

Northwest Regional Certified Crop Adviser

Performance Objectives

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Prepared by Northwest Regional CCA Board

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Certified Crop Adviser Northwest Regional Performance Objectives

Introduction

The Certified Crop Adviser Performance Objectives outline the knowledge and skill areas that are covered on the Northwest Regional Certified Crop Adviser Examination. The Northwest Regional Performance Objectives are a modification of the National Certified Crop Adviser Performance Objectives that outline knowledge and skill areas needed in the Northwest Region.

These Performance Objectives are dynamic, and will be upgraded, changed, and modified as the needs of the production industry evolve. The Certified Crop Adviser program will then remain a viable and useful tool that will recognize the high level of competence displayed by those who choose to earn this designation.

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NUTRIENT MANAGEMENT COMPETENCY AREAS:

1. Basic concepts of soil fertility
2. Nutrient movement in soil and water
3. Soil pH and modification
4. N, P, and K considerations
5. Secondary and micronutrients
6. Soil testing, plant analysis and fertilizer recommendations
7. Fertilizer forms and application
8. Manure and other organic by-products

COMPETENCY AREA 1. Basic concepts of soil fertility

1. The soil as a source of nutrients

1. List the ionic form in which each of the macro and secondary nutrients are available to plants.
2. Describe the role of cation exchange in plant nutrition.
3. Define soil solution and describe its relationship to nutrient mobility.
4. Describe how immobilization and mineralization affect nutrient availability.
5. Describe how soil pH affects nutrient availability.
6. Recognize how cation exchange capacity affects nutrient leaching.
7. Understand nutrient uptake and translocation.
8. Recognize and identify nutrient sources, including. irrigation, H₂O. atmospheric, legume credits, crop residue, manure, compost, etc.
9. Describe how banding versus broadcasting affects nutrient availability.
10. Influence of microbial activity on nutrient cycling and nutrient availability.

2. Assessment of soil productivity based on soil physical properties

1. Describe how texture, structure, organic matter, bulk density and compaction affect the productivity of soil.

COMPETENCY AREA 2. Nutrient movement in soil and water

1. Distinguish between point and non-point sources of entry into the environment and surface and/or groundwater resources.
2. Recognize how soil, climatic, and nutrient properties affect movement of a nutrient in soil or water.
3. Recognize how soil properties, tillage, irrigation practices and, cropping patterns affect nutrient runoff and leaching.
4. Understand the forms of N fertilizers commonly applied and their relative

immediate potential for leaching and/or volatility.

5. Recognize how application timing affects nutrient runoff and leaching and volatility.
6. Recognize how fall fertilizer applications affects nutrient runoff and leaching.
7. Understand precautions that reduce runoff and nutrient leaching, eg. tillage practices, filter strips, grass waterways, direct seeding, polyacrylamide (PAM), etc.

COMPETENCY AREA 3. Soil pH and modification

1. Define and calculate soil pH and understand the pH scale.
2. List processes or practices that cause soil pH to change.
3. Recognize benefits from lowering or raising soil pH.
4. Recognize how soil pH and physical properties affect soil processes such as nitrogen volatilization.
5. Recognize how excess free lime (calcium carbonate) affects nutrient availability.
6. Understand the process of liming and the role of various liming materials to increase soil pH.
7. Understand how elemental sulfur and sulfate fertilizers decrease pH.
8. Understand pH modification associated with addition of various nitrogen sources.

COMPETENCY AREA 4. N, P, K considerations

1. Nitrogen

1. Understand the role of nitrogen in plants.
2. Recognize general deficiency symptoms and ways to diagnose N deficiency symptoms prior to visual symptoms.
3. Understand the nitrogen cycle and how it affects nitrogen availability.
4. Recognize the ways nitrogen may become available or lost from the soil or

the plant.

5. Understand the limitations of N fertilizers.
6. Understand the process of biological N fixation.
7. Understand how soil physical properties affect the effectiveness of nitrogen fertilizers to supply crop demands for nitrogen.
8. Recognize how cropping systems and agronomic practices affect nitrogen fertilization.
9. Recognize how soil drainage, irrigation, precipitation levels, and potential for water contamination affect nitrogen fertilization including organic sources.
10. Understand the safety precautions that should be taken in handling various nitrogen fertilizers such as ammonium nitrate, anhydrous ammonia.
11. Recognize the role of application timing on plant availability and environmental protection.
12. Understand how to incorporate nitrogen contribution from all N sources soil into fertilizer recommendations.
13. Recognize primary environmental concerns with nitrogen use.

