

Certified Crop Adviser

Performance Objectives

for

Wisconsin

2008

**WISCONSIN CERTIFIED CROP ADVISER
PERFORMANCE OBJECTIVES**

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WISCONSIN CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

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The performance objectives for Wisconsin cover a wide variety of topics in the areas of nutrient management, soil and water management, pest management, crop production and state regulation covering the use of fertilizer and pesticides. Crop advisers should be knowledgeable in these areas. Many of the Wisconsin performance objectives overlap the international objectives. Consequently, some seemingly important subjects may have been omitted from the Wisconsin objectives if they were covered adequately in the international objectives. Overlap with international objectives was inevitable in some areas.

Major Wisconsin Crops					
Alfalfa	Corn	Pea	Red Clover	Soybean	Winter Wheat
Oat	Potato	Snap bean	Sweet Corn		

Wisconsin certified crop advisers should be familiar with the crops listed in the box above. Hereafter they will be referred to as “major Wisconsin crops.” Crops grown on fewer than 20,000 acres, such as cranberries and table beets, are not included even though they are very important locally.

Nutrient Management

A. Basic Concepts

Certified crop advisers should be able to:

01. List the 17 elements essential for plant growth and the primary function of each in plants.
02. Describe and identify the form(s) in which each of the 17 essential plant nutrients is taken in by plant roots.
03. Discuss the source and significance of cation exchange.
04. Describe the influence of soil pH, clay content and organic matter content on cation exchange capacity.
05. Describe how nutrients reach and are absorbed by plant roots
06. Describe how the following soil characteristics affect nutrient availability:
 - a. Texture
 - b. Structure
 - c. Drainage/aeration
 - d. Soil moisture
 - e. Organic matter
 - f. CEC

B. Soil Acidity and Liming

Certified crop advisers should be able to:

01. Describe the sources of soil acidity.
02. Describe how soil pH affects availability of essential plant nutrients.
03. Define pH buffering and list those factors that influence this process.
04. Describe the factors used in the lime requirement calculations for Wisconsin soils and how each influences the lime requirement.
05. Describe lime grade, calcium carbonate equivalent and neutralizing index
06. Identify optimum soil pH for major Wisconsin crops on mineral and organic soils.
07. Discuss soil characteristics that influence soil pH management.
08. Describe the benefits and drawbacks associated with various liming materials

C. Nitrogen

Certified crop advisers should be able to:

01. Describe the role and mobility of nitrogen in plants and identify nitrogen deficiency symptoms for major Wisconsin crops.
02. Understand the nitrogen cycle.
03. Discuss significance of the carbon:nitrogen ratio of crop residue and organic amendments and how they affect nitrogen availability to crops.
04. Describe the agronomic, economic and environmental consequences of nitrogen management factors.
 - a. Timing
 - b. Placement
 - c. Rate
 - d. Nitrification and urease inhibitors
05. Compare advantages and disadvantages of each of the following nitrogen fertilizer materials with respect to placement, losses, handling, crop injury on different soils, cropping systems and tillage systems:
 - a. Anhydrous ammonia
 - b. Ammonium sulfate
 - c. Urea
 - d. Urea-ammonium nitrate (UAN) solution

06. Explain the basis for the Wisconsin nitrogen rate guidelines.
 - a. Maximum Return to Nitrogen (MRTN) for corn
 - b. Nitrogen rate guidelines for other crops
07. Determine the credit adjustments for previous leguminous crops, manure applications, and nitrogen soil tests.

D. Phosphorus

Certified crop advisers should be able to:

01. Describe the role and mobility of phosphorous in plants and identify phosphorus deficiency symptoms for major Wisconsin crops.
02. Explain how each of the following affect soil retention or “fixation” of fertilizer phosphorous and its availability to plants:
 - a. Soil pH
 - b. Clay content
 - c. Method of placement
 - d. Forms of phosphorous applied
03. Describe factors that influence Wisconsin phosphorous management guidelines.
04. Understand the importance of soil buffering on the buildup and drawdown of soil test P.

E. Potassium, Calcium and Magnesium

Certified crop advisers should be able to:

01. Describe the role and mobility of potassium and identify potassium deficiency symptoms for major Wisconsin crops.
02. Describe the conditions under which ion antagonism affects potassium, calcium and magnesium uptake by plants.
03. Describe the soil conditions in which potassium, calcium and magnesium are most likely to be deficient.
04. Describe the factors affecting Wisconsin potassium management guidelines.
05. Determine when to recommend gypsum as a soil amendment or fertilizer.
06. Discuss the relative importance for managing the Ca:Mg ratios in Wisconsin soils
07. Identify magnesium deficiency symptoms for the major Wisconsin crops.

F. Sulfur and the Micronutrients

Certified crop advisers should be able to:

01. Describe the role, relative requirements and deficiency symptoms of:
 - a. Boron in alfalfa and peas
 - b. Manganese in corn, small grains, sweet corn and soybean
 - c. Sulfur in alfalfa, corn, soybean and sweet corn
 - d. Zinc in corn, pea, snap bean and sweet corn
02. Identify boron toxicity symptoms in small grains and manganese toxicity symptoms in pea, potato, snap bean and soybean.
03. Describe soil conditions conducive to deficiencies of sulfur and the micronutrients and to toxicity of boron and manganese.
04. Understand the components of the Sulfur Availability Index.
05. Describe the methods and materials for correcting deficiencies of sulfur and micronutrients.
06. Identify forms of micronutrients that are appropriate for soil and foliar application.

