

Minnesota CCA Study Guide

The publications listed here are reference materials for the **Performance Objectives** for the Minnesota Certified Crop Adviser Exam. Publications are listed for each area under the four competency areas: Nutrient Management, Soil and Water Management, Pest Management and Crop Management. This is a comprehensive list of applicable topics from University Extension Offices around the Midwest, but not the sole option for study material for the Minnesota CCA exam.

The **University of Minnesota (UMN)** has several publications that are crop specific and these are listed individually under each Competency Area, as they apply. The entire list of publications can be found on the UMN Extension website at: <https://extension.umn.edu/crop-production>

This study guide is not intended to provide direct questions and answers for the Minnesota CCA exam, but rather to provide reference materials for continuing education.

NUTRIENT MANAGEMENT COMPETENCY AREAS:

1. **Basic Concepts in Soil Fertility**
2. **Basic Concepts of Plant Nutrition**
3. **Soil pH and Soil Amendments**
4. **Primary Plant Nutrients (N, P, K)**
5. **Secondary and Micronutrients**
6. **Soil Sampling**
7. **Fertilizer Recommendations**
8. **Plant Analysis**
9. **Fertilizer Materials and Application**
10. **Manure Management**
11. **Diagnosis of Nutrient Deficiencies in Crops**
12. **Nutrient Management Planning**

COMPETENCY AREA 1: Basic Concepts in Soil Fertility

- *Soil Fertility Costs, UMN*
<https://blog-crop-news.extension.umn.edu/2022/04/strategic-farming-talked-taming-soil.html>
- *ISU Soil Fertility Website, ISU*
<https://www.agronext.iastate.edu/soilfertility/>

COMPETENCY AREA 2: Basic Concepts of Plant Nutrition

- *Guide to Fertilizing Plants, UMN*
<https://extension.umn.edu/manage-soil-nutrients/quick-guide-fertilizing-plants>
- *Crop Specific Nutrient Needs, UMN*
<https://extension.umn.edu/nutrient-management/crop-specific-needs>

COMPETENCY AREA 3: Soil pH and Soil Amendments

- *Soil pH 101 Podcast, UMN*
<https://blog-crop-news.extension.umn.edu/2018/01/nutrient-management-podcast-soil-ph-and.html>
- *Lime Needs in MN, UMN*
<https://extension.umn.edu/liming/lime-needs-minnesota>
- *Lime Use for Soil Acidity Management, UNL*
<https://extensionpublications.unl.edu/assets/html/g1504/build/g1504.htm#:~:text=For%20each%200.1%20pH%20buffer,in%20the%20top%207%20inches.>

COMPETENCY AREA 4: Primary Plant Nutrients (N, P, K)

Nitrogen

- *Understanding Nitrogen in Soils, UMN*
<https://extension.umn.edu/nitrogen/understanding-nitrogen-soils>
- *South Dakota Fertilizer Recommendation Guide, SDSU*
https://extension.sdstate.edu/sites/default/files/2019-03/P-00039_0.pdf
- *Corn Nitrogen Timing, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-20-Corn.pdf>
- *Nitrogen Fixation, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-23-Soybean.pdf>
- *Agronomic Management for Reduced Nitrate Leaching, UNL*
<https://cropwatch.unl.edu/2020/agronomic-management-reduced-nitrate-leaching>
- *Types and Uses of Nitrogen Fertilizers for Crop Production, Purdue*
<https://www.extension.purdue.edu/extmedia/AY/AY-204.html>

Phosphorus

- *Agronomic and Environmental Management of Phosphorus, UMN* <https://extension.umn.edu/phosphorus-and-potassium/agronomic-and-environmental-management-phosphorus>
- *Understanding Phosphorus Fertilizers, UMN*
<https://extension.umn.edu/phosphorus-and-potassium/understanding-phosphorus-fertilizers>

Potassium

- *Potassium for Crop Production, UMN*
<https://extension.umn.edu/phosphorus-and-potassium/potassium-crop-production>

COMPETENCY AREA 5: Secondary and Micronutrients

- *Zinc for Crop Production, UMN*
<https://extension.umn.edu/micro-and-secondary-macronutrients/zinc-crop-production>
- *Micro- and Secondary Macronutrients, UMN*
<https://extension.umn.edu/nutrient-management/micro-and-secondary-macronutrients>

