MID-ATLANTIC REGION CERTIFIED CROP ADVISER

PERFORMANCE OBJECTIVES

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MID-ATLANTIC CERTIFIED CROP ADVISER (CCA) PROGRAM

PERFORMANCE OBJECTIVES

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List of Acronyms Used in this Document

AFO	Animal Feeding Operation
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CEC	Cation Exchange Capacity
CES	Cooperative Extension Service
CNMP	Comprehensive Nutrient Management Plan
C:N	Carbon to Nitrogen Ratio
EPA	Environmental Protection Agency
ET	Evapotranspiration
FOTG	Field Office Technical Guide
FSA	Farm Service Agency
NHCP	National Handbook of Conservation Practices
NPPH	National Planning Procedures Handbook
NRCS	Natural Resource Conservation Service
OM	Organic Matter
RD	Rural Development (USDA)
RUSLE2	Revised Universal Soil Loss Equation 2
SOM	Soil Organic Matter
SSURGO	Soil Survey Geographic Database
SWCD	Soil and Water Conservation District
TSP	Technical Service Provider
USDA	United States Department of Agriculture
WEPP	Water Erosion Prediction Project

Soil and Water Management Competency Areas

Competency Area 1. Basic Biological, Chemical and Physical Properties

1. Know the primary processes of soil formation in the Mid-Atlantic Region and be able to distinguish between the following including their parent materials and characteristics.
    a. Piedmont
    b. Coastal Plain
    c. Allegheny Plateau
    d. Ridge and Valley
2. List typical soil textures common to the Mid-Atlantic Region.
3. Understand soil and subsoil textures and how they affect:
    a. pesticide rates,
    b. drainage class,
    c. permeability,
    d. N movement/risk factors.
4. Understand and be able to find/use the information available in a soil survey.
    a. Productivity
    b. Soil characteristics
    c. Water holding capacity
    d. Hydrology
    e. Crop suitability
    f. Erosion potential (slope)
    g. Familiar with symbols used in a soil survey (soil series, percent slope)
5. Explain CEC and how it is affected and effects soil properties.
    a. Texture
    b. Organic matter (increasing vs decreasing OM)
    c. Fertility/nutrient holding
    d. Effects of Tillage
    e. pH
8. Understand and explain the importance of soil pH on soil properties.
9. Soil structure:
    a. kinds,
    b. aggregation and the relationship with soil biology/ecology,
    c. recognize difference with texture,
    d. management including tillage,
    e. structure within the soil profile,
    f. differences in bulk density, porosity.

10. Recognize different types of soil structure and how structure can affect root growth and structure, water movement, and movement of nutrients and pesticides.
11. Describe how each of the following factors affects soil structure:
    a. compaction:
        i. know effects of soil compaction on soil physical, chemical and biological properties.
        ii. explain the influence of axle load and contact pressure on compaction.
        iii. know the importance of soil moisture content for compaction.
        iv. know how soil texture and corresponding structure influences soil compaction.
        v. know how soil compaction can influence soil structure.
        vi. know strategies to reduce subsoil compaction.
        vii. know strategies to reduce surface compaction.
        viii. know strategies to make soil environment more resistant to compaction.
        ix. know ways to alleviate compaction.
        x. understand how to measure soil compaction, i.e. potentiometer
    b. tillage system.
    c. organic matter.
    d. root systems.
    e. cropping system.
    f. soil biology.
    g. inherent soil properties.
12. Understand common sources of organic matter amendments in the Mid-Atlantic Region, their characteristics (components, C:N ratio), and ways to maintain the organic matter content of an agricultural soil.
    a. Manure (various types).
    b. Compost.
    c. Cover crops.
    d. Food waste.
    e. Municipal waste (leaves, etc.).
13. Define humus.
14. Describe how the carbon:nitrogen (C:N) ratio of soil organic materials may affect soil nitrogen availability to plants.

Competency Area 2: Soil Hydrology

1. Understand the water budget for soil profiles characteristic to the Mid-Atlantic Region.
    a. Soil infiltration.
    b. Hydraulic conductivity.
    c. Evaporation and transpiration.

d. Transport and Leaching.
e. Runoff.
f. Soil water storage.

