

Certified Crop Adviser

Performance Objectives For South Dakota

April 1, 2005

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SOIL NUTRIENT MANAGEMENT COMPETENCY AREAS

1. **Nutrient movement in soil and water**
2. **Lime application**
3. **N, P, K plant requirements**
4. **Secondary nutrient and micronutrient plant requirements**
5. **Nutrient application**
6. **Plant nutrient sources and application**
7. **State laws and rules governing fertilizer and manure use in storage and handling**

COMPETENCY AREA 1. Nutrient movement in soil and water

1. Recognize how soil, climatic, and nutrient properties affect movement of a nutrient in soil or water.

COMPETENCY AREA 2. Lime application

2. Recognize how each of the following factors affect lime application:
 - a. Type of cropping system
 - b. Soil type
 - c. Soil PH
 - d. Lime sources – Municipal Waste Water Treatments

COMPETENCY AREA 3. N, P, K plant requirements

Nitrogen

3. Recognize how soil physical properties affect nitrogen management
4. Recognize how cropping systems affect nitrogen management
5. Recognize how soil drainage, irrigation, precipitation levels, and potential for water contamination affect nitrogen fertilization
6. Recognize the analysis, physical form, and handling precautions of each of the following nitrogen fertilizer sources:
 - a. anhydrous ammonia
 - b. urea
 - c. UAN
 - d. Ammonium nitrate
 - e. Ammonium sulfate

Phosphorus

7. Recognize how soil properties affect phosphorus management.
8. Recognize how cropping systems affect phosphorus management.
9. List advantages and disadvantages of phosphorus application methods and sources.
10. Describe the appropriate situations for using the Bray, Olsen and Mehlich extractants for phosphorus.

Potassium

11. Recognize how soil properties affect potassium management.
12. Recognize how cropping systems affect potassium management.
13. List advantages and disadvantages of potassium application methods and sources.

COMPETENCY AREA 4. Secondary nutrient and micronutrient plant requirements (Emphasis on S, Zn, Fe, and Cl)

14. Recognize the general deficiency symptoms of the secondary nutrients and the micronutrients.
15. Recognize the general toxicity symptoms of the secondary nutrients and the micronutrients.
16. List methods of correcting secondary and micronutrient deficiencies.

COMPETENCY AREA 5. Nutrient application

17. Use a soil survey to locate a tract of land (or similar objective) and describe its characteristics.
18. Describe the recommended soil sampling and handling procedures for nutrient analysis in South Dakota.
19. Interpret the items on a soil test report.
20. Recognize economic and environmental factors involved in making fertilizer recommendations.
21. Make economically and environmentally sound fertilizer recommendations.

COMPETENCY AREA 6. Plant nutrient sources and application

22. Recognize how fertilizer placements and time of application affect nutrient use efficiency.
23. Recognize how starter fertilizers can cause crop injury.
24. Define Fertigation.
25. List types (ie., rotary spreader) of equipment used to apply fertilizers.
26. List procedures used to calibrate fertilizer application equipment.
27. Describe the nutrient value of manure
28. Identify nutrient losses associated with different methods of manure storage and application.

29. Describe manure sampling and sample handling procedures.
30. Recognize how sludges, composts, and other nonconventional products affect the soil and add nutrients for improving crop protection.
31. Describe the difference in nutrient content variability and availability for manures biosolids/sludges, composts and other materials.
32. Describe the requirements for and how to prepare a nutrient management plan.

COMPENTENCY AREA 7. State laws and rules governing fertilizer and manure use in storage and handling.

33. Describe safety handling procedures and placarding for fertilizer materials.
(Hazardous Identification Shipping Placarding)
34. Describe spill reporting requirements.
35. Recognize regulatory agency controlling fertilizer labeling, storage, licensing, sampling, inspection, analysis, distribution and handling.
36. Describe the appropriate loading and storage procedures for bulk nutrients and manure.
37. Describe regulations regarding permitted livestock facilities in South Dakota.