COMPETENCY AREA 6: Soil Sampling

- *Testing and Analysis, UMN*
<https://extension.umn.edu/nutrient-management/testing-and-analysis#plant-analysis-testing-and-interpretation-695210>
- *Take a Good Soil Sample to Help Make Good Fertilization Decisions, ISU*
<https://store.extension.iastate.edu/product/3915>

COMPETENCY AREA 7: Fertilizer Recommendations

- *Guide to Fertilizing Plants, UMN*
<https://extension.umn.edu/manage-soil-nutrients/quick-guide-fertilizing-plants>
- *Estimating Yield Goals and Nitrogen Phosphorus, Potassium, Iron, and Zinc Recommendations, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-23-Corn.pdf>
- *Starter, Banding, and Broadcasting Phosphorus Fertilizer for Profitable Corn Production, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-26-Corn.pdf>

COMPETENCY AREA 8: Plant Analysis

- *Understanding Plant Analysis for Crops, UMN*
<https://extension.umn.edu/testing-and-analysis/understanding-plant-analysis-crops>

COMPETENCY AREA 9: Fertilizer Materials and Application

- *Fertilizers Used in Soybean and Corn Production, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-21-Soybean.pdf>
- *Fertilizing with Biosolids, UNL*
<https://lancaster.unl.edu/enviro/biosolids/fertil.shtml>
- *Fertilizer Handling and Safety, Yara*
<https://www.yara.us/crop-nutrition/fertilizer-handling-and-safety/fertilizer-storage/>
- *Calibration of Fertilizer Application Equipment, NSFA*
<http://www.nsfa-fane.ca/efp/wp-content/uploads/2019/09/Calibration-of-Fertilizer-Application-Equipment-On-Farm.pdf>

COMPETENCY AREA 10: Manure Management

- *Manure Management Homepage, UMN*
<https://extension.umn.edu/livestock-operations/manure-management>
- *Factors that Affect the Price of Manure as a Fertilizer, UNL*
<https://water.unl.edu/documents/Value%20of%20Manure%20As%20A%20Fertilizer.pdf>

COMPETENCY AREA 11: Diagnosis of Nutrient Deficiencies in Crops

- *Scouting Deficiencies in Corn and Soybeans (With Photos), UMN*
<https://blog-crop-news.extension.umn.edu/2021/06/scouting-for-nutrient-deficiencies-in.html>
- *4 Key Nutrient Deficiencies, UMN*
<https://blog-crop-news.extension.umn.edu/2017/05/4-key-nutrient-deficiencies-to-scout.html>

COMPETENCY AREA 12: Nutrient Management Planning

- *Crop Specific Nutrient Needs, UMN*
<https://extension.umn.edu/nutrient-management/crop-specific-needs>

SOIL AND WATER MANAGEMENT COMPETENCY AREAS:

1. **Basic Physical Properties of Soils**
2. **Soil Erosion**
3. **Tillage and Residue Management**
4. **Soil Compaction and Restrictive Layers**
5. **Drainage**
6. **Water Quality**

COMPETENCY AREA 1: Basic Physical Properties of Soils

- *Five Factors of Soil Formation, UMN*
<https://extension.umn.edu/soil-management-and-health/five-factors-soil-formation>
- *Soil Physical Properties and Processes, MPCA*
https://stormwater.pca.state.mn.us/index.php?title=Soil_physical_properties_and_processes#:~:text=Physical%20properties%20of%20soil%20include,nutrient%20cycling%2C%20and%20biologic%20activity.

COMPETENCY AREA 2: Soil Erosion

- *Soil Management, UMN*
<https://extension.umn.edu/soil-management-and-health/reduce-wind-erosion-long-term-profitability>
- *Soil Erosion & Water Quality, ISU*
<https://store.extension.iastate.edu/Product/5501-pdf>

- *Conservation Buffers & Water Quality, ISU*
<https://store.extension.iastate.edu/Product/5502-pdf>
- *Cover Crops in Rotations Including Corn, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-15-Corn.pdf>
- *Cover Crops in Rotations with Soybeans, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-05-Soybean.pdf>

COMPETENCY AREA 3: Tillage and Residue Management

- *Crop Residue Management, UMN*
<https://extension.umn.edu/corn-harvest/crop-residue-management>
- *Methods for Measuring Crop Residue, ISU*
<https://crops.extension.iastate.edu/encyclopedia/methods-measuring-crop-residue>