2. Phosphorus

1. Understand the role of phosphorus in plants.
2. Recognize general phosphorus deficiency symptoms and ways to diagnose P deficiency symptoms prior to visual symptoms.
3. Understand how soil properties affect phosphorus fertilization and plant availability.
4. Understand how cropping systems and agronomic practices affect phosphorus fertilization.
5. Understand how the soil retains or loses phosphorus.
6. Recognize the analysis and chemical composition of different phosphorus fertilizers.

7. Understand how nitrogen and phosphorus applications differ relative to water quality pollution.
8. Recognize local phosphorus recommendations and restrictions to be consistent with regulatory phosphorus management plans.
9. Recognize the primary environmental concerns with phosphorus emanating from such areas as feedlots, dairies, urban areas and others.

3. Potassium

1. Understand the role of potassium in plants.
2. Recognize general potassium deficiency symptoms in plants and ways to diagnose potassium deficiency symptoms prior to visual symptoms.
3. Understand potassium luxury consumption.
4. Understand how the soil retains potassium.
5. Recognize how soil and irrigation water properties affect potassium fertilization.
6. Recognize how cropping systems and agronomic practices affect potassium fertilization.
7. Recognize the analysis and chemical composition of different potassium fertilizers.

COMPETENCY AREA 5. Secondary and micronutrients

1. Recognize the general deficiency and toxicity symptoms of the secondary and micronutrients.
2. Know methods of correcting secondary and micronutrient deficiencies.
3. Recognize the effect of soil pH on micronutrient availability.

COMPETENCY AREA 6. Soil testing, plant analysis and fertilizer recommendations

1. Use a map to locate a tract of land and give a legal description.
2. Understand the limitations of a county soil survey in determining soil characteristics.

3. Describe soil sampling and handling procedures to include sampling depth, number of cores, selection of areas to sample and sampling patterns, and sources of contamination.
4. Describe how precision agriculture can be utilized in different sampling techniques, i.e., zone sampling, grid sampling.
5. Understand when to and how to use diagnostic sampling (good vs poor vigor, good vs poor emergence, etc.).
6. Understand soil spatial variability in relation to precision agriculture.
7. Describe the philosophy of soil testing and plant analyses and the role of sampling, analysis, interpretation and recommendation in making a fertilizer recommendation.
8. Understand the different methods soil testing labs use for analyzing samples, i.e., variation in results due to extraction methods.
9. Understand the agronomic importance of items on a soil test and plant analyses reports.
10. Use information from soil test and plant analyses reports to determine economically and environmentally sound fertilizer recommendations.
11. Use fertilizer analysis information to calculate amounts of different fertilizers required to meet a specific recommendation.

COMPETENCY AREA 7. Fertilizer forms and application

1. Understand potential advantages and disadvantages of broadcast versus banded fertilizer applications.
2. Recognize how fertilizer placement and time of application affect nutrient availability and leaching.
3. Understand special environmental concerns associated with fertilizer applications.
4. Understand how fertilizer additives can affect plant availability and reduce loss.
5. Understand fertilizer application equipment operation and calibration, including fertigation.

COMPETENCY AREA 8. Manure and other organic by-products

1. Understand calculations related to manure production from animal units, manure types, application, and calibration of application equipment, including irrigation systems.
2. Recognize site calculations and practices that influence manure off-site movement.
3. Understand manure nutrient analysis, including salt index, for determining application rates, manure handling, and sampling practices.
4. Recognize risks, benefits, and limitations of manure applications.
5. Understand nutrient losses associated with manure handling and storage systems.
6. Understand confined animal feedlot ordinances (CAFO) regulatory process.
7. Understand composting principles and odor control practices.

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SOIL AND WATER MANAGEMENT COMPETENCY AREAS:

1. Basic properties of soils
2. Soil water management
3. Soil conservation
4. Tillage operations and soil characteristics
5. Management of saline and sodic soils

COMPETENCY AREA 1. Basic properties of soils

1. Soil texture and soil structure

1. Understand characteristics of sand, silt, and clay.
2. Use a textural triangle to determine textural classification of a soil when given the percent of two of the soil separates.
3. Understand importance of sand, silt and clay in plant growth.
4. Understand how soils are formed:
 - a. including volcanic soils, alluvial fans, glacial/ice-age impacts, floodplain features.
5. Understand benefits of well-developed soil aggregation.
6. Recognize how soil organisms, tillage, and cropping systems affect soil structure.
7. Recognize characteristics of soil horizons.