2. Know the relationship between the listed soil parameters and soil water content, soil water tension, soil pore size, plant growth and the fate and transport of nutrients and pesticides. Qualitatively understand how these parameters vary for different soil types.
    a. Field capacity.
    b. Permanent wilting point.
    c. Available water capacity.
    d. Total soil water storage capacity.
    e. Porosity.
    f. Soil texture, structure.
    g. Macroporosity/preferential flow.
    h. Saturated and unsaturated flow.
    i. Water holding capacities and plant response.
3. Understand the implications of proximity to surface and groundwater as well as regulatory setbacks and widths.
    a. Buffers.
    b. Grass waterway.
    c. Riparian systems.
    d. Setbacks defining treatable areas.
    e. Fencing off streams as a buffer practice.
4. Understand permeability and infiltration and how they are affected by soil characteristics, precipitation, and management practices.
5. Understand infiltration rates, factors affecting infiltration rates, drainage classes and units of measure.
6. Understand how seasonal soil conditions and landscape position affect runoff and leaching including application timing and tillage.
7. Know simple field methods to assess soil water conditions.
    a. Observation/visual assessment:
        i. redoximorphic features,
        ii. vegetative changes, presence of hydrophytic vegetation,
        iii. soil moisture – Ball test.
    b. Soil moisture probe.

Competency Area 3. Erosion Processes

1. Recognize and understand the factors used in the water erosion prediction technology models.
    a. RUSLE2
        i. Understand the terms used in RUSLE2 such as R, K, LS, CM.
        ii. Know where to find values of R, K, LS, CM.
    b. WEPP (when available).
2. Explain how conservation practices/BMPs affect sheet, rill, and gully erosion.
3. Explain where erosion by water is likely to occur and management practices to minimize erosion.
    a. Soil characteristics/landscape position.
    b. Slope.
    c. Buffers.
    d. Soil cover including residue, mulch, cropping system.
4. Explain where erosion by wind is likely to occur and management practices to minimize erosion.
    a. Soil characteristics/landscape position.
    b. Physical barriers.
    c. Buffers.
    d. Residue, mulch, cropping system.
5. List physical factors which affect the rate of erosion by water and wind.
6. Understand how the T value influences soil management decisions.
7. Know how to estimate percent residue using the line-transect method.
8. In a given situation, make economically sound management recommendations that will result in soil conservation.

Competency Area 4: Drainage and Irrigation

1. Understand the relationship between soil drainage class and crop productivity.
2. Qualitatively understand how hydrology and soil and landscape properties influence drainage class and drainage criteria.
3. Know the advantages and disadvantages/limitations of:
    a. surface drainage,
    b. subsurface drainage,
    c. historical layout of drainage systems,
    d. pattern layout of drainage systems.
4. Understand the potential impacts of the following factors affecting soil drainage and the installation of drainage systems:
    a. location of bedrock and limiting horizons,
    b. soil type and texture,

c. soil hydraulic conductivity,
d. soil porosity,
e. topography,
f. organic soils,
g. type of crop,
h. outlet and downstream infrastructure.

5. Understand the benefits and risks to the environment that are potentially inherent from a drainage system and potential for management of outlet/water control structures.
6. Understand the concept of hydric soils, hydric soil indicators, and the regulatory aspects associated with wetlands and the installation of drainage systems.
7. Explain the factors that influence the potential and actual evapotranspiration of crops.
8. Understand the relationships of hydrology, the soil water budget, and crop water requirements as these pertain to irrigation system water requirements and the potential benefits of irrigation.
9. Know the various methods of irrigation and the advantages and disadvantages of each with respect to different soil conditions and crop types:
    a. overhead irrigation,
    b. drip irrigation,
    c. subsurface drip irrigation,
    d. fertigation.
10. Understand the sources of water for irrigation and how the quantity and quality affects irrigation methods including water sources for vegetable crops that are pathogen free.
11. Describe the components of irrigation scheduling and understanding decision models with regard to irrigation:
    a. use of sensors to assess soil available water,
    b. balance between soil available water and nutrient availability/uptake,
    c. use of ET to schedule irrigation.

