)

- [Confined Space Manure Storage Hazards](#)
 - [Confined Space Manure Storage Emergencies](#)
 - [Confined Space Manure Storage Gas Monitoring](#)
 - [Non-Enclosed Manure Storage Safety Tips](#)
6. Know the essential components of a contingency plan. ([NMO](#), [AMS](#))
 7. Understand how manure storage affects nutrient concentrations of manure. ([MMN](#))
 8. Understand the application limitations of various manure spreaders. ([AMS](#), [SLM](#))

Environmental Management

1. Describe areas that may be environmentally sensitive to manure applications. ([PWW](#), [PIW](#))
 - [Nutrient Management Rules and Regulations \(25 PA Code Ch. 83\)](#)
 - [Pennsylvania Farm-A-Syst: Worksheet 10 – Animal Waste Land Application Management](#)
2. Know nitrogen loss mechanisms to surface water and groundwater and approaches to minimizing these losses. ([MMN](#))
 - [Agronomy Facts 12: Nitrogen Fertilization of Corn](#)
3. Understand effects of high levels of nitrogen in surface water and groundwater. ([MMN](#))
 - [Agronomy Facts 12: Nitrogen Fertilization of Corn](#)
4. Know phosphorus loss mechanisms to surface and groundwater and approaches to minimizing these losses. ([MMN](#), [PIW](#))
 - [Managing Phosphorus for Agriculture and the Environment](#)
 - [Agronomy Facts 13: Managing Phosphorus for Crop Production](#)
 - [Pennsylvania Phosphorus Index: Version 2](#)
5. Understand effects of high levels of phosphorus in surface water. ([MMN](#), [PIW](#))
 - [Managing Phosphorus for Agriculture and the Environment](#)
 - [Agronomy Facts 13: Managing Phosphorus for Crop Production](#)
6. Understand the basis of the Pennsylvania Phosphorus Index and how to use the Index in nutrient management planning. ([PIW](#))
 - [The Pennsylvania Phosphorus Index: Version 2](#)
7. Recognize how sinkholes and other limestone and Karst features relate to groundwater contamination. ([NMO](#), [MMN](#))
 - [A Quick Guide to Groundwater in Pennsylvania](#)
 - [Sinkholes in Pennsylvania](#)
8. Recognize the importance of cover crops and crop residues. ([MMN](#))
 - [A Conservation Catalog: Practices for the Conservation of Pennsylvania's Natural](#)

Resources

9. Understand "point" and "non-point" source pollution. ([NMO](#))

Animal Concentration Areas Management

1. Know how to identify animal concentration areas and pasture congregation areas. ([AMS](#))
2. Understand how to evaluate animal concentration areas and associated management and identify inadequate manure management practices and conditions. ([AMS](#))
 - Pennsylvania Farm-A-Syst: Worksheet 4 – Animal Concentration Areas Management
 - Pennsylvania Farm-A-Syst: Worksheet 5 - Milkhouse Waste Management
 - Pennsylvania Farm-A-Syst: Worksheet 6 - Stream & Drainageway Management
 - Pennsylvania Farm-A-Syst: Worksheet 8 – Silage Storage Management
3. Know the BMPs available to address inadequate manure management practices and conditions and understand how to select the appropriate BMP options to correct these problems. ([AMS](#))
 - A Conservation Catalog: Practices for the Conservation of Pennsylvania's Natural Resources
 - PA NRCS Field Office Technical Guide (FOTG) – Section IV

Stormwater Management

1. Understand stormwater runoff and management on crop fields and pastures. ([SSL](#))
 - The Penn State Agronomy Guide (current edition) – Soil Management: Soil Erosion; Water Erosion; Tillage Erosion
2. Describe the two common types of stormwater runoff and the type of erosion associated with each. ([SSL](#))
 - The Penn State Agronomy Guide (current edition) – Soil Management: Soil Erosion; Water Erosion; Tillage Erosion
3. Understand how sediment and nutrient pollution to surface water can result from each type of stormwater runoff. ([SSL](#))
 - The Penn State Agronomy Guide (current edition) – Soil Management: Soil Erosion; Water Erosion; Tillage Erosion
 - Agronomy Facts 12: Nitrogen Fertilization of Corn
 - Agronomy Facts 13: Managing Phosphorus for Crop Production
 - Managing Phosphorus for Agriculture and the Environment
4. Understand how to evaluate crop fields and pastures for the adequacy of existing runoff control practices and identify critical runoff problem areas. ([SSL](#))
 - Pennsylvania Farm-A-Syst: Worksheet 11 – Soil Conservation Management

5. Understand the physical factors, most of which can be observed, causing the critical runoff problem areas. [\(SSL\)](#)
 - The Penn State Agronomy Guide (current edition) – Soil Management: Soil Erosion; Water Erosion; Tillage Erosion
6. Know the BMPs available to address critical runoff problem areas and understand how to select the appropriate BMP options to address these problems. [\(SSL\)](#)
 - A Conservation Catalog: Practices for the Conservation of Pennsylvania's Natural Resources
 - PA NRCS Field Office Technical Guide (FOTG) – Section IV
7. Know the common conditions that may be observed that would reflect the need for maintenance of existing BMPs. [\(SSL\)](#)
 - Pennsylvania Farm-A-Syst: Worksheet 11 – Soil Conservation Management
 - PA NRCS Field Office Technical Guide (FOTG) – Section IV