2. Soil organic matter

1. Understand the role of sampling depth and laboratory methods in determining soil organic matter and organic carbon.
 - a. Know how to convert OM to OC and vice versa.
 - b. Understand the relationship between and utility of different methods, including Loss on Ignition, Total Organic Carbon and Walkley Black methods.
2. Understand the role of soil organic matter in pesticide management.
3. Understand the importance of soil organic matter in nutrient management.
4. Recognize how soil organic matter is related to soil color, structure, and soil temperature.
5. Understand how the carbon nitrogen ratio of organic materials in the soil may affect the availability of soil nitrogen to plants.
6. Recognize advantages and disadvantages of organic matter contributions including cover crops.

7. Recognize how soil organic matter affects soil aggregation, water holding capacity and water infiltration.
8. Understand ways to maintain the organic matter content of an agricultural soil.
9. Understand the function and diversity of soil microorganisms and their role in soil organic matter.
10. Understand how soil organic matter is created and lost.

COMPETENCY AREA 2. Soil water management

1. Define plant available water.
2. Understand how pore size distribution affects the drainage characteristics and water holding capacities of soils.
3. Recognize how soil texture, soil structure, and soil organic matter affect pore size, soil drainage and plant available water.
4. Recognize how cropping systems and agronomic practices affect infiltration rate.
5. Recognize factors that influence the rate and timing of irrigation.
6. Recognize the role of soil erosion by wind and water in nutrient loss.
7. Recognize how infiltration rate and hydraulic conductivity affects potential groundwater contamination.
8. Understand how sprinkler, furrow, rill, flood, and drip irrigation methods can impact surface and ground water quality.
9. Understand how to use soil and crop characteristics, ET, and climatic data to develop an irrigation schedule.
10. Understand how irrigation can affect soil temperature.

COMPETENCY AREA 3. Soil conservation

1. Recognize types of water and wind erosion.
2. Understand management practices that reduce wind and water erosion, as well as reduce runoff and leaching.
3. Describe how soil loss through erosion affects loss of plant nutrients.

COMPETENCY AREA 4. Tillage operations and soil characteristics

1. Recognize how tillage operations influence erosion, soil structure, organic matter content, pH, compaction, surface residue, and biological activity.
2. Identify plant symptoms and soil characteristics associated with compaction and impermeable layers.
3. Recognize practices that alleviate compaction and conditions necessary for successful implementation of those practices.

COMPETENCY AREA 5. Management of saline and sodic soils

1. Define saline, saline-sodic, and sodic soils.
2. Understand how to prevent and reclaim saline, saline-sodic, and sodic soils.
3. Understand the complications associated with irrigation water quality and control of saline conditions.
4. Understand irrigation water sources and irrigation water quality including being able to calculate EC and interpret SAR.

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PEST MANAGEMENT COMPETENCY AREAS:

1. Management of weeds
2. Management of plant diseases
3. Management of nematodes
4. Management of Vertebrates
5. Management of insects
6. Calibration of pesticide application equipment
7. Using pesticides in an environmentally sound way
8. Protecting against off target pesticide exposure
9. Integrated pest management

COMPETENCY AREA 1. Management of weeds

1. Weed biology

1. Understand the differences between sedges, grasses and broadleaf weeds.
2. Understand distinguishing characteristics of annual, biennial, and perennial weeds.
3. Understand weed reproduction and survival strategies, including seed dormancy and rhizome root structures.

2. Weed management practices

1. Understand cultural, chemical, biological, and mechanical weed management.
2. Understand cultural practices used in making non-chemical weed management recommendations including crop rotation, seeding date, organic versus conventional production systems.
3. Understand economic thresholds in their relation to weed populations and crop competition.

3. Herbicide application

1. Define herbicide persistence.
2. Understand the difference between contact and systemic herbicides.
3. Understand how adjuvants affect herbicide performance.
4. Recognize the importance of timing in herbicide application.
5. Recognize the relationship between plant vigor and herbicide effectiveness in postemergence applications.
6. Identify general plant symptoms caused by various herbicide mode/mechanism of action groups.
7. Understand environmental and growth factors that affect the performance of herbicides.

8. Understand management, plant, and environment factors involved in making herbicide recommendations.
9. Recognize the possible off-target effects of herbicide application
 - a. volatility.
 - b. drift.
 - c. leaching and runoff.
 - d. carryover
10. Understand different herbicide modes of action and how they relate to weeds controlled and herbicide resistant weeds.
11. Understand differences between soil and foliar applied herbicides.
12. Understand herbicide selectivity.