SOIL AND WATER MANAGEMENT COMPETENCY AREAS

- 1. Soil drainage and water movement in soils**
- 2. Soil conservation**
- 3. Tillage operations and soil characteristics**
- 4. Management of saline and sodic soils**
- 5. Irrigation**
- 6. Water quality**

COMPETENCY AREA 1. Soil drainage and water movement in soils

1. List factors affecting the installation of a surface or tile drainage system.
 - a. Topographic
 - b. Soil texture
 - c. Soil chemistry/salinity
 - d. Environmental impact
2. Recognize how soil physical characteristics influence the selection of land for irrigation.
3. Define the chemical characteristics of irrigation water measured by electrical conductivity and sodium adsorption ratio.
4. Recognize how the electrical conductivity and the sodium adsorption ratio of water affect suitability for irrigation purposes.
5. List factors that influence the rate and timing of irrigation.
6. Recognize how cropping and tillage systems are related to soil drainage and plant available water (no-till vs. minimum till vs. conventional tillage practices).

COMPETENCY AREA 2. Soil conservation

7. Enumerate steps involved in wind- and water-caused soil erosion.
8. Describe how soil properties, characteristics, landscape and cover affect water runoff and soil erosion.
9. Describe (including advantages, disadvantages, effectiveness) of common erosion control practices, i.e., residue management, contouring, strip cropping, terraces, grass waterways, filter strips, windbreaks and cover crops.
10. Distinguish the difference between and describe practices, related to point and non-point sources of pollution.
11. List physical factors of the soil, which affect rate of erosion.
12. Estimate percent residue using the line-transect method.
13. In a given situation, make economically sound management recommendations that will result in soil conservation.

COMPETENCY AREA 3. Tillage operations and soil characteristics

14. Recognize how tillage operations and no-till farming influence soil structure and compaction.
15. Recognize how tillage operations influence water movement in soil.
 - a. Percolation and infiltration
 - b. Evaporation

COMPETENCY AREA 4. Management of saline and sodic soils

16. Describe chemical and physical properties of saline, saline-sodic, and sodic soil.
17. Recognize plant responses to saline, saline-sodic, and sodic soils.
18. Describe the cropping potentials of saline, saline-sodic, and sodic soils.
19. Recognize how the salt content and sodium adsorption ratio of irrigation water relate to soil salinity and sodicity.
20. List techniques used to improve saline, saline-sodic, and sodic soils.

COMPETENCY AREA 5. Irrigation

21. Describe water quality concerns for irrigation
22. List regulatory agencies controlling surface and ground water use for irrigation.
23. Recognize standard approaches to irrigation scheduling.
24. Recognize the impact of application of sprinkler irrigation water on soil characteristics.

COMPETENCY AREA 6. Water quality

25. Describe how the following agricultural practices affect water quality:
 - a. Nutrient placement practices and nutrient placement amounts
 - b. Tillage
 - c. Pesticide applications
 - d. Drainage
26. Describe how watershed and site characteristics influence crop management.
27. Describe regulations regarding application of fertilizers, manure, and crop chemicals.
 - a. Chemigation
 - b. Environmentally sensitive areas and aquifers.

PEST MANAGEMENT COMPETENCY AREAS

1. Basic pest management practices
2. Management of weeds
3. Management of plant diseases
4. Management of insects
5. Calibration of pesticide application equipment
6. Using pesticides in an environmentally sound way
7. Integrated pest management

COMPETENCY AREA 1. Basic pest management practices

1. List examples of cultural, chemical, and biological pest management.
2. Describe advantages and limitations of cultural, chemical and biological pest management.