G. Fertilizer, Forms and Application

Certified crop advisers should be able to:

01. Describe the advantages, limitations and precautions associated with the following fertilizer placements methods:
 - a. Injection
 - b. Broadcast
 - c. Band
 - d. Fertigation
 - e. Foliar
 - f. Sidedress
 - g. Topdress
 - h. Seed-placed
02. Describe sources of plant nutrients that are approved for organic crop production.
03. Explain how to calibrate different types of fertilizer spreaders.
04. Define fertilizer grade and analysis.
05. Explain how to calculate amounts and rates of fertilizer needed to meet specified soil test recommendations.

06. Understand conditions where an economic return can be gained from starter fertilizer

H. Organic Waste Management

Certified crop advisers should be able to:

01. Describe the availability of nitrogen, phosphate and potash for beef, dairy, poultry and swine manure.
02. Describe application restrictions for spreading manure on:
 - a. Frozen and snow covered soils
 - b. Land adjacent to Karst features
 - c. Sloping land
 - d. Land adjacent to surface water
 - e. Soils with high leaching potential
 - f. Land adjacent to wells
03. Explain how to calibrate a manure spreader and calculate rates of manure and manure nutrient applications.
04. Describe allocation of manure to farm fields based on:
 - a. The Wisconsin P Index
 - b. Soil test P
 - c. Crop nitrogen requirement
 - d. Site characteristics
05. Describe the advantages and disadvantage of applying sewage sludge, whey and compost to cropland.
06. Describe factors affecting recommended rates of application of sewage sludge, whey, and compost.
07. Recognize how storage and processing of manure and other organic wastes and method of application affects their nutrient value.
08. Describe proper manure sampling and sample-handling procedures.
09. Discuss economic considerations involved in comparing manure and/or other organic wastes with commercial fertilization.

I. Soil Testing and Plant Analysis

Certified crop advisers should be able to:

01. Describe the University of Wisconsin recommendations for soil sampling and handling.
 - a. Whole-field
 - b. Grid-point and zone sampling
 - c. Contour strips
 - d. Tillage considerations

02. Describe the effect of the following factors on soil test results and interpretations:
 - a. Depth of sampling
 - b. Frequency of sampling
 - c. Number of cores per composite sample
 - d. Number of composite samples per field
 - e. Areas to be avoided
 - f. Handling of samples for nitrate-N analysis
 - g. Fall versus spring sampling

03. Describe University of Wisconsin recommendation for plant sampling of the major Wisconsin crops with respect to:
 - a. Plant part to sample
 - b. Stage of growth
 - c. Handling of sample

04. Interpret soil test and plant analysis reports for:
 - a. Nutrient deficiency or sufficiency
 - b. Crop response to applied nutrients
 - c. Reliability of test
 - d. Nutrients needed to meet recommendation
 - e. Soil pH adjustments
 - f. DRIS and PASS methods

05. Understand the University of Wisconsin nutrient application guidelines

06. Understand the use of soil N availability tests
 - a. Pre-plant nitrate test
 - b. Pre-sideress nitrate test

J. Nutrient Management Planning

Certified crop advisers should be able to:

01. List situations where a conventional versus a comprehensive nutrient management plan is required.
02. Discuss the USDA NRCS 590 Technical Standard with respect to the:
 - a. Minimum criteria.
 - b. Additional criteria for groundwater protection
 - c. Additional criteria for surface water protection
 - d. Technical notes
03. List the required components of a conventional and a comprehensive nutrient management plan.
04. Discuss the impact of manure management on nutrient management planning.
 - a. Describe the allocation of manure to fields based on:
 - Restrictions for frozen or snow covered soil, slope, proximity to surface water, proximity to groundwater access
 - Crop N or P demand
 - Amount of manure produced vs. collected
 - P Index versus soil test P
 - b. Explain how manure storage and application method affect plans
 - c. Discuss how required conservation practices affect manure management:
 - Conservation tillage
 - Crop rotation
 - In-field structures
05. Identify factors that encourage the implementation of nutrient management plans.
06. Describe the factors that influence the Phosphorus Index

K. Soil and Plant Additives

Certified crop advisers should be able to:

01. Understand the characteristics of various non-traditional soil and plant additives
 - a. Growth regulators
 - b. Biological inoculants
 - c. Organic supplements
 - d. Low analysis/low volume fertilizers
 - e. Wetting agents

WISCONSIN CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

Soil and Water Management

- A. Basic Properties**
- B. Soil Erosion**
- C. Crop Residue Management**
- D. Restrictive Soil Layers**
- E. Site Characterization**
- F. Site-Specific Soil Management**
- G. Land Application of Municipal and Industrial Wastes**
- H. Water and Solute Movement**
- I. Irrigation and Drainage**
- J. Soil Quality**
- K. Water Quality**

Soil and Water Management

A. Basic Properties

Physical

Certified Crop advisers should be able to:

01. Describe the impact of the five soil forming factors on soil characteristics.
02. Define:
 - a. Soil texture
 - b. Soil structure
 - c. Soil bulk density
 - d. Soil porosity
03. Use the soil textural triangle to identify soil textural class.
04. Describe how to determine soil texture by the hand texturing method.
05. Understand how soil texture affects:
 - a. Field moisture capacity
 - b. Wilting point
 - c. Plant available water
 - d. Water movement through soils
06. Differentiate between the following soil structure types:
 - a. Granular
 - b. Platy
 - c. Blocky
 - d. Columnar and prismatic
 - e. Structureless
 - Massive
 - Single-grained
07. Describe how the following affect soil structure:
 - a. Soil organisms and organic matter
 - b. Mechanical forces
 - Wheel traffic
 - Wetting/drying
 - Freezing/thawing
 - Excessive tillage
 - c. Cropping system
 - d. Soil texture

