
Atlantic Provinces CERTIFIED CROP ADVISER

PERFORMANCE OBJECTIVES



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NUTRIENT MANAGEMENT

COMPETENCY AREA 1: BASIC SOIL CONCEPTS

1. Describe the roles of nitrogen, phosphorus, potassium, calcium, and magnesium in plants.
2. Define base saturation.
3. Describe the influence of soil pH, clay content, and organic matter content on cation exchange capacity and base saturation.
4. Define guaranteed analysis of fertilizers (solid and liquid) from a grower's perspective.

COMPETENCY AREA 2: SOIL TESTING AND PLANT ANALYSIS

1. Describe the soil sampling procedures recommended in provincial publications.
2. Describe methods used for zone and grid soil sampling and list their advantages and limitations.
3. Describe the tissue sampling procedures recommended in provincial publications for potatoes.
4. List advantages and disadvantages of the following three fertilizer recommendation approaches:
 - a. cation saturation ratio
 - b. nutrient buildup and maintenance
 - c. nutrient sufficiency.
5. Distinguish between the extractable amount and the total amount of a nutrient in a soil.
6. Describe how nutrient credits from animal manures, biosolids, legumes, cover crops, and previous crops influence fertilizer recommendations.
7. Interpret the information given on a soil testing laboratory report.
8. Calculate the amounts and rates of fertilizer needed to meet specific soil test recommendations.
9. Describe the role of soil testing, plant tissue testing, and visual plant symptoms in a fertilization program.
10. Interpret the information from a zone or grid soil sampling report.
11. Describe how zone or grid sampling reports are used to develop prescriptions for variable rate fertilizer and lime applications.

COMPETENCY AREA 3: LIMING AND PH

1. Identify the chemical characteristics of an acid soil.
2. Recognize how soil pH changes with topography.
3. Distinguish between soil pH and buffer pH or lime index.
4. Describe how the soil test uses soil pH and buffer pH to determine soil lime requirements.
5. Define neutralizing value and fineness rating of liming materials
6. Calculate lime application rates using a soil testing report and the neutralizing value and fineness rating of the liming material.
7. Determine when to use dolomitic versus calcitic lime to correct soil pH.
8. List recommended soil pH ranges for potatoes, corn, soybeans, cereals, forage grasses, and forage legumes.
9. Describe the agronomic benefits for land application of wood ash.

COMPETENCY AREA 4: FERTILIZER PLACEMENT

1. Rank the relative toxicity of fertilizer materials to corn, wheat, and soybean seedlings.
2. Identify factors affecting the amount of fertilizer that can safely be applied in a band near the seed.
3. Identify safe limits for seed-placed fertilizers for corn, soybeans, potatoes, and cereals.

COMPETENCY AREA 5: NITROGEN

1. Identify how nitrogen is gained, lost, and transformed in the soil.
2. Describe how nitrogen gains, losses, and transformations in the soil influence nitrogen fertilization practices and nitrogen availability to plants.
3. Describe how topography can influence soil nitrate levels.
4. Recognize nitrogen deficiency symptoms on corn, soybeans, alfalfa, potatoes, and cereals.

5. Describe the agronomic advantages and disadvantages of each of the following fertilizer materials in potato, corn, winter wheat, and forage production:
 - a. urea
 - b. ammonium nitrate
 - c. calcium ammonium nitrate
 - d. ammonium sulfate.
6. Describe the role and benefits of enhanced efficiency fertilizers.

COMPETENCY AREA 6: PHOSPHORUS

1. Describe how soil chemical properties affect phosphorus availability and mobility in the soil.
2. Describe the advantages and disadvantages of seed-placed, banded, and broadcast fertilizer phosphorus placement methods.
3. Recognize phosphorus deficiency symptoms on corn, soybeans, alfalfa, potatoes, and cereals.
4. Describe the agronomic advantages and disadvantages of each of the following fertilizer materials in potato, corn, winter wheat, and forage production:
 - a. triple superphosphate
 - b. diammonium phosphate
 - c. monoammonium phosphate
 - d. liquid phosphorus (ammonium polyphosphate).