COMPETENCY AREA 2. Management of plant diseases

1. Biology of plant diseases

1. Understand the disease triangle: favorable environment – virulent pathogen – susceptible host.
2. Recognize symptoms caused by fungi, bacteria, viruses, abiotic factors and other organisms.
3. Understand systemic acquired resistance (SAR) and how it can impact disease management in a crop.

2. Plant disease management practices

1. Understand cultural, chemical, biological, and genetic disease management.
2. Recognize how to determine plant disease economic threshold levels.
3. Recognize differences between systemic and contact pesticides.
4. Recognize different strategies involved with the use of seed, foliar, and soil applied pesticides.
5. Recognize the importance of rotating different FRAC groups for resistance management.

6. Understand the role of biologicals in managing pesticide resistance and improving efficacy.

COMPETENCY AREA 3. Management of nematodes

1. Understand nematode biology and management practices.
2. Identify plant damage symptoms caused by nematodes.
3. Understand nematode sampling and monitoring methods as well as economic thresholds.
4. Understand cultural and chemical types of nematode management including cover crops, biofumigant and trap cover crops, soil fumigation.
5. Understand management, plant and environmental factors to include in making recommendations for nematodes.

COMPETENCY AREA 4. Management of Vertebrates

1. Understand vertebrate biology and management practices.
2. Identify plant damage symptoms caused by vertebrates.
3. Understand cultural and chemical types of Vertebrate management including buffer zones, tillage and pesticides.

COMPETENCY AREA 5. Management of insects

1. Insect biology

1. Understand the differences between hard body and soft body insects.
2. Understand complete and simple metamorphosis.
3. Understand insect life cycles and their impact on cropping systems.

2. Insecticide application

1. Distinguish among contact insecticides, systemic insecticides, and insect growth regulators.
2. Recognize the importance of insecticide application timing.

3. Understand management, plant and environmental factors used in making insect management recommendation (chemical, cultural, and biological).
4. Understand the importance of beneficial insects and decisions to be made as part of an IPM program.
5. Understand the risks associated with pesticide applications and their potential impact on pollinators.

COMPETENCY AREA 6. Calibration of pesticide application equipment

1. Pesticide formulations and labels

1. Recognize the physical characteristics of pesticide formulations including:
 - a. Emulsifiable Concentrate (EC).
 - b. Soluble Concentrate (SC).
 - c. Dry Flowable (DF).
 - d. Dry Granule (DG).
 - e. Wet Granule (WG).
 - f. Wettable Powder (WP).
 - g. Water Soluble Bag/Pouch (WSB/P).
2. Recognize the types of information found on a pesticide label:
 - a. Re-entry Interval (REI).
 - b. Preharvest Interval (PHI).
 - c. use rate.
 - d. rotational restrictions.
 - e. labeled crops.
 - f. Personal Protective Equipment (PPE).
 - g. Section 1e or 24c (specialized local use).
3. Use information on a label to determine proper rate in a given situation.

2. Identification of application equipment and critical components

1. Recognize pattern, relative droplet size and primary uses of different nozzle types.
2. Understand how to determine nozzle tip wear.
3. Understand application techniques, adjuvants, and equipment that avoid or reduce drift.

3. Basic principles of calibration

1. Understand methods used to establish accurate ground speed under field conditions.
2. Understand factors affecting uniform spray coverage.
3. Calculate the amounts of pesticide an applicator applies at a specific rate, either band or broadcast, on a given area.
4. Understand the procedure used to adjust the output of a sprayer.
5. Use the calibration factors of gallons per acre, gallons per minute, width of nozzle spacing, spray pressure and ground speed to demonstrate how to calibrate a sprayer.
6. Recognize the importance of field calibration to ensure accuracy of application.
7. Understand use of back siphon to protect water quality.

COMPETENCY AREA 7. Using pesticides in an environmentally sound way

1. Pesticide movement and degradation in soil and water

1. Distinguish between point source and non-point sources of entry into the environment.
2. Describe the differences between, and the factors leading to, point source and nonpoint source water quality contamination from pesticides commonly used in the Pacific Northwest.
3. Recognize how soil, environmental, and pesticide properties affect movement of pesticides in soil or water.
4. Recognize how soil properties, environmental, and biological factors affect pesticide degradation.
5. Recognize how sandy soil, sinkholes, shallow water table and water management affect potential for groundwater contamination.