08. Describe the relationship between soil bulk density and soil porosity.
09. List typical values for soil bulk density and porosity as affected by texture.
10. Describe how the following affect soil color:
 - a. Drainage
 - b. Organic matter
 - c. Parent material

Biological

Certified Crop advisers should be able to:

01. List the components of soil organic fraction.
02. Describe beneficial effects of soil organic matter.
03. Describe how to maintain or increase soil organic matter levels.
04. Explain why it is difficult to increase soil organic matter.
05. Explain how the following agricultural practices influence soil microbial activity:
 - a. Tiling
 - b. Tillage
 - c. Organic matter additions
 - d. Fertilizer and lime applications
 - e. Pesticide use
 - f. Crop rotation
 - g. Rotational grazing
06. Explain how the C:N ratio of a material affects organic matter decomposition and nutrient availability.
07. Explain the role of soil microorganisms for:
 - a. Nutrient transformations and cycling.
 - b. Soil structure formation and maintenance.
 - c. Degradation of pathogens and contaminants.
08. Discuss composting as a method to manage organic materials.

B. Soil Erosion

Certified Crop advisers should be able to:

01. Describe the soil erosion process for:
 - a. Water

- b. Wind
02. Differentiate between the following types of water erosion:
- a. Sheet
 - b. Rill
 - c. Ephemeral gully
 - d. Gully
03. Explain how each of the following factors of the Revised Universal Soil Loss Equation 2 (RUSLE2) affect the rate of water erosion:
- a. Duration and intensity of rainfall (R)
 - b. Soil texture (K)
 - c. Slope length (L)
 - d. Slope steepness (S)
 - e. Vegetative and residue cover (C)
 - f. Conservation practice (P)
04. Explain how each of the following factors affect the rate of erosion by wind:
- a. Vegetative and residue cover
 - b. Wind velocity
 - c. Unsheltered distance
 - d. Soil surface roughness
 - e. Soil texture
05. Describe how erosion decreases the following:
- a. Crop yield potential
 - b. Water holding capacity
 - c. Plant available nutrients
 - d. Organic matter content
 - e. Infiltration
 - f. Surface water quality
 - g. Air quality
06. Explain how each of the following cropland conservation practices decrease erosion:
- a. Strip cropping
 - b. Contour tillage
 - c. Terraces
 - d. Grassed waterways
 - e. Surface crop residues
 - f. Cover crops
 - g. Row spacing
 - h. Crop rotation
07. Describe the purpose and function of a riparian vegetative filter strip.

08. Understand the purpose and use of the Soil Conditioning Index (SCI) and the Soil Tillage Intensity Rating (STIR)

C. Crop Residue Management

Certified Crop advisers should be able to:

01. Discuss how the following influence tillage selection and management:
- Crop rotation
 - Economics
 - Soil properties
 - Conservation planning
02. List the advantages, disadvantages and limitations of each of the following tillage systems.
- Moldboard plowing
 - Chisel plowing or mulch tillage
 - No-till
 - Zone or strip-tillage
03. List advantages, disadvantages and limitations of each of the following pieces of tillage equipment:
- Twisted shanks vs. points vs. sweeps for chisel plows
 - Planter residue-clearing attachments
 - Tandem disk
 - Field cultivator
 - Combination tillage tools
 - Row crop cultivators
 - Rotary hoe
04. Describe the influence of tillage system and implement operation on the following:
- Crop residue level
 - Soil disturbance
 - Incorporation of fertilizer, lime and pesticides
 - Manure management
 - Pest type and severity
 - Water infiltration
05. Describe the relationship between deep tillage (sub-soiling) method and crop residue level.
06. Explain how to estimate percent surface crop residue using the line-transect method.

D. Restrictive Soil Layers

Certified Crop advisers should be able to:

01. List the causes and significance of the following restrictive soil layers:
 - a. Crusting
 - b. Surface compaction
 - c. Subsurface compaction
02. Describe methods to detect subsurface compaction.
03. List soil and plant symptoms of compaction.
04. Describe methods of preventing and alleviating soil compaction.
05. Understand the benefits and limitations of deep tillage as a method to remove compaction.

E. Site Characterization

Certified Crop advisers should be able to:

01. Use the USDA NRCS Web Soil Survey to locate and determine soil characteristics.
02. Describe limitations to crop production with respect to the following factors:
 - a. High leaching potential
 - b. Highly erodible land
 - c. Sinkholes and creviced bedrock
 - d. Surface water features

F. Site-Specific Soil Management

Certified Crop advisers should be able to:

01. Define site-specific management.
02. Describe basic coordinate systems:
 - a. Latitude/longitude
 - b. State plane
03. Explain the function of basic site-specific management tools:
 - a. Differentially corrected GPS
 - b. Crop yield monitors

- c. Variable-rate application
 - d. Geostatistics
 - e. Mapping and data management software
04. Describe methods to assess within-field variability of soil properties:
- a. Grid-point sampling
 - b. Management zones
 - c. Remote sensed and other digital imagery
 - d. On-the-go sensors
05. Describe benefits and concerns associated with site-specific management.

