

Iowa Certified Crop Adviser
Performance Objectives

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INDEX

Nutrient Management

- Basics of Soil Fertility
- Nitrogen
- Phosphorus
- Potassium
- Secondary and Micronutrients
- Soil and Plant Sampling Analysis

Soil and Water Management

- Soils and Landscapes
- Soil Properties
- Soil Erosion
- Tillage
- Residue Cover

Pest Management

- General Pesticide Use
- Weed Management
- Plant Disease Management
- Insect and Mite Management

Crop Management

- Crop Establishment, Growth and Development
- Biotechnology
- Data Analysis

NUTRIENT MANAGEMENT

Basics of Soil Fertility

1. Know the elements essential for plant growth (listed below). Understand which elements are mobile in the plant.

Carbon	Sulfur	Phosphorous	Iron
Hydrogen	Boron	Potassium	Manganese
Oxygen	Chlorine	Calcium	Molybdenum
Nitrogen	Copper	Magnesium	Zinc

2. Understand the ionic form in which essential elements are taken up by plants from the soil.

3. Define cation exchange capacity (CEC) and understand its relationship with soil properties and base saturation. Understand the relationship between CEC and mobility and plant availability of nutrients in the soil.

4. Understand nutrient movement in soil and water. Understand how the factors listed below influence nutrient movement and availability.

Soil texture, structure, and bulk density	Soil pH
Drainage – surface and subsurface	Soil slope and crop residue cover
Nutrient form – cations and anions	Rate of nutrient application
Time of nutrient application	Precipitation – amount and distribution

5. Understand the nutrients available from materials other than commercial fertilizers, including the following:

Manures	Legumes	Sludges	By-products
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6. Understand the effect of soil pH on nutrient availability and suitability of growing specific crops. Understand the relationship between soil pH and buffer pH.

7. Understand the effect of different fertilizer materials on soil pH

8. Understand the effects of the following factors on liming practices.

Soil characteristics	CEC	Liming material and quality
Depth of incorporation	Cropping system	ECCE

9. Understand the composition and role of gypsum, dolomitic limestone, calcitic limestone, etc in soil management.

10. Recognize deficiency symptoms of the following nutrients in corn, soybean, alfalfa and small grains.

Nitrogen	Potassium	Phosphorous	Magnesium
Sulfur	Zinc	Iron	Boron

Nitrogen

11. Understand the nitrogen cycle in soils and know the mechanisms and the nitrogen forms involved in each of the following processes.
Mineralization Nitrification Immobilization Fixation
12. Understand the nitrogen loss pathways and role of nitrification and urease inhibitors.
Leaching Denitrification Volatilization from soils and plants
Crop removal Soil erosion/ overland flow
13. Understand the availability of nitrogen from common organic sources and how C/N ratio affects nitrogen availability.
14. Recognize the factors that determine appropriate nitrogen fertilization rates.
15. Recognize the analysis, physical form, and handling precautions of each of the following nitrogen fertilizer materials and understand their effect on soil pH and nitrogen availability. Understand the products advantages and disadvantages in different situations.
Anhydrous ammonia Urea Ammonium nitrate
MAP and DAP UAN solutions Ammonium sulfate
16. Understand the proper methods, benefits and limitations of in-season tests used to assess nitrogen needs or availability (late-spring soil nitrate, late season cornstalk nitrate, chlorophyll readings).

Phosphorus

17. Recognize how each of the following factors affect phosphorus fertilization.
Soil properties Cropping system Availability of soil phosphorus
Soil test level Crop grown Environmental concerns
Iowa P Index Availability of capital
18. Recognize how each of the following factors affect soil retention and fixation of phosphorus and related losses through erosion.
Soil clay Soil pH Soil texture
Crop residue Tillage system
19. Recognize the analysis, physical form, handling precautions, and phosphorus availability of each of the following fertilizer phosphorus materials. Understand the advantages and disadvantages of their use in different systems and application methods.
Diammonium phosphate Monoammonium phosphate Triple superphosphate
Ordinary superphosphate Ammonium polyphosphate Manure (by species)

Potassium

20. Recognize how each of the following factors affects potassium fertilization.
Soil properties Availability of soil potassium Soil test level
Cropping system Tillage system Crop grown Availability of capital

21. Recognize the analysis, physical form, handling precautions, potassium availability, and relationship to chloride in soils of each of the following potassium fertilizer materials.
Potassium chloride Potassium sulfate Potassium nitrate Manure (by species)

Secondary and Micronutrients

22. Identify plant deficiency symptoms of each of the following secondary and micronutrients in corn, soybean, alfalfa, and small grains. Recognize soil properties and nutrient interactions affecting their availability to plants.