Competency Area 5. Tillage and Residue Management

1. Understand the characteristics (including advantages and disadvantages) of different tillage systems used in the Mid-Atlantic Region and how they relate to RUSLE2 (and eventually WEPP).
    a. No till (both long term and short term).
    b. Strip tillage/ridge till.
    c. Minimum till.
    d. Conventional till (moldboard plow).
2. Effects of tillage on organic matter (maintaining OM levels – tillage types (vertical, ripping) and newer tillage tools).

3. Understand the importance of residue cover and minimum levels for sustainability, for example:
    a. corn stalk residue (non-fragile residue),
    b. soybean residue (fragile residue),
    c. cover crop residues (including rolled cover crops),
    d. stale seed beds.
4. Describe the components of sustainable no-tillage systems.
5. Know ways to manage manure in no-till.
    a. Timing of application.
    b. Products.
    c. Equipment.
6. Explain tillage decisions based on
    a. soil loss,
    b. soil type,
    c. slope,
    d. manure,
    e. perennial weed population, and
    f. weather conditions.
7. Explain the relationship of tillage to residue cover, nutrient loss to surface and groundwater (including particle bound phosphorus), and insect, weed and disease management.
8. Understand crop residue and its effects on soil and water.

Competency Area 6: Soil Quality/Soil Health

1. Describe the relationship between soil health and soil organic matter, soil color, and structure.
2. Understand the concept of soil health, and know and identify indicators:
    a. Chemical indicators
        i. CEC.
        ii. pH.
        iii. Macro and micro nutrient availability.
    b. Physical indicators
        i. Soil tilth and aggregation.
        ii. Compaction.
        iii. Color.
        iv. Infiltration rate.
        v. Residue cover.
    c. Biological indicators
        i. Biological diversity.
        ii. OM/SOM.

iii. Anaerobic vs aerobic conditions in soil.
iv. Respiration potential in soil.

3. Describe the effects of Microbial biomass and diversity on soil health.
    a. Nutrient cycling.
    b. Soil aggregation.
    c. Nutrient and water holding ability.
    d. Resilience/resistance to soil-borne diseases.
4. Describe different types of soil conditions and compaction, and understand their agronomic and environmental implications.
    a. Surface crusts.
    b. Plow layer compaction.
    c. Subsoil compaction.
    d. Surface compaction.
5. Understand the processes and management practices that impact soil compaction and their relative significance under Mid-Atlantic conditions.
    a. Equipment traffic and load distribution.
    b. Timing of tillage and traffic as it relates to soil water conditions, i.e., time of year and soil saturation.
    c. Tillage methods (conservation, no-till, conventional, strip till, vertical tillage).
    d. Livestock traffic.
6. Understand the relationship between soil compaction and the following factors and understand each factor's relation to plant growth and important soil chemical and biological processes.
    a. Aeration.
    b. Aggregation/structure.
    c. Runoff and erosion.
    d. Drainage.
7. Understand susceptibility to compaction among soil types due to:
    a. drainage,
    b. texture,
    c. organic matter/organic amendments.
8. Understand the effect of soil compaction on
    a. root and shoot growth,
    b. crop variability within the field,
    c. and crop yield.
9. Understand the use of a soil penetrometer and how to detect compaction layers.

10. Understand how compaction can lead to soil and water degradation the broader environmental consequences of soil degradation from compaction affecting:
    a. energy requirements,
    b. runoff and water quality.
11. Know how to prevent or minimize soil compaction.
12. Describe approaches for remediation of soil compaction, and understand when they are appropriate.
    a. Crop rotation.
    b. Deep tillage (subsoil compaction).
    c. Organic materials applications.
    d. Cover crops (plow layer compaction; subsoil compaction when using deep-rooted cover crops).
    e. Reduced tillage (plow layer compaction).
    f. Chemical amendments (gypsum).