G. Land Application of Municipal and Industrial Wastes

Certified Crop advisers should be able to:

01. List advantages and disadvantages of the land application of waste materials.
02. Describe characteristics of the following waste materials:
- a. Municipal bio-solids
 - b. Whey and other cheese plant wastes
 - c. Solid waste compost
 - d. Construction debris
 - e. Papermill sludge
 - f. By-product liming materials
03. Regarding regulations controlling land application of waste materials:
- a. List information needed to apply for appropriate permits
 - b. Discuss the factors affecting setbacks required for land applications
 - c. Describe method for determining material application rate
 - d. Discuss potential impacts on environmental quality and human or animal health

H. Water and Solute Movement

Certified Crop advisers should be able to:

01. Explain the importance of the following components with respect to the soil water cycle and Wisconsin's agricultural water budget:
- a. Precipitation
 - b. Irrigation
 - c. Runoff
 - d. Soil water storage
 - e. Evapotranspiration
 - f. Percolation

02. Describe how the following factors influence infiltration:
 - a. Soil texture
 - b. Soil structure
 - c. Crop residue cover
 - d. Crop canopy
 - e. Soil organic matter
 - f. Surface crusting
 - g. Landscape position
 - h. Soil compaction
 - i. Soil pore size distribution
03. Describe the forces that regulate water flow under saturated and unsaturated conditions.
04. Describe how the following factors influence solute leaching:
 - a. Infiltration
 - b. Soil texture
 - c. Natural and man-made soil layers
05. Explain the significance of the following factors with respect to the leaching of solutes:
 - a. Depth to groundwater and bedrock
 - b. Evapotranspiration
 - c. CEC
 - d. Soil organic matter
 - e. Soil texture
 - f. Ionic charge
 - g. Solubility
 - h. Persistence of organic compounds
06. Define preferential flow and its effect on solute movement.
07. Describe how the following management practices affect solute movement:
 - a. Application timing
 - b. Application rate
 - c. Erosion control
 - d. Irrigation
 - e. Tillage method
 - g. Artificial drainage
08. Describe management practices that minimize nitrogen and phosphorus transport from a field.
09. Describe Wisconsin's agricultural water budget as it relates to crop production and soil and nutrient management.

I. Irrigation and Drainage

Certified Crop advisers should be able to:

01. Describe the following irrigation methods:
 - a. Sprinkler
 - b. Low pressure
 - c. Drip/trickle
02. Describe the factors used in developing an irrigation schedule.
03. Explain regulations associated with placing irrigation systems.
04. Explain regulations associated with installing agricultural drainage systems.
05. Identify characteristics of well-drained and poorly drained soils.
06. Describe the following drainage methods:
 - a. Tile
 - b. Open ditch
 - c. Land forming
 - d. Diversions
07. Identify soil data used to determine the effectiveness of tile drainage.
08. Describe field characteristics that identify inoperative tile lines.

J. Soil Quality

Certified Crop advisers should be able to:

01. Understand soil and management factors that affect soil quality.
02. Describe methods of assessing soil quality.
03. Identify management practices that can improve soil quality.

K. Water Quality

Certified Crop advisers should be able to:

01. Describe how nutrients, pesticides and sediments move off fields and negatively impact water quality.
 - a. Movement overland in runoff.

- b. Movement into and through tile lines.
 - c. Movement through macropores and karst features
02. Identify the contaminants in groundwater that may come from agriculture:
 03. Describe how agricultural practices may affect drinking water quality.
 04. State the nitrate drinking water standard.
 05. Cite the human health consequences of drinking water contaminated with nitrate.
 06. Describe management practices to minimize groundwater contamination by nitrate and other compounds.
 07. Identify the contaminants in surface water that may come from agriculture.
 08. Understand how the Phosphorus Index can be used to reduce the risk of phosphorus loss to surface water.
 09. Explain how sediment in runoff affects water quality
 10. Describe the effect of tillage or manure on phosphorus delivery to surface water.
 11. List management practices that would limit the loss of phosphorus from high-testing soils.
 12. Define hypoxia and discuss its relationship to agriculture.

WISCONSIN CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

Pest Management

- A. Integrated Pest Management**
- B. Weed Management**
- C. Insect Management**
- D. Plant Disease Management**
- E. Pesticides & the Environment**
- F. Pesticides & Human Health**
- G. Pesticide Application Equipment Calibration**

Pest Management

A. Integrated Pest Management

Certified crop advisers should be able to:

01. Describe the scouting techniques for the key pests of major Wisconsin crops.
02. Identify what crop and pest management information is needed to develop an IPM program.
03. Define economic threshold, and describe its use in relation to pest management.
04. List the advantages and limitations of chemical and non-chemical pest control tactics.
05. Relate the importance of Wisconsin's environmental conditions and how it affects pests, pest populations and crop production. (For example, pest migration and time of arrival, disease potential vs. environmental conditions).

B. Weed Management

Certified Crop advisers should be able to:

01. Identify Wisconsin's common weeds:
 - a. Wild Proso Millet
 - b. Canada thistle
 - c. Common lambsquarters
 - d. Common ragweed
 - e. Large crabgrass
 - f. Eastern black nightshade
 - g. Giant foxtail
 - h. Yellow foxtail
 - i. Green foxtail
 - j. Giant ragweed
 - k. Quackgrass
 - l. Redroot pigweed
 - m. Velvetleaf
 - n. Yellow nutsedge
 - o. Woolly Cupgrass
 - p. Tall Waterhemp
 - q. Wirestem muhly
 - r. Horseweed
02. Explain how herbicide resistant weed biotypes develop and describe effective management strategies to delay resistance.