Magnesium Sulfur Zinc Iron Boron

23. Understand the advantages and disadvantages of each of the following practices for correcting and micronutrient deficiencies and toxicities.

Foliar application Soil application Adjusting soil pH

Soil and Plant Sampling Analysis

24. Understand Iowa industry-standard (ISU), recommended soil sampling and handling procedures and the effect of the following factors on soil test results and interpretations.

Taking consistent, representative samples Time of sampling
Depth of sampling Sample location (within the fields)
Frequency of sampling Sampling density (number per acres)

25. Interpret laboratory soil and plant test reports for the following:

Degree of nutrient deficiency or adequacy
Expected crop response to applied nutrients
Units of measure and conversion between different units
The effect of the following extractants on soil test P results
Bray P-1 Mehlich-3 P Mehlich-3 ICP Olsen P

26. Know the appropriate plant parts and crop development stage to sample when determining the nutrient status of the following crops.

Corn Soybean Alfalfa Small grains

SOIL AND WATER MANAGEMENT

Soils and Landscapes

1. Understand how to use Soil Survey maps for identifying the following:
Soil properties Suitability of soils for specific purposes
Soil types Soil slopes
Field location and size
2. Understand the relationships among the following:
Soil order Soil family Soil series Soil type Soil map unit
3. Understand the major sources of soil parent materials in Iowa. Recognize general management considerations associated with different soil parent materials (loess, glacial till, alluvium, etc.).

Soil Properties

4. Understand how the following soil properties influence soil performance in terms of nutrient, water and herbicide retention, crop productivity, erosion and compaction.

Soil texture Organic matter Soil structure Parent material Bulk density

5. Recognize the effects of soil structure, plant cover, plant residue, and tillage system on water infiltration, soil erosion, soil temperature, and soil moisture.

6. Understand the differences between saturated and unsaturated water flow.

7. Understand the advantages and disadvantages of using surface and subsurface drainage to manage excess water.

Soil Erosion

8. Understand the different phases of water erosion.

Detachment Transportation Deposition

9. Understand the different types of wind erosion.

Saltation Creep Suspension

10. Understand the relationship between the slope and slope length on erosion losses.

11. Identify and understand the following erosion control practices recommended for use in Iowa

Residue management	Tillage systems
Terracing	Grass waterways
Crop rotation	Vegetative filter strips
Windbreaks	Contouring

12. Understand the variables used in RUSLE2 and the Iowa P Index to assess the risk of erosion and phosphorous losses and how these tools are used.

Tillage

13. Recognize how each of the following factors influence the selection and use of tillage systems.

Crop rotation/field history Land shape Soil properties
Field design (terrace and waterway spacings, point rows, etc.)
Governmental program requirements (HEL, nonHEL)

14. Describe the influence of tillage systems and tillage implements on each of the following:

Soil disturbance/compaction/bulk density	Crop residue on the soil surface
Incorporation of fertilizers, lime, and pesticides	Weed control
Soil organic matter	Soil microbiology

Residue Cover

15. Recognize how each of the following factors affect soil residue cover.
- | | | | |
|-----------------------------------|-----------------------------|---------|----------------|
| Crop rotation | Harvesting methods | Weather | Tillage system |
| Fertilizer and manure application | Post harvest stover removal | | |
| Harvest equipment settings | | | |
16. Know how to measure soil residue cover and how to apply the results in a management system.