COMPETENCY AREA 2. Management of weeds

3. Identify the following weeds by common name at any stage of growth, and classify each by life cycle:

Grasses and Sedges

- | | |
|----------------------|--------------------|
| a. Giant foxtail | i. Quackgrass |
| b. Green foxtail | j. Woolly cupgrass |
| c. Yellow foxtail | k. Sandbur |
| d. Barnyardgrass | l. Yellow nutsedge |
| e. Downy brome | m. Foxtail barley |
| f. Wild proso millet | n. Crabgrasses |
| g. Wild oats | |
| h. Fall panicum | |

Broadleaves:

- | | |
|---------------------------|-----------------------|
| a. Canada thistle | q. Wild mustard |
| b. Russian thistle | r. Wild buckwheat |
| c. Perennial sowthistle | s. Hoary cress |
| d. Musk thistle | t. Wild sunflower |
| e. Plumeless thistle | u. Russian knapweed |
| f. Bull thistle | v. Black nightshade |
| g. Giant ragweed | w. Velvetleaf |
| h. Common ragweed | x. Buffalobur |
| i. Redroot pigweed | y. Common milkweed |
| j. Pennsylvania smartweed | z. Waterhemp |
| k. Common lambsquarters | a'. Biennial wormwood |
| l. Kochia | b'. Absinth wormworrd |
| m. Leafy spurge | c'. Venice mallow |
| n. Field bindweed | d'. Blue vervain |
| o. Common cocklebur | |
| p. Field pennycress | |

4. Recognize factors that affect herbicide carryover.
5. Recognize why/how herbicide resistance and tolerance develop and how to prevent their occurrence.

6. Recognize factors that affect species and genetic shifts in weed populations:
 - a. Weed populations
 - b. Herbicide use
 - c. Tillage
7. List the factors that affect pesticide movement in soils and into surface and ground waters.
8. Recognize statewide regulated noxious weeds.
9. Recognize how state laws impact the management of noxious weeds.

COMPETENCY AREA 3. Management of infectious plant diseases

10. Identify each of the following agronomic diseases by host plant symptoms, and classify each by crops infected and type of causal organism:

<ol style="list-style-type: none"> a. Stalk rots b. Northern corn leaf blight c. Pythium seeding rot d. Phytophthora root rot e. Sclerotinia diseases f. Holcus spot g. Stem rust h. Loose smut i. Ergot j. Bacterial wilt k. Leaf rust l. Cyst nematode m. Aster yellows 	<ol style="list-style-type: none"> n. Rhizoctonia root/crown rot o. Barley yellow dwarf p. Red leaf of oat q. Tan spot r. Head scab s. Wheat streak mosaic t. Downy mildew u. Common leafspot v. Ear rots/mold w. Ascochyta leaf blight x. Black chaff y. Bean pod mottle
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11. Describe how environmental conditions affect disease development and spread.
12. Recognize how other pests, such as insects and weeds, interact with disease?
13. Describe the basic principles of disease management.
 - a. Avoidance/Evasion
 - b. Eradication
 - c. Therapy
 - d. Sanitation
14. Distinguish between systemic and non-systemic/protectant fungicides.
15. Recognize how/why fungicide resistance tolerance develops and how to prevent their occurrence.

COMPETENCY AREA 4. Management of insects

16. Identify the following pests and classify each by feeding habits crops attacked, type of metamorphosis and symptoms of damage on plants:
- | | |
|--|-------------------------------|
| a. Grasshopper | m. Two-spotted spider mite |
| b. Bean leaf beetle adult | n. Hessian Fly |
| c. Alfalfa weevil larva and adult | o. Wheat stem sawfly |
| d. Aphids | p. Wheat stem maggot |
| e. Leafhoppers | q. White grub |
| f. European corn borer | r. Armyworm |
| g. Corn earworm larva | s. Red sunflower seed weevil |
| h. Wireworm larva | t. Gray sunflower seed weevil |
| i. Northern corn rootworm
Adult and larva | u. Banded sunflower moth |
| j. Western corn rootworm
Adult and larva | v. Sunflower moth |
| k. Sunflower beetle | w. Soybean aphid |
| l. Black cutworm | x. Western bean cutworm |
| | y. Palestriped flea beetle |
| | z. Army cutworm |
17. Describe basic principles of cultural, genetic, chemical, and biological approaches to insect management.
18. Recognize the importance of timing when applying insecticides.
19. Recognize difference in scouting for and managing univoltine and bivoltine European corn borer infestations.
20. Recognize the role of transgenic crops in insect management and the crop insect controlled.