Competency Area 7. Conservation Planning, Regulations and Policy

1. Explain how federal, state, and local programs support implementation of conservation plans.
2. Explain how tillage and manure application are legislated in the Mid-Atlantic Region.
3. Conservation practices including engineering, cropping systems.
4. Understand Chesapeake Bay Watershed goals (processes, causes, management):
    a. eutrophication,
    b. runoff,
    c. subsurface nutrient transport,
    d. sediment,
    e. point sources and non-agricultural contributions.
5. Explain how 4R Nutrient Management concepts intersect with soil and water.
    a. Right Source, Rate, Timing and Placement.
6. Understand the T value and how it would be used in management and relates to state and federal regulations with respect to water quality.
7. Know how HEL is defined and how it is used in land management programs.
8. Explain how policies, procedures, technical guidance, and programs at the federal, state and local level fit together in planning processes such as Comprehensive Nutrient Management Plan (CNMP), Stormwater Management, and Conservation Planning. Understand the key elements of the planning process.
9. Understand what a Technical Service Provider (TSP) is and the types of work done by TSPs.

10. Be aware of the uses of the following USDA NRCS references:
    a. Field Office Technical Guide (FOTG),
    b. National Handbook of Conservation Practices (NHCP),
    c. National Planning Procedures Handbook (NPPH),
    d. Agricultural Waste Management Field Handbook (National Engineering Handbook Part 651),
    e. County Soil Surveys, Web Soil Survey, SSURGO.
11. Define “Concentrated Animal Feeding Operation” (CAFO) and “Animal Feeding Operations” (AFO) and explain how these relate to local regulations and national Clean Water Act strategies.
12. Understand the roles and responsibilities of the local, state, and federal conservation agencies.
    a. USDA Farm Service Agency (FSA)
    b. USDA Natural Resource Conservation Service (NRCS)
    c. USDA Rural Development (RD)
    d. Environmental Protection Agency (EPA)
    e. Cooperative Extension Service (CES)
    f. Soil and Water Conservation District (SWCD)
    g. State Environmental Regulation Agencies

INTEGRATED PEST MANAGEMENT (IPM) COMPETENCY AREAS

Competency Area 1 - Management of Weeds

1. Identify the following weeds by common name at the first true-leaf stage and at plant maturity, and classify each by life cycle. Be able to distinguish among rhizomes, stolons, aerial bulblets, and nutlets.

Bermudagrass	Horseweed (marestail)
Burcucumber	Italian ryegrass
Canada thistle	Jimsonweed
Common chickweed	Johnsongrass
Common cocklebur	Large crabgrass
Common lambsquarter	Morningglory species, pitted or ivyleaf
Common milkweed	Palmer amaranth
Common pokeweed	Pennsylvania smartweed
Common ragweed	Redroot pigweed
Eastern black nightshade	Shattercane
Fall panicum	Smooth pigweed
Field bindweed	Velvetleaf
Giant foxtail	Wild garlic
Hemp dogbane	Wild mustard
Henbit	Yellow nutsedge
Horsenettle	

2. Describe how these factors influence herbicide performance:

    a. soil texture.
    b. organic matter.
    c. soil pH.
    d. size of weeds to be controlled.
    e. stage of growth crop to be to be treated.
    f. rotational restrictions for following crops.
    g. seasonal soil moisture levels (rainfall).

3. Distinguish the difference between herbicide drift and herbicide volatility.

4. Identify those factors that increase the likelihood of herbicide drift versus volatility for herbicides.

5. Describe how the following factors influence herbicide persistence and/or carryover.

a. soil texture	g. herbicide rate
b. soil moisture	h. herbicide family
c. soil pH	i. tillage
d. temperature	j. crop rotation
e. cation exchange capacity	k. sludge application
f. organic matter	l. sunlight

6. Recognize factors contributing to the development of herbicide resistant weeds.
7. Describe the role and importance of herbicide resistant crops in weed management decisions.
8. Classify herbicides by mode of action.
9. Recognize crop and weed injury based on herbicide mode of action.
10. Describe the effect of tillage systems on weed populations.
11. Understand what factors of weed biology contribute to a weed's competitiveness.
12. Recognize factors that influence herbicide contamination of ground and surface water.
13. Distinguish control approaches for annual versus perennial weeds.
14. Describe how adjuvants affect herbicide activity.
15. Understand how spray volume influences weed control.
16. Be able to define invasive and noxious weeds.
17. Describe how cover crops can influence weed management.