03. Describe mode of action and injury symptoms for common herbicides used on Wisconsin crops.
04. Outline appropriate management strategies in no-till, minimum till and conventional tillage systems for annual, winter annual, biennial and perennial weeds in Wisconsin crops.
05. Explain how cultural practices impact weed management.
06. Describe the criteria essential for successful mechanical weed control.
07. Explain why weed competitive indices and thresholds differ among field, vegetable, and forage crops.

C. Insect Management

Certified Crop advisers should be able to:

01. Identify each of the following key insect pests, their feeding habits and injury symptoms, life cycle, economic threshold and appropriate management tactics.
 - a. Alfalfa weevil
 - b. Black cutworms
 - c. Colorado potato beetle
 - d. Corn rootworms
 - e. European corn borer
 - f. Potato leafhopper
 - g. Soybean aphid
02. Identify each of the following insect & mite pests, their feeding habits, injury, symptoms and economic threshold (when available).
 - a. Armyworm
 - b. Bean leaf beetle
 - c. Corn earworm
 - d. Green peach aphid
 - e. Hop vine borer
 - f. Seed corn maggot
 - g. Stalk borer
 - h. Tarnished and alfalfa plant bugs
 - i. Two-spotted spider mites
 - j. Variant western corn rootworm
 - k. Western bean cutworm
 - k. White grubs
 - l. Wireworms
03. Identify the common beneficial insects (e.g.: lady beetle larvae and adults, damsel bugs).

04. Recognize symptoms of insect parasitoids and diseased insects.
05. Describe how crop production, crop sequence, tillage and weed control influence the potential for occurrence of insect pests.
06. Outline IPM plans for managing insect resistance to transgenic crop plants, including IRM requirements.

D. Plant Disease Management

Certified Crop advisers should be able to:

01. Identify damage symptoms, lifecycle, host range, disease development, contributing environmental factors and appropriate management options for the following key diseases and pathogens:
 - a. Phytophthora root rot of alfalfa
 - b. Aphanomyces root rot of alfalfa
 - c. Crown rot of alfalfa
 - d. Verticillium wilt of alfalfa
 - e. Phytophthora root and stem rot of soybean
 - f. White mold on soybean
 - g. Soybean cyst nematode
 - h. Brown stem rot
02. Identify damage symptoms caused by the following diseases and pathogens and discuss their management:
 - a. Alfalfa
 - Spring black stem
 - Root-knot nematode
 - Fusarium Wilt
 - Downy mildew
 - b. Soybean
 - Soybean rust
 - Soybean mosaic
 - Green stem
 - Downy mildew
 - Bean pod mottle virus
 - Sudden death syndrome
 - Septoria brown spot
 - Bacterial blight
 - c. Corn
 - Rust
 - Eyespot
 - Gray leaf spot

- Northern corn leaf blight
- Anthracnose leaf blight and stalk rot
- Gibberella Stalk Rot
- Ear rots (Gibberella, Fusarium)
- Stewart's Wilt
- Seedling blight
- Lesion nematode

d. Small Grains

- Scab
- Septoria leaf blotch
- Rusts
- Powdery mildew
- Barley yellow dwarf/oat red leaf
- Take-all
- Ergot

e. Potatoes

- Late blight
- Early blight
- Early dying

f. Snapbean and Peas

- Pythium
- Aphanomyces root rot
- Bacterial brown spot
- Rhizoctonia root rot
- White mold

03. Identify how environmental and host factors relate to disease development.
04. Recognize clues as to whether a problem is caused by an abiotic agent or pathogen.
05. Identify strategies to manage pesticide resistance in pathogen populations that reduce the risk of selecting resistant strains.
06. Describe nematode biology and management practices for Wisconsin crops.

E. Pesticides and the Environment

Certified crop advisers should be able to:

01. Identify steps that can be taken to reduce the amount of solid and hazardous pesticide waste generated.
02. Describe the options for disposing of pesticide containers.
03. Describe how to manage and dispose of liquid pesticide wastes.

04. List the “3 C’s” of pesticide spill management (control, contain, clean up) and steps to take in each.
05. Contrast particle drift and vapor drift.
06. Describe the relation of each of the following to drift:
 - a. Weather conditions
 - b. Spray particle size, including those factors which influence particle size
 - c. Method of application and nozzle height
07. List ways in which a pesticide can move from the site of application.
08. Describe each of the following and its effect on the movement of a pesticide from a target site:
 - a. Adsorption
 - b. Solubility
 - c. Volatility
 - d. Degradation
 - e. Persistence
09. Describe how characteristics of a pesticide and a given site affect the likelihood of groundwater and surface water contamination.
10. List management practices that help prevent groundwater and surface water contamination.
11. Contrast point and nonpoint sources of pollution.
12. Know the common ways in which nontarget plants and animals become exposed to pesticides and how to prevent or minimize such exposure.
13. Summarize management options to protect beneficial insects from pesticides.

F. Pesticides and Human Health

Certified crop advisers should be able to:

01. List the four routes by which pesticides enter the body.
02. Give examples of how a person may be exposed to pesticides via these four routes.
03. Recognize the general symptoms of pesticide poisoning and list appropriate responses to pesticide exposure incidents.