PEST MANAGEMENT

General Pesticide Use

1. Know the differences between General and Restricted use pesticides.
2. Understand the basic parts of a pesticide label.
3. Understand label restrictions:

Restricted-entry intervals (R.E.I.s)	Pre-harvest intervals (P.H.I.s)
Worker protection standards (WPS)	Crop rotation intervals
Forage and grazing restrictions	
4. Understand how pesticide resistance develops and where you can find resistance management information on the label.
5. Be familiar with pesticide and pesticide container disposal and pesticide spill cleanup.
6. Be familiar with laws and regulations and terminology related to pesticide use (for example: FIFRA, FFDCA, registration).
7. Understand potential consequences of pesticide use on non-target organisms and the environment. Understand the procedures required by the Iowa Bee Rule.
8. Use information found on pesticide labels to determine appropriate pesticide rates, additives and application timings.
9. Recognize how the following factors affect spray delivery, spray coverage, and off-target movement.

Spray pressure	Application speed
Nozzle type & spacing	Spray droplet size
10. Recognize how movement of pesticides in soil or into surface or groundwater may be affected by the following pesticide and soil properties.

Soil texture/organic matter	Erosion and erosion control practices
Depth of water table	Precipitation and runoff
Pesticide application	Pesticide degradation and persistence

11. Differentiate between point and non-point sources of pollution and describe practices that reduce point and non-point source contamination.

Weed Management

12. Identify the following weeds at all growth stages by common name. Know the characteristics of different life cycles and classify each weed by life cycle.

Grass family: quackgrass downy brome field sandbur large crabgrass
barnyardgrass woolly cupgrass wirestem muhly witchgrass
fall panicum giant foxtail green foxtail yellow foxtail shattercane

Smartweed family: Pennsylvania smartweed swamp smartweed curly dock
smooth dock wild buckwheat

Spurge family: leafy spurge toothed spurge

Lambsquarter family: lambsquarters kochia russian thistle

Pigweed family: redroot pigweed waterhemp smooth pigweed Palmer amaranth

Mustard family: wild mustard field pennycress

Mallow family: velvetleaf Venice mallow

Carrot family: wild carrot wild parsnip poison hemlock

Milkweed family: common milkweed hemp dogbane

Morningglory family: field bindweed hedge bindweed tall morningglory

Nightshade family: jimsonweed smooth groundcherry horsenettle black nightshade

Sunflower family: giant ragweed common ragweed cocklebur common
sunflower musk thistle bull thistle Canada thistle horseweed dandelion

Other weeds: Horsetail scouring rush common mullein henbit
wild hemp Asiatic dayflower yellow nutsedge

14. Understand the following principles relating to weed management:

Weed seed bank dynamics

Competitive interactions between crops and weeds

15. Understand the effects of tillage on weed populations and herbicide effectiveness.

16. Understand the factors that affect the effectiveness of rotary hoeing and inter-row cultivation and their roles in weed management.

17. Understand the interactions between herbicides, soil colloids and water in determining the effectiveness and fate of herbicides in the soil.
18. Understand the advantages and disadvantages of herbicide application timing:
- | | |
|----------------|-----------------------|
| Early preplant | Preplant incorporated |
| Preemergence | Postemergence |
19. Understand how environment and spray additives influence the effectiveness of postemergence herbicides.
20. Know the factors that influence the development of herbicide resistance and ways to reduce the risk of selecting herbicide resistant weed biotypes.
21. For the following herbicide groups, be able to identify injury symptoms, potential risks for herbicide resistant weeds, carryover and crop injury, off-target injury potential, and major factors that influence their performance. Know the major herbicides from these classes, how they are used, and their site of action.
- | | |
|-----------------------------|-----------------------------|
| Group 1 (ACCase inhibitors) | Group 2 (ALS inhibitors) |
| Group 3 (dinitroanilines) | Group 4 (growth regulators) |
| Group 5 (triazines) | Group 9 (glyphosate) |
| Group 14 (PPO inhibitors) | Group 15 (amide, etc.) |
| Group 27 (HPPD inhibitors) | |

Plant Disease Management

22. Identify each of the following diseases and nematodes and how and when it infects crop Plants (corn, soybean and alfalfa). Recognize host-plant symptoms, classify each by type of causal organism, and know when and how to scout. Know what environmental conditions favor each disease.

