

**ROCKY MOUNTAIN
CERTIFIED CROP ADVISER**

**Local Performance Objectives
For Exams and Continuing Education Programs**

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INTRODUCTION

Rocky Mountain Certified Crop Adviser Performance Objectives

The Certified Crop Adviser (CCA) Performance Objectives outline the knowledge and skill areas that are covered on the Rocky Mountain Certified Crop Adviser Examination and in continuing education programs. These performance objectives should be used to help you prepare for the examination. All the questions on the examination are based directly on the performance objectives. Questions on the Rocky Mountain Certified Crop Adviser Exam were developed by a number of people including personnel from: Montana State University and the University of Wyoming; Montana and Wyoming Departments of Agriculture; Montana and Wyoming Natural Resources Conservation Service; Montana and Wyoming Departments of Environmental Quality; and Nancy Matheson and others, Alternative Energy Resources Organization.

The Performance Objectives are divided into five sections 1. Nutrient Management, 2. Soil and Water Management, 3 Pest Management, and 4. Crop Management.

The Performance Objectives also serve as the guide for the continuing education part of the CCA program. Once certified, you, the Crop Adviser, will be required to demonstrate participation in continuing education programs. You will have to describe your continuing education activities by competency area and specific performance objectives.

As you participate in the Continuing Education portion of the CCA program, you may want to use the Performance Objectives to help you decide those areas you wish to learn more about. It will also help you describe your continuing education credits, so you can demonstrate to your Regional Board that your credits meet recertification requirements.

Since the Performance Objectives have been developed over the material that Certified Crop Advisers need to know, they are the base on which the entire CCA program is built. The continuing education program is designed to provide further educational opportunities in the five competency areas. The learning process is ongoing, and this booklet can help you direct your learning and identify those areas and competencies in which you need further study. The first step is adequately mastering the material covered in the Performance Objectives to pass the examination. The second step is to upgrade yourself by pursuing training in those areas that you need further study. In this way you will maintain or increase your proficiency as a Crop Adviser, and will insure the credibility and success of all those who have earned the Certified Crop Adviser designation.

NUTRIENT MANAGEMENT COMPETENCY AREAS

1. Basic concepts of soil fertility

- 1.1 Recognize how soil properties and nutrient cycling processes affect nutrient management.
- 1.2 Determine field variability to apply precision nutrient management practices.

2. Nutrient movement in soil and water

- 2.1 Recognize how soil, climatic, and nutrient properties affect nutrient movement in soil or water.
- 2.2 Recognize how soil drainage, irrigation, precipitation levels, and potential for water contamination affect nitrogen management practices.

3. Soil reaction and soil amendments

- 3.1 Describe how the carbon:nitrogen ratio of soil organic materials may affect soil nitrogen availability to plants.
- 3.2 Describe how soil properties and elements impact crop nutrient availability.

4. Basic concepts of plant nutrition

- 4.1 Recognize how cropping systems affect nitrogen, phosphorus, potassium, and sulfur management.
- 4.2 Describe ways that satellite imagery can be used for fertilizer application, predicting yield and efficient use of fertilizer.
- 4.3 Distinguish the function and mobility of nutrients in plants by growth stages.

5. Soil and plant test reports and nutrient recommendations

- 5.1 Describe soil and plant sampling and handling procedures.
- 5.2 Recognize the philosophies in soil and plant testing programs.
- 5.3 Interpret a soil and plant test report.
- 5.4 Given soil and plant test reports and calibration data, develop economically and environmentally sound nutrient recommendations.
- 5.5 Use nutrient analysis information to calculate amounts of nutrients to be applied to meet a specific recommendation.

6. Nutrient source and applications

- 6.1 Calculate nitrogen and phosphorus contributions from animal manure, biosolids, irrigation water, fertilizer, organic material, legumes, urban/industrial waste, and soil organic matter.
- 6.2 Recognize the analysis, physical form, and handling precautions of nitrogen, phosphorus, potassium, and sulfur nutrient sources.

7. Nutrient management planning

- 7.1 Recognize how nutrient placement and time of application affect nutrient availability.
- 7.2 Develop a comprehensive nutrient management plan that is both economically and environmentally sound.
- 7.3 Describe the benefits of Precision Agriculture as related to nutrient management.

8. Ag emergency preparedness

- 8.1 Maintain risk assessments and mitigation plans.