Competency Area 2 - Management of Plant Diseases

1. Be able to identify via signs and symptoms the following diseases and know whether the cause of the disease is a fungus, bacteria virus or nematode.

Corn	Alfalfa
Common rust	Sclerotina crown and stem rot
Gray leaf spot	Spring black stem and leaf spot
Northern corn leaf blight	Verticillium wilt
Southern corn leaf blight	
Stalk rot	
Wheat	Soybean
Barley yellow dwarf	Brown spot
Leaf rust	Charcoal rot
Powdery mildew	Downy mildew
Scab	Frog eye leaf spot
Septoria blotch	Pod and stem blight
Soil-borne wheat mosaic	Root-knot nematode
Stagonospora blotch	Soybean cyst nematode
Stripe rust	Soybean rust
Take-all	Sudden death
Wheat spindle streak	White mold

2. For each of the diseases listed above know the environmental conditions and cropping practices that favor disease development.

3. Be able to determine the best management practices for economic management of the diseases listed above including:
    a. cultural: sanitation, crop rotation, and host eradication.
    b. mechanical: tillage.
    c. chemical: foliar and soil applied fungicides; seed treatments.

4. Describe the role and importance of disease resistant crops in disease management decisions.

5. Understand the factors related to the development of mycotoxin and aflatoxin problems in field crops:
    a. environmental (temperature and moisture).
    b. crop susceptibility.
    c. mechanical damage.
    d. residue management.

Competency Area 3 - Management of Insects and Other Invertebrates

1. Identify immature and adult stages of the following pests.

Corn	Soybean	Wheat	Forage Grasses
Cutworms	Bean leaf beetle	Aphids	Billbugs s
European corn borer	Corn earworm	Cereal leaf beetle	Cereal rust mite
Flea beetle	Grasshopper	Grass sawfly	
Rootworm	Green cloverworm	True armyworm	
Seedcorn maggot	Kudzu bugs		Alfalfa
Slugs	Mexican bean beetle		Alfalfa weevil
True armyworm	Slugs		Potato leafhopper
Wireworms	Spider mites		
	Soybean aphid		
	Stinkbugs		

2. Know the type of injury and the crop stage when each pest in # 1 above causes economic damage.

3. Be able to determine what the best management practices from for economic management of the insects listed above including:
    a. cultural: sanitation, crop rotation, and host eradication.
    b. mechanical: tillage.
    c. chemical: foliar and soil applied insecticides; seed treatments.

4. Recognize how the following factors influence insect management decisions:
    a. insect life cycles.
    b. beneficial organisms.
    c. crop growth stage.
    d. environmental factors.
    e. cultural practices.
    f. economic factors (crop value, control costs).

5. Describe the role played by beneficial insects (predators and parasites) and fungal pathogens in pest management systems.

6. Identify the immature and adult stages of the following beneficial insects from a photo: ladybug, lacewing, syrphid, nabid, and minute pirate bug.

7. Classify insecticides by their mode of action.

8. Describe factors that influence the development of insecticide resistance.

9. Explain the underlying principles of the following resistance management approaches: rotation of chemical modes of action; high dose/refuge; adherence to treatment thresholds coupled with non-chemical tactics.

10. Describe the role and importance of insect resistant crops in disease management decisions.

Competency Area 4 - Integrated Pest Management Principles

1. Recognize the key strategies used in the implementation of an IPM program.
2. Describe how economic thresholds are used to make pest management decisions.
3. Explain the importance of sampling pest populations and the need for using adequate sample size to estimate an organism's numbers.
4. List types of pest monitoring methods and the advantages and disadvantages of each.
5. Recognize the various elements involved in making IPM recommendations: economic, environmental, health, and social.
6. Describe the importance of field history in pest management decisions.