04. Explain the role that personal protective equipment (PPE) plays in reducing the hazard associated with pesticide use.
05. Compare the different levels of protection afforded by work clothes, coveralls, aprons and spray suits.
06. Recognize the features of suitable protective footwear, headgear, eyewear and gloves.
07. Describe how to wash and when to discard PPE.
08. Understand when and what type of respirator should be worn.
09. Identify the factors that contribute to heat stress and discuss how to reduce the risk of heat stress.

G. Pesticide Application Equipment Calibration

Certified crop advisers should be able to:

01. Discuss the variables that determine the application rate for sprayers and granular applicators.
02. Recognize the importance of spray pattern uniformity.
03. Describe the procedures used to calibrate sprayers and granular applicators and the methods used to adjust output.
04. Calculate the amount of pesticide and adjuvant to add to the spray tank of a calibrated sprayer.

WISCONSIN CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

Crop Management

- A. Soil Adaptation for Major Wisconsin Crops**
- B. Cropping Systems**
- C. Crop Establishment**
- D. Crop Management during Growth & Development**
- E. Harvest Factors**

Crop Management

A. Soil Adaptation for Major Wisconsin Crops

Certified crop advisers should be able to:

01. Explain the optimum pH range for the major Wisconsin crops and how these crops respond to pH modification.
02. Describe the relative nutrient requirements of the major Wisconsin crops.
03. Explain the specific environmental and soil conditions that influence the selection and production strategies for the major Wisconsin crops.

B. Cropping Systems

Certified crop advisers should be able to:

01. Understand the management and economic considerations in making crop rotation decisions involving major Wisconsin crops.
02. Recognize the ramifications associated with introduction of a processing crop into a cash grain or forage system.
03. Identify the advantages and limitations of using cover crops.
04. Explain the advantages and limitations of organic farming.
05. Describe the objectives of sustainable agriculture and the principal obstacles toward achieving these objectives.

C. Crop Establishment

Certified crop advisers should be able to:

01. Describe the environmental and cultural factors influencing seeding depth, seeding rate and row spacing for major Wisconsin planting systems.
02. Discuss tillage management considerations for various cropping systems.
03. Describe management considerations for successful implementation of conservation tillage systems.

04. Identify principles underlying optimum planting time, the consequences of planting too early or too late, and the effect of relative maturity for major Wisconsin crops.
05. Explain how each major crop responds to changes in row spacing and plant population.
06. Describe the value of inoculation of legume seed and the environments in which it should be done.
07. Explain how to calculate seeding rates and plant populations.
08. Describe the effect of seed quality on germination and crop growth.
09. Discuss the advantage of using seed treatments.
10. Identify and utilize the information required on seed tags.
11. Summarize the criteria for selecting adapted crop varieties and hybrids:
 - a. Emergence
 - b. Disease and pest resistance
 - c. Population and row spacing
 - d. End use
 - e. Soil type
 - f. Location in state
 - g. Drought tolerance
 - h. Standability
12. Explain the advantages and limitations of producing genetically modified crops.
13. Understand the various GMO events and how they impact management.
14. Identify the advantages and disadvantages of value-added crops.
15. Explain the basic components of precision agriculture and its advantages and disadvantages.

D. Crop Management During Growth and Development

Certified crop advisers should be able to:

01. Recognize and utilize growth staging systems for the major crops.
02. State the factors influencing winter hardiness of forages and winter wheat and the effect management practices have on winter survival.

03. Demonstrate awareness of diagnostic techniques such as soil and plant analysis; nematode testing; insect, weed and disease identification; proper sample submission to diagnostic laboratories.
04. Calculate growing degree-days and relate the growing degree-day concept to corn and other crop development.
05. Describe how water needs of crops change during crop growth and development.
06. Discuss diagnostic methods to assess the management consequences of the following
 - a. Winter kill
 - b. Hail
 - c. Frost
 - d. Fertilizer/chemical damage
 - e. Wildlife or insect feeding damage

E. Harvest Factors

Certified crop advisers should be able to:

01. Explain the optimum stage at which to harvest the major Wisconsin crops for grain or forage or edible plant part and describe consequences of harvesting too early or too late.
02. Explain the soil conservation advantages and disadvantages of baling, grazing or chopping crop residue, versus leaving the crop residue on the soil surfaces versus incorporation of residue into the soil with tillage.
03. Explain how fall harvest management of alfalfa affects yield, winter survival and feed value of the following year's crop.
04. Cite the appropriate moisture ranges for forages stored in various structures (upright silos, bunkers, bags, etc.).
05. Understand crop drying and processing systems.
06. Describe harvest and grading factors for crop use.

WISCONSIN CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

Regulations

- A. Environmental Protection**
- B. Surface & Groundwater Protection**
- C. Employee & Public Protection**
- D. Pesticide Use Records**
- E. Pesticide Labels & Registration**
- F. Applicator Certification & Licensing**

Regulations

A. Environmental Protection

Certified crop advisers should be able to:

01. Determine whether a pesticide spill needs to be reported and what agencies need to be notified.
02. Know that a use permit is required to use any pesticide for the control of mammals (other than rats and mice) or birds.
03. Know the difference between “drift” and “overspray”, and what constitutes “significant drift”..
04. Recognize the responsibilities of the farmer, commercial pesticide applicator and beekeeper with respect to advance notification of pesticides, labeled as “Highly Toxic to Bees”.
05. Know that pesticide wastes are classified as either solid or hazardous, and how best to dispose of hazardous wastes.