COMPETENCY AREA 5. Calibration of pesticide application equipment

21. Identify and describe the function of the following chemigation equipment components:
- Back-flow prevention valve
 - Pesticide metering device
22. Describe steps involved in calibration of pesticide application equipment.

COMPETENCY AREA 6. Using pesticides in an environmentally sound way

23. Understand state and federal certification and licensing requirements for pesticide applicators and dealers.
- Private applicators
 - Commercial applicators
 - Uncertified and unlicensed applicators
 - Pesticide dealers
24. Understand state and federal pesticide product registration requirements and categories.
- Emergency exemption registrations
 - Special local need registrations
 - Experimental use registrations

- d. Pesticides exempt from federal registration
 - e. Regular pesticide product registration
 - f. Cancellation and restriction of pesticide registrations
25. Understand state and federal pesticide use requirements.
- a. Storage and handling requirements for bulk and packaged pesticides
 - b. Application requirements for pesticides
 - c. Recordkeeping requirements for pesticides
 - d. Disposal requirements for pesticides

COMPETENCY AREA 7. Integrated pest management

26. Describe principles integrated pest management.
27. Describe general rationale and procedures of scouting crop pests.
28. Define economic threshold and economic injury levels. Describe how they impact pest control decision-making.
29. Describe management strategies for control of stored grain insects.
30. Make economically and environmentally sound pest management recommendations.

CROP MANAGEMENT COMPETENCY AREAS

1. General crop adaptation
2. Tillage systems used for seedbed preparation of row, small grain and forage crops
3. Seeding date factors
4. Seeding rates and pattern factors of major crops
5. Seeding depth factors
6. Crop damage, mortality, and factors influencing replanting decisions
7. Cropping systems
8. Identification of crops in both seed and vegetative states
9. Growth and development stages of major agronomic crops
10. Crop improvement and biotechnology
11. Precision agriculture

COMPETENCY AREA 1. General crop adaptation

1. Describe how crops respond to the following factors:
 - a. Soil fertility levels
 - b. Soil pH
 - c. Soil drainage
2. List the recommended soil pH ranges for agronomically important crops in South Dakota.
3. Describe adaptation of crops to prevailing climate conditions.
 - a. Precipitation
 - b. Temperature
 - c. Sunlight/day length

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

4. Recognize how environmental and management factors influence the selection of a tillage system.
5. Identify the following implements and describe their functions in an intensive tillage system:
 - a. Moldboard plow
 - b. Chisel plow
 - c. Disk-chisel
 - d. Heavy disk
 - e. One-pass tool
 - f. Light disk
 - g. Field cultivator
 - h. Harrows
 - i. Culti-packer
 - j. Strip tiller
6. Describe the timing and sequence of tillage operations in an intensive tillage system.
7. Describe advantages and disadvantages of fall vs. spring tillage.
8. Describe the advantages and limitations of an intensive tillage system.

9. Identify the following implements and describe their function in a ridge-till system:
 - a. Ridge-till planter
 - b. Ridge-till cultivator
10. Describe the timing and sequence of tillage operations in a ridge-till system.
11. Describe the advantages and limitations of a ridge-till system.
12. Describe the functions and operation of a no-till planter.
13. Describe the timing and sequence of operations in a no-till system.
14. List the advantages and limitations of a no-till system.

COMPETENCY AREA 3. Seeding date factors

15. Describe factors, which determine when to seed corn, soybeans, small grains and forages.
16. Recognize consequences of seeding too early or too late.