SOIL AND WATER MANAGEMENT COMPETENCY AREAS

1. Basic physical properties of soils

- 1.1 List characteristics of gravel, sand, silt and clay.
- 1.2 Know characteristics about the soil horizons.
- 1.3 List sources of soil organic matter.
- 1.4 Describe the relationship between soil organic matter and soil color, soil structure, soil nutrient-supplying ability, and erosion.
- 1.5 Know how cation exchange capacity varies among oxides, silicate clays, and humus.
- 1.6 Describe relative ratios of air, solids, and water.

2. Water/solute movement in soils and water quality

- 2.1 Describe how soil physical and chemical properties affect solute movement.
- 2.2 List soil and water management practices that reduce sediment, nutrient and pesticide transport to protect water quality.
- 2.3 Know definitions of runoff, percolation, transmissivity, evaporation, transpiration, and leaching.
- 2.4 Know drinking water standard for nitrate-N.

3. Management practices and erosion

- 3.1 Describe how residue management practices and cropping systems affect soil productivity.
- 3.2 List ways to maintain and improve soil organic matter levels and soil health.
- 3.3 Differentiate among the different types of water and wind erosion.
- 3.4 List physical factors which affect the rate of erosion.
- 3.5 Know how to estimate percent residue.
- 3.6 In a given situation, list economically sound management alternatives that will result in soil conservation.
- 3.7 Recognize how soil texture and management influence soil structure, compaction, and soil organisms.
- 3.8 Describe the appropriate situation to use soil amendments such as lime and gypsum.

4. Site characterization

- 4.1 Recognize the difference between saline, sodic and saline-sodic soils, and possible causes of each.
- 4.2 Use soil survey and other information sources to make sound land management decisions.
- 4.3 Determine field variability to apply precision soil and water management practices.

5. Plant/Water relations

- 5.1 Describe how the relative ratios of air, solids and water affect bulk density and porosity.
- 5.2 Describe the effects of soil water status on plant nutrients and uptake.
- 5.3 Describe how climate and soil water affect plant water relations.
- 5.4 Determine the relative difference of plant tolerance to salts, sodium, and high pH.
- 5.5 Describe techniques for dryland and irrigated water management, including understanding irrigation efficiency.

6. Ag emergency preparedness

- 6.1 Understand how you would develop maps to identify potential pathogen risks (ex: manure lagoons).
- 6.2 Understand how to create land maps and records of sewer, septic tanks, wells and cisterns, streams, wildlife refuge or wetlands, chemical, pesticide and anhydrous ammonia storage and tanks.

PEST MANAGEMENT COMPETENCY AREAS

1. Basic integrated pest management practices

- 1.1 Recognize examples of cultural, chemical, and biological pest management.
- 1.2 Describe advantages and limitations of cultural, chemical, and biological pest management.
- 1.3 Recognize how field scouting and economic injury levels are related to integrated pest management.
- 1.4 List steps in carrying out an integrated pest management program.
- 1.5 List the advantages and limitations of integrated pest management.
- 1.6 Outline methods for sampling plant and pest material.
- 1.7 Outline methods for submitting plant or pest material to the National Plant Diagnostic Network for diagnosis and lab analysis.
- 1.8 Recognize economic and environmental factors involved in making a pest management recommendation.
- 1.9 Identify general plant symptoms caused by different herbicide modes of action.

2. Management of weeds, plant diseases and insects

- 2.1 Distinguish between contact and systemic herbicides.
- 2.2 Recognize the importance of timing in pesticide application.
- 2.3 Be able to identify pests based on distinguishing characteristics and damage.
- 2.4 Recognize complete and gradual metamorphosis.
- 2.5 Know about diseases and pests that are potentially a threat to the region.
- 2.6 Describe ways GPS might aid in fighting noxious or troublesome weeds.

- 2.7 Recognize the relationship between plant vigor and herbicide effectiveness in post-emergence applications.
- 2.8 Understand the advantages and limitations of genetically enhanced crops.
- 2.9 List soil and climatic factors that affect pesticide performance and fate in soil and water.
- 2.10 List the types of disease causing organisms and how they survive and disperse.
- 2.11 Describe basic principles of disease development.
- 2.12 Distinguish between systemic and non-systemic fungicides.
- 2.13 Distinguish between seed, foliar, and soil treatments.
- 2.14 Define protectant, eradicant, and disinfectant type fungicides.