B. Surface and Groundwater Protection

Certified crop advisers should be able to:

01. Distinguish between preventative action limits and enforcement standards.
02. Determine whether a site is suitable for mixing and loading with respect to nearby wells or surface water.
03. Describe the purposes and uses of a mixing and loading pad and when such a pad is required.
04. Describe precautions that must be taken to protect the water supply when mixing and loading.
05. Outline Wisconsin’s atrazine use rule.
06. Recognize the role of the USDA-NRCS Nutrient Management Standard 590 and WDNR Code NR 151 for protecting water resources.

C. Employee and Public Protection

Certified crop advisers should be able to:

01. Identify employers, employees and the pesticide applications that are covered by the Worker Protection Standard (WPS).
02. List the responsibilities of employers of pesticide handlers and agricultural workers regarding PPE.
03. State the responsibilities of employers of pesticide handlers and agricultural workers when a victim of pesticide exposure or heat stress needs medical attention.
04. Know who must receive WPS safety training and when.
05. Identify who can be in a treatment area during an application that is covered by the WPS.
06. Describe when and where decontamination sites are required and what such sites include.
07. List the agricultural employer's responsibilities to a handler who is applying a pesticide.
08. Recognize the purpose of the employer information exchange and what types of information must be exchanged before and after an application, including information required by the WPS and ATCP 29.
09. List the information that must be displayed at a central location for viewing by workers and handlers and indicate how long such information must be displayed.
10. Determine when you must give workers oral warning of a pesticide application under the WPS, the time frame in which you must do so and the content of such a warning.
11. Identify who may enter a treated site during a restricted-entry interval.
12. State the conditions and restrictions for early entry with no contact and early entry with contact into a treated site.

13. With respect to posting a site that has been treated with a pesticide, indicate:
 - a. When posting is required
 - b. What warning signs to use
 - c. Where signs are to be posted
 - d. When signs must be posted and taken down
 - e. Who is responsible for posting
14. Explain Wisconsin regulations regarding pesticide overspray and drift.

D. Pesticide Use Records

Certified crop advisers should be able to:

01. Determine when and for how long pesticide application records must be kept.
02. Know when the USDA may request pesticide application records.
03. Recognize that pesticide application under emergency exemption (Section 18) or local need (Section 24 {C}) will require additional record keeping and reporting requirements.

E. Pesticide Labels and Registration

Certified crop advisers should be able to:

01. Understand that the label and supplemental labeling are legally binding documents.
02. Decide what to do if state laws are stricter than label directions.
03. Determine which directions should be followed when using a product whose label has changed since it was purchased.
04. Compare and contrast emergency exemption (Section 18) and special local need (Section 24 {C}) registrations.
05. Describe and locate the kinds of information that appear on a pesticide label.
06. List the four ways in which a person may legally deviate from pesticide label directions.
07. Determine a product's relative toxicity based on its signal word.

F. Applicator Certification and Licensing

Certified crop advisers should be able to:

01. Determine whether the person making any given pesticide application is a private applicator or a commercial applicator for hire.
02. Know the legal limits and conditions that allow a private applicator to act as a commercial applicator.
03. Identify the certification requirements for private applicators, commercial applicators and mixer-loaders.

WISCONSIN CERTIFIED CROP ADVISER PERFORMANCE OBJECTIVES

References

Nutrient Management

Soil & Water Management

Pest Management

Crop Management

Regulations

References

The following publications are available from the University of Wisconsin Cooperative Extension Service Publications (Cooperative Extension Publications, 432 N. Lake St., Madison, WI 53706; 877-947-7827; <http://learningstore.uwex.edu/>)

Nutrient Management

- Sampling Soils for Testing. (UWEX publication # A2100)
- Understanding Plant Nutrients Series –
Soil and Applied:
 - Nitrogen. (UWEX publication # A2519)
 - Phosphorus. (UWEX publication # A2520)
 - Potassium. (UWEX publication # A2521)
 - Boron. (UWEX publication # A2522)
 - Calcium. (UWEX publication # A2523)
 - Magnesium. (UWEX publication # A2524)
 - Sulfur. (UWEX publication # A2525)
 - Manganese. (UWEX publication # A2526)
 - Copper. (UWEX publication # A2527)
 - Zinc. (UWEX publication # A2528)
 - Iron. (UWEX publication # A3554)
 - Molybdenum. (UWEX publication # A3555)
 - Chlorine. (UWEX publication # A3556)
- Soil Test Recommendations for Field Vegetable and Fruit Crops. (UWEX publication # A2809)
- Management of Wisconsin Soils. (UWEX publication # A3588)

Soil and Water Management

- Management of Wisconsin Soils. (UWEX publication # A3588)
- Estimating Residue Using the Line Transect Method. (UWEX publication A3533)
- Irrigation Management in Wisconsin – The Wisconsin Irrigation Scheduling Program (WISP). UWEX publication A3600

Pest Management

- Pest Management in Wisconsin Field Crops (UWEX publication # A3646)
- Weeds of the North Central States (UWEX publication # NCR 281)
- Herbicide Mode of Action and Injury Symptoms (UWEX publication # NCR 377)

- Herbicide Resistant Weeds (UWEX publication # NCR 468)
- Reduced Herbicide Rates: Aspects to Consider (UWEX publication # A3563)
- Common Weed Seedlings of the North Central States (UWEX publication #NCR 607)
- Corn Insects Above Ground (UWEX publication #A2046)
- Corn Insects Below Ground ((UWEX publication #A2047)
- Corn Rootworm (UWEX publication # A3328)
- The European Corn Borer (UWEX publication # A1220)
- Small Grain Insects (UWEX publication # A2558)
- Alfalfa Management Guide (UWEX publication # NCR 547)
- Red Clover-Establishment, Management and Utilization (UWEX publication # A3492)

