

# **California Nitrogen Management Specialist Exam**

## **PERFORMANCE OBJECTIVES**

**The American Society of Agronomy**

**International Certified Crop Adviser Program**

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## FOREWORD

The Certified Crop Adviser (CCA) program is predicated on the concept that there is a basic set of knowledge and experience that one must know to provide sound advice to producers. The role of the CCA in agricultural production and their relationship to producers has grown over the life of the certification program and continues to grow alongside ever-evolving agricultural standards and practices, which include economic, environmental, and social considerations. With that in mind, the California Department of Food and Agriculture (CDFA), the University of California – Davis, the American Society of Agronomy's (ASA) International Certified Crop Adviser (ICCA) Program and the CCA – Western Region (WR) Board have collaborated on developing a Specialty Certification for California CCAs around the Nitrogen Management Program.

The CA-NSp is for California based CCAs in good standing who desire to provide nitrogen management planning services for their clients. The purpose of implementing this Specialty is to utilize CCAs to help farmers/producers to become better acquainted with and adopt/enhance/implement nitrogen management concepts and best management practices within their operations. CCAs are the single best influencers to work with local producers and help them adopt more sustainable crop production practices that will satisfy the future demands of the food industry and address demands from consumers for safe food, while protecting the environment and preserving natural resources.

Performance Objectives (POs) are the heart of the CCA Program. They outline the basic knowledge and skills required by individuals providing advice to crop producers. Like all CCA POs, the California Nitrogen Management Specialty POs are also dynamic, and are upgraded as the needs evolve to ensure that the POs reflect the state of the practice. This will help to ensure that the CCA CA-NSp will remain a viable and useful tool that recognizes the high level of competence displayed by those who choose to earn this designation.

The CA-NSp POs are divided into seven Competency Areas. Within each Competency Area are specific POs which describe the knowledge needed to demonstrate competency as a Nitrogen Management Specialist. All questions on the California Nitrogen Specialty Exam are based directly on these POs. UC Davis offers online educational modules that will help a CCA prepare for the exam and provide existing CCAs that achieve the Nitrogen Management Specialty an opportunity to earn CEUs in nutrient management and soil and water management.

The Nitrogen Management Specialty working group gratefully acknowledges the support of the California Department of Food & Agriculture and the University of California-Davis in developing this Specialty.

### **Competency Area 1. Environmental Impacts of Nitrogen Loss**

1. Identify the impact of nonpoint source N pollution on human health.
2. Recognize sources of surface runoff and describe the effect on water quality.
3. Describe how N leaching influences groundwater and drinking water quality.
4. Understand the role of Certified Crop Advisers in promoting efficient N use.

### **Competency Area 2. Nitrogen Cycling - Soil Transformations**

1. Describe mineralization including N sources and products, types of microbes, and how moisture, temperature, and C:N ratios affect rates.
2. Describe immobilization including N sources, energy requirements, types of products, and impact of C:N ratios.
3. Explain nitrification including the necessary reactants, products, and how rates are impacted by temperature.
4. Explain denitrification including reactants, intermediary steps and products, and how soil moisture and soil texture affect rates.
5. Define volatilization and the role soil pH plays along with what practices create significant losses.

### **Competency Area 3. Nitrogen Uptake - Plant Utilization**

1. Compare the differences in root N uptake of ammonium and nitrate profile and the consequences of choice of N source on soil pH.
2. Understand the process of assimilation of inorganic N into organic N compounds in plants.
3. Identify important times in the growing season for N uptake and understand the patterns of N allocation and utilization for annual and permanent crops.

#### **Competency Area 4. Nitrogen Sources**

1. Outline the contribution of various N sources to soil by different forms of fertilizers (organic/synthetic/foliar/controlled release/inhibitors).
2. Identify organic matter amendments and crop residues and how their availability is impacted by C:N ratios.
3. Identify and calculate the availability of nitrate in irrigation water.
4. Describe the residual soil nitrate as a N source during crop rotations.
5. Recognize the contribution of soil organic matter as a source of N via mineralization.

#### **Competency Area 5. Nitrogen Budgeting**

1. Define different terminologies of N requirement, N uptake, and N removal.
2. Understand how to account for N credits from irrigation water, residual nitrate, and organic matter amendments.
3. Calculate the N sink and source terms to develop a balanced N budget.
4. Express the N removed over input ratio to determine crop N use efficiency using the partial nutrient balance method.

#### **Competency Area 6. Irrigation and Nitrogen Management**

1. Understand how irrigation practices can lead to N leaching below the root zone due to nitrate mobility in soils.
2. Identify efficient fertigation methods by surface and pressurized irrigation systems like split applications.
3. Identify the role of evapotranspiration in irrigation scheduling and how timing irrigation scheduling relative to fertigation can influence nitrate leaching.
4. Understand how the practice of leaching excess salt under saline or sodic conditions may increase the risk of N leaching below the root zone.

5. Determine how distribution uniformity by irrigation systems influences N use efficiency.

### **Competency Area 7. California Cropping Systems**

1. Describe how to minimize N losses during annual crop rotations and what factors to consider like residual soil nitrate, crop residues, and rooting depth.
2. Discuss storage and remobilization of stored N in woody biomass of permanent crops and what role N storage plays in early season N demand.