COMPETENCY AREA 4. Seeding rates and pattern factors of major crops (e.g., corn, soybean, wheat, sunflower, alfalfa)

17. List factors that influence the seeding rate of major crops.
18. List factors that influence the planting pattern of major crops.
19. List methods used to seed small grains and forage crops.
20. Explain why forage crop establishment is more difficult than the establishment of grain crops.
21. List recommended seeding rates for major crops.
22. List advantages and disadvantages of seeding pure grass or legume stand vs. mixed stands.
23. Recognize how difference in seedling characteristics influence emergence of major crops.

COMPETENCY AREA 5. Seeding depth factors

24. List recommended seeding depths for major crops.
25. Recognize how crops respond to depth of planting.
26. Recognize conditions that affect seeding depth.

COMPETENCY AREA 6. Crop damage, mortality, and factors influencing replanting decisions.

27. Describe the type of damage hail, frost, drought, and wind can cause corn, soybean, small grain and forage crops.
28. Describe climatic and plant factors, which influence a plant's ability to resume growth after being damaged.
29. Determine when crop damage would justify replanting.

COMPETENCY AREA 7. Cropping systems

30. List advantages and limitations of growing cover crops and companion crops in a cropping system.
31. Compare and contrast single crop and crop rotation systems.

COMPETENCY AREA 8 (SD). Identification of crops in both seed and vegetative states

32. Identify the seed and mature plant of each of the following crops:

- | | |
|----------------------------|-----------------------------|
| a. Alfalfa | l. Orchardgrass |
| b. Barley | m. Red clover |
| c. Buckwheat | n. Reed canarygrass |
| d. Canola | o. Rye |
| e. Corn | p. Safflower |
| f. Field Peas | q. Smooth bromegrass |
| g. Flax | r. Sorghum (grain & forage) |
| h. Intermediate wheatgrass | s. Soybean |
| i. Kentucky bluegrass | t. Sunflower |
| j. Millet | u. Wheat |
| k. Oats | |

COMPETENCY AREA 9 (SD). Growth and development stages of major agronomic crops

Plant Staging

33. Describe systems for staging corn, soybeans, and small grains.
34. Use staging systems to identify the stage of growth at any time between emergence and physiological maturity.
35. Describe systems used to stage forage legumes and grasses.
36. Recognize how growth states influence susceptibility of major crops to specific environmental stresses (e.g. moisture stress, temperature stress).

Harvesting and regrowth of forage

37. Describe how frequency of harvest is related to forage yield and quality.
38. Describe how frequency and timing of harvest affects stand longevity, food reserves, and stand persistence.
39. Describe the locations and functions of meristems used for regrowth in forage legumes and forage grasses.

Management factors related to the anatomy, growth, and development of major crops

40. Relate anatomical features of major crops to developmental stages.
41. Recognize relationships between the growth and development of major crops and management factors.

COMPETENCY AREA 10. Crop improvement and biotechnology

42. Define genetic issues regarding introduction and expression of bio-tech traits.
43. List the regulatory agencies that oversee traits governing biotechnology.
44. Describe Plant Variety Protection Act and how it relates to production and sales of bio-tech crops.
45. Delineate the legal restrictions regarding bio-tech crops.
 - Plant Variety Protection Act
 - End Product Restrictions (Import/Export Mandates)
46. Describe agronomic implications of planting bio-tech crops.

COMPETENCY AREA 11. Precision agriculture

47. Describe how the following cause variability in fields.
 - a. Slope
 - b. Soil texture
 - c. Historical use
 - d. Drainage
48. Describe how to use the following to measure variability.
 - a. Grid sampling
 - b. Yield monitoring
 - c. E.C. measurement
 - d. Remote sensing
49. Describe how to use the following in interpreting variability.
 - a. Geographic Information System (GIS)
 - b. Variably nutrient and pesticide applications
 - c. Variably seeding, type and amount