Crop Management

- Alfalfa Management Guide. (UWEX publication # NCR 547)
- Commercial Vegetable Production in Wisconsin. (UWEX publication # A3422)
- Small Grain Varieties for Grain and Forage in Wisconsin. (UWEX publication # A3397)
- Selecting Corn Hybrids (UWEX publication # A3265)
- Uneven Emergence in Corn (UWEX publication # NCR 344)

Regulations (Contact the UWEX Pesticide Application Program for current publications (608-262-7588)

- Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
- Wisconsin Pesticide Law (Chapter 94. 67-71)
- Wisconsin Groundwater Law (Chapter 160)
- Wisconsin Spill Law (Chapter 144.76)
- Pesticide Use and Control (Chapter ATCP 29)
- Pesticide Product Restrictions (Chapter ATCP 30)
- Worker Protection Standard How to Comply Manual
- Training Manual for the Commercial Pesticide Applicator: Field & Vegetable Crops (available from UWEX Pesticide Applicator Training Program)
- Training Manual for the Private Pesticide Applicator (available from your county Extension office)

Other University of Wisconsin Cooperative Extension Publications

- Field Crop Scouting Manual (available from UWEX IPM Program, 608-263-4073, also available at: <http://ipcm.wisc.edu/>)
- Vegetable Crop Scouting Manual (available from UWEX IPM Program, 608-263-4073, also available at: <http://ipcm.wisc.edu/>)

- Training Manual for the Commercial Pesticide Applicator: Field & Vegetable Crops, 4th edition (available from UWEX Pesticide Applicator Training Program, 608-262-7588)
- Pest Management Principles for the Private and Commercial Applicator: Agriculture Fumigation, 2nd edition (available from UWEX Pesticide Applicator Training Program, 608-262-7588)

Other Publications

- Identification of Aphids on Small Grains (Washington State University, publication # EB0003, Telephone: 1-800-723-1763)
- Vegetable Insect Management with Emphasis on the Midwest (Meister Publishing Company, Willoughby, Ohio)
- Ontario Weeds (Publications Ontario, 416-326-5300)
- Weeds of Nebraska and the Great Plains (Nebraska Dept. of Agriculture, Bureau of Plant Industry, P.O. Box 94756, Lincoln, NE 68509)
- Weeds of the Northeast (CUP Services, Telephone 607-277-2211)
- Waterhemp Management in Agronomic Crops (publications # X855, Communication Services, University of Illinois at Urbana-Champaign, telephone 217-333-2007)
- Guide to Herbicide Injury Symptoms in Corn (Agri-Growth Research, telephone 507-889-4371)
- Guide to Herbicide Injury Symptoms in Soybean (Agri-Growth Research, telephone 507-889-4371)
- Crop Protection Reference (C & P Press, <http://www.greenbook.net>)
- Church, G.A. (Mgr.). 1992. Conservation Tillage Systems and Management. MWPS-45. Midwest Plan Service. Ames, Iowa
- USDA-NRCS Nutrient Management Standard 590 (Sept. 2005)
- USDA-NRCS Wisconsin Conservation Planning Technical Note WI-1
- WDATCP Soil and Water Resource Management Chapter ATCP 50
- WDNR Runoff Management (Chapter NR 151)

Websites:

<http://www.weeds.iastate.edu/> Iowa State University Weed Science Program, Department of Agronomy

<http://datcp.state.wi.us/static/arm/> Wisconsin Department of Agriculture, Trade and Consumer Protection, Agriculture Resource Management Division

<http://www.ipni.net/> International Plant Nutrition Institute

University of Wisconsin Cooperative Extension and College of Agricultural and Life Sciences websites

http://www.uwex.edu/ces/crops/uwforage/uwforage.htm	University of Wisconsin-Extension Team Forage
http://www.uwex.edu/ces/forage/	University of Wisconsin Forage Research and Extension
http://ipcm.wisc.edu/	UW Integrated Crop and Pest Management Programs (NPM, IPM, PAT)
http://ipcm.wisc.edu/uw_weeds/	UW-Weed Science
http://www.plantpath.wisc.edu/soyhealth/	UW-Soybean Plant Health web site
http://soybean.agronomy.wisc.edu/	UW Soybean Extension
http://corn.agronomy.wisc.edu/	Wisconsin Corn Agronomy
http://ipcm.wisc.edu/wcm/	Wisconsin Crop Manager
http://www.uwex.edu/ces/ag/teams/grains/	Extension, Team Grains
http://www.plantpath.wisc.edu/pddc/	Plant Disease Diagnostics Clinic
http://www.entomology.wisc.edu/entodiag.html	Insect Diagnostic Lab
http://agronomy.wisc.edu/	UW Department of Agronomy
http://www.entomology.wisc.edu/	UW Department of Entomology
http://www.horticulture.wisc.edu/	UW Department of Horticulture
http://www.plantpath.wisc.edu/	UW Department of Plant Pathology
http://www.soils.wisc.edu/extension/	UW Soil Science Research and Extension
http://uwlab.soils.wisc.edu/	Wisconsin Soil and Plant Analysis Lab
http://www.soils.wisc.edu/wimnext/	UW-MN Cooperative Extension Agricultural Weather
http://www.plantpath.wisc.edu/wivegdis/	UW Vegetable Pathology
http://www.plantpath.wisc.edu/fpath/frames.htm	UW Fruit Pathology