COMPETENCY AREA 7: POTASSIUM

1. Describe how soil chemical and physical properties affect potassium fertilizer availability, mobility, and leaching.
2. Recognize potassium deficiency symptoms on corn, soybeans, alfalfa, potatoes, and cereals.
3. Recognize potassium luxury consumption and its effects on forage quality for ruminant livestock.
4. Describe the agronomic advantages and disadvantages of each of the following fertilizer materials in potato, corn, winter wheat, and forage production:
 - a. muriate of potash
 - b. sulphate of potash magnesia.

COMPETENCY AREA 8: SECONDARY AND MICRONUTRIENTS

1. Describe how soil chemical and physical properties affect magnesium availability, mobility, and leaching.
2. Recognize magnesium deficiency symptoms on potatoes, corn, soybeans, and forages.
3. Describe the agronomic advantages and disadvantages of each of the following magnesium sources:
 - a. sulphate of potash magnesia
 - b. magnesium sulphate
 - c. dolomitic lime.
4. Recognize the deficiency symptoms of:
 - a. zinc in corn
 - b. sulfur in potatoes
 - c. boron in alfalfa.
5. Describe how the interactions between the following can affect crop nutrition:
 - a. phosphorus and zinc
 - b. pH and zinc
 - c. pH and manganese
 - d. potassium and magnesium
 - e. weather conditions and boron.
6. Describe the advantages and limitations of foliar and soil micronutrient applications.
7. Describe the risks associated with over-application of micronutrient fertilizers.
8. Describe the role of sulfur in plants and the possible reasons why sulfur deficiency has become more prevalent over the past number of years.
9. Describe the factors that affect Calcium availability for crop uptake.

SOIL AND WATER MANAGEMENT

COMPETENCY AREA 1: SOIL HYDROLOGY

1. Describe how the spacing and depth of tile drains relate to soil texture and structure, internal drainage, soil trafficability, crop type, and topography.
2. Identify the benefits of tile drainage to crop production.
3. Identify the impacts of tile drainage on the environment.
4. Define watershed.
5. Describe the importance of the Canada Drinking Water Quality Guidelines.
6. Identify the material losses from the soil resulting from crop production and their impacts on nearby aquifers, wetlands, wildlife habitat, and aquatic systems.
7. Describe how the following affect pesticide movement:
 - a. method of application
 - b. precipitation
 - c. pesticide adsorption
 - d. soil erosion
 - e. pesticide persistence
 - f. soil pH
 - g. pesticide solubility
 - h. soil texture.
8. Describe the benefits and limitations of the following methods for managing surface water:
 - a. land forming
 - b. terraces
 - c. grass water ways.

COMPETENCY AREA 2: MANURES, BIOSOLIDS, AND WASTES

1. List advantages and disadvantages of the following methods of manure application:
 - a. solid spreading
 - b. drag hose irrigation
 - c. liquid spreading
 - d. injection.
2. List advantages and disadvantages of fall versus spring applied manures.
3. Describe the agronomic benefits, risks, and precautions for land application of wastes, biosolids, and manure.
4. Describe manure's role in the nutrient cycling of carbon, nitrogen, phosphorus, and potassium.

5. Describe the benefits of over-winter cover crops for soil quality and nitrogen management.
6. Describe factors influencing nitrogen release from decomposing organic materials and the microbial processes involved.
7. Identify environmental limitations for applying wastes and biosolids to crop land.
8. List possible methods of reducing the potential for tile and surface water contamination from biosolids and manure applications.