COMPETENCY AREA 4: Soil Compaction and Restrictive Layers

- *Soil Compaction, UMN*
<https://extension.umn.edu/soil-management-and-health/soil-compaction>

COMPETENCY AREA 5: Drainage

- *How Agricultural Drainage Works, UMN*
<https://extension.umn.edu/agricultural-drainage/how-agricultural-drainage-works>
- *Soil Water holding, UNL*
[How a Soil Holds Water](#)
- *Managing Wetlands, NRCS*
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/>

COMPETENCY AREA 6: Water Quality

- *U of MN Water Management Homepage, UMN*
<https://extension.umn.edu/water>
- *Nitrogen Management for Water Quality in the Midwest, UNL*
<https://agronomy.unl.edu/faculty/ferguson/rp189.pdf>
- *Tillage, Manure Management and Water Quality, ISU*
<https://store.extension.iastate.edu/Product/12004-pdf>

PEST MANAGEMENT COMPETENCY AREAS:

- 1. Weed Management and Herbicides**
- 2. Plant Disease Management and Fungicides**
- 3. Insect Management and Insecticides**
- 4. Integrated Pest Management**
- 5. Pesticide Use**

COMPETENCY AREA 1: Weed Management and Herbicides

- *Resistance Management, UNL*
<https://cropwatch.unl.edu/resistance-management>
- *Herbicide Mode of Action, OK State*
<https://extension.okstate.edu/fact-sheets/herbicide-how-to-understanding-herbicide-mode-of-action.html>
- *Management, IRAC*
<https://irac-online.org/about/resistance/management/>

COMPETENCY AREA 2: Plant Disease Management and Fungicides

- *Corn Plant Diseases, UMN*
<https://extension.umn.edu/corn/corn-pest-management>
- *Soybean Cyst Nematode, UMN*
<https://extension.umn.edu/soybean-pest-management/soybean-cyst-nematode-scn>
- *Scouting for Corn Diseases, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-45-Corn.pdf>
- *Bacterial Diseases of Soybeans, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-58-Soybean.pdf>
- *Fungal and Fungal-like Diseases in Soybeans, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-59-Soybean.pdf>
- *Viral Diseases of Soybeans, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-60-Soybean.pdf>
- *Fungicidal Seed Treatments for Soybeans, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-08-Soybean.pdf>
- *Wheat Diseases Identification, SDSU*
<https://extension.sdstate.edu/sites/default/files/2018-12/03-2000-2018.pdf>
- *Fungicide Resistance, Penn State*
<https://extension.psu.edu/fungicide-resistance>

COMPETENCY AREA 3: Insect Management and Insecticides

- *Corn Rootworm, UMN*
<https://blog-crop-news.extension.umn.edu/2020/06/whats-your-risk-from-corn-rootworms.html>
- *Corn Insect Pests, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-51-Corn.pdf>
- *Soybean Aphid Identification, Biology, and Management, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-35-Soybean.pdf>
- *Bean Leaf Beetle Identification, Biology, and Management, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-36-Soybean.pdf>
- *The Identification, Biology, and Management of Two-spotted Spider Mites, Grasshoppers, and Caterpillar, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-37-Soybean.pdf>

COMPETENCY AREA 4: Integrated Pest Management

- *Integrated Pest Management Control Tactics, Cornell University*
<https://biocontrol.entomology.cornell.edu/ipm.php>
- *IPM Solutions to Pest Management for Corn Production, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-03-Corn.pdf>

COMPETENCY AREA 5: Pesticide Use

- *Pesticide Handling, Use and Storage, SD Department of Agriculture*
<https://sdda.sd.gov/ag-services/pesticide-program/compliance/pesticide-program-pesticide-handling-use-and-storage/>
- *Chemical Sprayer Application and Calibration, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-41-Corn.pdf>
- *Chemigation, NDSU*
<https://www.ag.ndsu.edu/irrigation/chemigation>

CROP PRODUCTION COMPETENCY AREAS:

1. Identification of Crops
2. General Crop Adaptation
3. Anatomy, Growth, and Developmental Stages of Major Agronomic Crops
4. Seeding Date Factors
5. Seeding Rates and Patter Factors of Major Crops
6. Seeding Depth Factors
7. Crop Damage, Mortality, and Factors Influencing Replanting Decisions
8. Cropping Systems
9. Site Specific Technology

COMPETENCY AREA 1: Identification of Crops

- *Plant Identification, NRCS*
https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/wapmstn9835.pdf
- *Identifying Crops, USDA*
https://www.nass.usda.gov/Education_and_Outreach/Reports,_Presentations_and_Conferences/Presentations/Craig_ASPRS10_Lower48CDL.pdf

COMPETENCY AREA 2: General Crop Adaptation

- *Crop Production, UMN*
<https://extension.umn.edu/crop-production>

COMPETENCY AREA 3: Anatomy, Growth, and Developmental Stages of Major Agronomic Crops

- *Corn Growth and Development, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-05-Corn.pdf>
- *Soybean Growth Stages, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-03-Soybean.pdf>
- *Identifying Leaf Stages in Small Grain, NDSU*
<https://www.ag.ndsu.edu/publications/crops/identifying-leaf-stages-in-small-grain>
- *Environmental Factors Affecting Plant Growth, OSU*
<https://extension.oregonstate.edu/gardening/techniques/environmental-factors-affecting-plant-growth>

COMPETENCY AREA 4: Seeding Date Factors

- *Planting Date Considerations, UMN*
<https://extension.umn.edu/corn-planting/planting-date-considerations-corn>
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- *Soil Temperature for Planting Spring Crops, SDSU*
<https://extension.sdstate.edu/soil-temperature-planting-spring-crops>

COMPETENCY AREA 5: Seeding Rates and Pattern Factors of Major Crops

- *Seeding Rates for Small Grains, UMN*
<https://extension.umn.edu/planting-small-grains/seeding-rate-small-grains>
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- *Soybean Planting Recommendations, South Dakota Soybean Association*
<https://www.sdsoybean.org/topics/production-resources/optimal-planting-date-seeding-rates-row-spacing/>
- *Corn seeding rates and variable-rate seeding, ISU*
<https://crops.extension.iastate.edu/encyclopedia/corn-seeding-rates-and-variable-rate-seeding>

COMPETENCY AREA 6: Seeding Depth Factors

- *Adjusting Planting Soil Depth for Better Germination, ISU*
<https://crops.extension.iastate.edu/encyclopedia/adjusting-planting-soil-depth-better-germination>
- *Soybean Planting Depth: Consider Planting Deeper, UNL*
<https://cropwatch.unl.edu/soybean-planting-depth-consider-planting-deeper>

COMPETENCY AREA 7: Crop Damage, Mortality, and Factors Influencing Replanting Decisions

- *Corn Growers Guide to Evaluating Damage, UMN*
<https://extension.umn.edu/corn-planting/corn-crop-damage-and-replant-options>
- *Soybean Damage and Replanting, UMN*
<https://extension.umn.edu/soybean-planting/soybean-damage-and-replanting>
- *Resources for Early-Season Crop Damage, UNL*
<https://cropwatch.unl.edu/2020/resources-early-season-crop-damage>

COMPETENCY AREA 8: Cropping Systems

- *Cover Crops in Rotations Including Corn, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-15-Corn.pdf>
- *Crop Rotations Can Increase Corn Profitability and Reduce Pests, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-09-Corn.pdf>
- *Timing Critical in Alfalfa Harvest, NDSU*
<https://www.ag.ndsu.edu/news/newsreleases/2013/sept-23-2013/timing-critical-in-alfalfa-harvest/>
- *Fall Forage Management, NDSU*
<https://www.ag.ndsu.edu/plantsciences/research/forages/docs/FallHarvestManagement2011-PPT.pdf>

COMPETENCY AREA 9: Site Specific Technology

- *Site-specific Farming: Economics and the Environment, NDSU*
<https://www.ag.ndsu.edu/publications/crops/site-specific-farming-economics-and-the-environment>
- *Precision Farming Opportunities, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-19-Corn.pdf>
- *Troubleshooting Precision Agricultural Equipment, SDSU*
<https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-02-Corn.pdf>
- *Soil Sampling for Precision Phosphorus Soybean Management, SDSU*
<https://extension.sdstate.edu/sites/default/files/2020-03/S-0004-20-Soybean.pdf>