Corn	Soybean	Forage	General
Stalk rots	Brown stem rot	Black stem	Pythium
Common rust	Phytophthora	Rhizoctonia	
Southern rust	Brown spot (Septoria)		
Eyespot	Soybean mosaic		
Crazy top	Soybean cyst nematode		
Anthraxnose	Soybean rust		
Northern leaf blight	Sudden death syndrome		
Stewart's wilt	White mold		
Gray leaf spot	Charcoal rot		
Anthraxnose:	Bean pod mottle virus		
-Top dieback	Frogeye leaf spot		
- Leaf spot	Bacterial blight		
- Stalk rot	Bacterial pustule		
- Root rot	Cercospora leaf spot		
Corn nematodes	Downy mildew		
	Fusarium		
	Colletotrichum		
	"Damping-off"		

23. Recognize cultural techniques that can influence plant diseases and may be used for management of plant diseases.

24. Recognize genetic techniques for management of plant diseases.
 General resistance Race-specific resistance Tolerance
25. Know the fungicide families and primary fungicides used to manage crop diseases in Iowa.
26. Understand the appropriateness and timing of applications. Know the difference between preventative and curative applications.
27. Understand crop tolerance concerns with different fungicide families and related off- target concerns.

Insect and Mite Management

28. Identify each of the following field crop insects and mites, recognize each of their associated crop injury symptoms, and understand each of their life cycles. Identify the primary strategy for the primary pests*.

Corn

Armyworm
 Corn earworm
 Corn leaf aphid
 Corn rootworms*
 Cutworms (black* & dingy)
 European corn borer*
 Fall armyworm
 Grasshoppers
 Colaspis beetles
 Seedcorn maggot
 Stalk borer
 Spider mites
 Seedcorn beetles

Soybean

Bean leaf beetle*
 Soybean aphids*
 Green cloverworm
 Potato leafhopper
 Seedcorn maggot
 Spider mites*
 Thistle caterpillar
 Grasshoppers*
 Whitefly
 Stink bugs
 Japanese beetles

Alfalfa

Alfalfa weevil*
 Cloverleaf weevil
 Aphids (pea & cowpea)
 Blister beetles
 Plant bugs
 Potato leafhopper*
 Spittlebugs
 Grasshoppers

29. Identify common predators and parasitoids and their potential impact on pest insects.
 Beetles Lacewings Flies Bugs Wasps
30. Describe standard scouting procedures for major pests in different crops.
31. Relate the degree-day concept to insect development and be able to calculate degree-days for insect development. Understand how degree-days are used in insect management.
32. Know the concepts of economic threshold and economic injury level and how they are used in decision-making for insect control.
33. Recognize how cultural practices (e.g. crop rotation, date of planting, tillage, weed infestations, refuges, transgenic traits, etc.) can influence the potential for the occurrence of insects in crops.

CROP MANAGEMENT

Crop Establishment, Growth, and Development

1. Understand how the following factors influence and affect success in crop establishment and growth.

Planting date	Soil conditions
Weather outlook	Planting depth
Variety selection	

2. Describe crop responses to planting patterns and plant populations (seeding rates).
Understand how to calculate seeding rates and crop stands, and determine planting depth.

3. Explain the effect of seed quality on crop growth and development.

4. Determine pure live seed (PLS) from seed sample analyses and know how to calculate desired seeding rates.

5. Describe the effect of time and temperature on growth and development of crops.

6. Relate the growing degree day concept (GDD) to corn development, recognize its function in production systems, and be able to calculate growing degree days for corn.

7. Understand the different vegetative and reproductive stages of corn and soybean and the systems used to describe them.

8. Distinguish the growth stages during which crops are most susceptible to environmental stress or pest related injury.

9. Identify damage to agronomic crops from hail, frost, flooding, drought, and wind.
Understand the impact of this damage on future development of the crop.

10. Determine crop damage levels that justify replanting and interpret the following factors that influence replant decisions:

Calendar date	Environmental conditions	Stand count
Uniformity of stand	Plant stage	

11. Understand the benefits and drawbacks of different crop rotations

12. Understand how harvest timing influences grain or forage quality for silage and forage crops, alfalfa, corn and soybean.

Biotechnology

13. Understand the differences between traditional crop breeding and the use of biotechnology to generate crop varieties.

14. Understand the factors that influence movement of traits among different populations of plants (gene flow).

15. Know the following terms and their significance to biotechnology in agriculture:

DNA	chromosome	gene
gene expression	gene flow	hybrid
outcrossing	protein	recombinant DNA
species	transgenic organism	mutation
yield drag	yield lag	

Data Analysis

16. Understand how to interpret data and basic statistics.