6. Recognize how equipment calibration and maintenance affects potential for groundwater contamination.
7. Understand the fate of pesticides in groundwater and surface waters.

2. Government regulations

1. Interpret a Safety Data Sheet (SDS).
2. Understand the proper disposal procedure for pesticide waste, rinsates, containers and spills.
3. Understand sources of information to determine toxicity levels, first aid procedures, and other safety and toxicity information.
4. Understand record-keeping regulations for restricted use pesticides.

COMPETENCY AREA 8. Protecting against off-target pesticide exposure

1. Keeping pesticides on target

1. Understand differences between spray drift, volatilization, and temperature inversion.
2. Recognize factors that affect off-target pesticide movement.
3. Understand means of checking for off-target movement.

2. Human toxicity

1. Understand pesticide modes of entry into the human system.
2. Distinguish between chronic and acute poisoning effects.
3. Recognize general symptoms of acute pesticide poisoning.
4. Recognize possible chronic effects of pesticide poisoning.
5. Recognize general procedures to follow if pesticide gets on the skin, in the eyes, in the mouth or stomach, or if inhaled.

3. Handling pesticides safely

1. Recognize that pesticide labels are the best source of information concerning toxicity levels, handling precautions, first aid procedures, and other safety information.
2. Recognize protective gear used during loading, mixing and application of pesticides.
3. Understand proper cleanup procedures for application equipment and protective gear.
4. Understand proper ways of storing and disposing of pesticide containers.

COMPETENCY AREA 9. Integrated pest management

1. Recognize how field scouting and economic threshold levels relate to integrated pest management.
2. List, explain, and provide examples of the different forms of IPM: cultural, chemical, biological, physical.
3. Recognize steps in carrying out an integrated pest management program.
4. Understand the advantages and limitations of integrated pest management.

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CROP MANAGEMENT COMPETENCY AREAS:

1. General crop considerations
2. Tillage systems used for seedbed preparation
3. Hybrid and cultivar (variety) selection
4. Crop damage, mortality, and factors influencing replanting decisions
5. Cropping systems

COMPETENCY AREA 1. General crop considerations

1. Soil conditions

1. Recognize how crops respond to soil fertility, soil pH, soil salinity and soil drainage.
2. Describe the soil pH ranges where agronomically important crops will perform best.
3. Describe how the fertilizer salt index can affect
 - a. seed germination.
 - b. foliar application.
 - c. tank mix compatibility.

2. Climatic adaptation

1. Recognize how the water needs of a crop typically change during growth and development.
2. Understand the implications of local climate and restrictions on crops that can be grown, for example:
 - a. corn hybrids.
 - b. fruit crops.
 - c. potato varieties.
 - d. dry and succulent beans.
 - e. alfalfa dormancy and winter hardiness ratings.

COMPETENCY AREA 2. Tillage systems used for seedbed preparation.

1. Recognize the environmental and management factors that influence the selection and use of a tillage system.
2. Recognize how cropping systems, environment, and tillage affect soil residue cover.
 - a. Crop residue and its relationship to seedbed preparation and quality.
 - b. Understand how tillage systems can affect nutrient cycling and plant availability.

3. Recognize the different tillage systems and List the advantages and limitations of each, for example:
 - a. conventional tillage.
 - b. reduced till.
 - c. strip till.
 - d. no till.
4. Seeding depth factors.
 - a. Describe seed, soil, and environmental conditions that affect recommended seeding depths.

COMPETENCY AREA 3. Hybrid and cultivar (variety) selection.

1. Recognize how test weight influences seed quality.
2. Explain how storage time, handling, and storage conditions may affect seed quality.
3. Define seed dormancy and hard seed.
4. Recognize how local climates affect hybrid or variety selection.

COMPETENCY AREA 4. Crop damage, mortality, and factors influencing replanting decisions.

1. Recognize the type of damage hail, frost, flooding, drought, wind, insects, disease, and weed pressure can cause agronomic crops.
2. List climatic and plant factors which influence plant mortality or its ability to resume growth after injury.
3. Understand how to determine and evaluate ideal plant populations to determine if replanting is economically feasible.

COMPETENCY AREA 5. Cropping systems

1. Describe the function(s) of fallowing fields in crop production.
2. Recognize advantages and disadvantages of growing cover crops.
3. Recognize advantages and disadvantages of a monoculture system versus a crop rotation.