3. Calibration of pesticide application equipment

- 3.1 Use information on a label to determine proper dosage in a given situation.
- 3.2 Recognize the relationship between spray boom height and nozzle spacing.
- 3.3 Calculate the amounts of pesticides needed in a given area to apply a specific rate, either broadcast or banded.
- 3.4 Use the calibration factors of gallons per acre, gallons per minute, width of nozzle spacing, and ground speed to set up and calibrate a sprayer.
- 3.5 Distinguish between spray drift and spray volatilization.
- 3.6 Recognize how wind speed, nozzle type, nozzle orifice size, spray droplet size, boom height, evaporation rate, and spray viscosity affect spray drift.
- 3.7 Determine field variability to apply crop production precision management practices.

4. Pesticide resistance

- 4.1 List factors influencing the development of pesticide resistance.
- 4.2 List ways to prevent the occurrence of pesticide resistant diseases, insects and weeds.
- 4.3 List ways to manage pesticide resistant diseases, insects and weeds once they have occurred.
- 4.4 Recognize the types of information found on a label.

5. Protecting humans and non-target species against pesticide exposure

- 5.1 Distinguish between contact insecticides, stomach poisons, and systemic insecticides.
- 5.2 Recognize the physical characteristics of pesticide formulations.
- 5.3 List pesticide modes of entry into the human system.
- 5.4 Distinguish between chronic and acute poisoning effects.
- 5.5 Recognize general symptoms of acute pesticide poisoning.
- 5.6 List possible chronic effects of pesticide poisoning.
- 5.7 Recognize general procedures to follow if pesticide gets on skin, in eyes, in mouth or stomach, or if inhaled.

6 Ag emergency preparedness

- 6.1 Describe pesticide characteristics that affect pesticide fate in soil and water.
- 6.2 Describe worker protection standards and where the information is located.
- 6.3 Describe how to store pesticides safely and handle pesticide spills.

CROP MANAGEMENT COMPETENCY AREAS

1. General crop adaptation

- 1.1 Describe how crops respond to soil fertility levels, soil pH, and drainage.
- 1.2 Describe how extremes of temperature generally affect the growth and development of a crop.
- 1.3 Describe the adaptation of agronomically important crops to extremes of precipitation.
- 1.4 Describe advantages and limitations of bacterial inoculants.
- 1.5 Describe how the water needs of a crop typically change during growth and development.
- 1.6 Define allelopathy.
- 1.7 Define phytotoxicity.
- 1.8 Describe plant growth and development stages.

2. Tillage systems used for seedbed preparation of row, small grain and forage crops

- 2.1 Recognize how environmental and management factors influence the selection of a tillage system.
- 2.2 Describe the timing and sequence of tillage operations in an intensive tillage system.
- 2.3 Describe the advantages and limitations of an intensive tillage system.
- 2.4 Describe the timing and sequence of tillage operations in a reduced tillage system.
- 2.5 Describe the advantages and limitations of a reduced and no-till system.

3. Hybrid and cultivar (variety) selection

- 3.1 List the characteristics used in selecting a hybrid or cultivar.
- 3.2 Recognize how storage time, handling, and storage conditions may affect seed quality.
- 3.3 Understand and apply the Plant Variety Protection Act.

4. Seeding date, rate, and depth factors

- 4.1 Define seed dormancy and hard seed.
- 4.2 Define PLS and calculate % PLS values for seedlots when given percentage purity and percentage germination or seeding rate and the % PLS.
- 4.3 Recognize consequences of seeding too early or too late.
- 4.4 List factors that influence the seeding rate of major crops.
- 4.5 Recognize characteristics of major crops that make them adapted to high or low seeding rates.
- 4.6 Know how to take a plant population count in a crop field.
- 4.7 Recognize how crops respond to depth of planting.
- 4.8 Recognize conditions which would cause recommended seeding depth to be altered.

5. Crop damage, mortality, and factors influencing replanting decisions

- 5.1 Describe climatic and plant factors which influence a plant's ability to resume growth after being damaged.
- 5.2 Determine when crop damage would justify replanting.
- 5.3 List information needed to diagnose a crop production problem in the field.

6. Cropping systems

- 6.1 Define the term “growing degree day” and describe how it is used in crop production systems.
- 6.2 Compare and contrast single crop systems and crop rotations.
- 6.3 Describe advantages and disadvantages of green manure.
- 6.4 Differentiate between summer annuals, winter annual, biennial, and perennial plants.
- 6.5 Describe how taproot and fibrous root systems differ in erosion control and nutrient uptake patterns.
- 6.6 Determine field variability to apply crop production precision management practices.

7. Harvest and storage

- 7.1 Describe the factors that influence harvest and crop quality.