COMPETENCY AREA 3: CONSERVATION TECHNOLOGY

1. List the benefits of windbreaks to crop production.
2. Identify the functions of grassed buffer strips along natural water courses.
3. Describe the objectives of an Environmental Farm Plan.
4. List the major components of a nutrient management plan.
5. Describe the importance of phosphorous in a nutrient management plan.
6. Describe cover crop residue and mulch management for reducing soil erosion in potato production.
7. Describe the effects of field operations on soil compaction, nutrient requirements, and crop growth and ways to reduce these effects (e.g. controlled traffic).
8. Describe the advantages and disadvantages of maintaining wildlife habitat.

COMPETENCY AREA 4: SOIL HEALTH

1. Define soil health/quality.
2. Identify common threats to soil quality/health in Atlantic Canada.
3. Identify soil quality indicators in Atlantic Canada.
4. Recognize improvements to soil quality as an on-going strategy that takes time.
5. Describe how conservation and no-till systems impact soil properties and soil health over time.

PEST MANAGEMENT

COMPETENCY AREA 1: PRINCIPLES AND PRACTICES

1. List the steps of an integrated pest management process.
2. Describe the importance of each step in an integrated pest management process.
3. Describe sampling methods for monitoring pest populations.
4. Identify the monitoring techniques for the following pests:
 - a. Colorado potato beetle
 - b. European corn borer
 - c. potato aphids
 - d. late blight
 - e. pink rot
 - f. wireworms.
5. Outline methods for submitting plant and pest material for diagnosis and laboratory analysis.
6. Describe how to use the following variables to calculate the economic injury level (EIL):
 - a. cost of control
 - b. crop value
 - c. effectiveness of control action
 - d. pest density/crop damage relationship.
7. Describe the unique characteristics of each of the following:
 - a. Bt or corn
 - b. *Verticillium* Resistant Alfalfa
 - c. Virus Resistant Potatoes.

COMPETENCY AREA 2: WEED MANAGEMENT

Predominant Weeds in Atlantic Canada:

barnyard grass	sow thistle-annual and perennial
lamb's-quarters	dandelion
common burdock	velvetleaf
pigweed-redroot and smooth	fall panicum
Canada thistle	tufted vetch
quack grass	field horsetail
chickweed-common and mouse-eared	wild buckwheat
common ragweed	field mint
cleavers	wild oats
smooth bedstraw	goldenrod
scentless chamomile	wild radish
corn spurry	hemp-nettle
shepherd's-purse	yellow nut sedge
crabgrass, smooth	lady's-thumb

1. Identify, by common name, the predominant weeds in Atlantic Canada at the 3 to 6 leaf growth stage.
2. Describe the life cycles of summer annuals, winter annuals, biennials, and perennials.
3. Classify the predominant weeds in Atlantic Canada by life cycle (annual, biennial, or perennial).
4. Describe the growth habit of the predominant weeds in Atlantic Canada.
5. Describe the following vegetative reproductive structures:
 - a. creeping roots
 - b. rhizomes
 - c. tubers
 - d. bulbs
 - e. stolons.
6. Identify weeds that exhibit the following structures:
 - a. creeping roots rhizomes
 - b. tubers
 - c. bulbs
 - d. stolons.
7. Compare and contrast weed control strategies for annual, biennial, and perennial weeds.

8. Describe crop injury symptoms of commonly-used herbicides on potatoes and cereals:
 - a. 2,4-D
 - b. dimethenamid
 - c. atrazine
 - d. metolachlor
 - e. bentazon
 - f. metribuzin
 - g. bromoxynil
 - h. nicosulfuron/rimsulfuron
 - i. dicamba.

9. Describe how the following may affect herbicide retention and absorption on plant leaves:
 - a. type of carrier
 - b. additives
 - c. spray volume
 - d. leaf orientation
 - e. plant canopy
 - f. weed size
 - g. rain-free time.

10. Describe how the following factors affect cuticular penetration:
 - a. herbicide solubility in water
 - b. moisture
 - c. relative humidity
 - d. temperature.

11. Distinguish between contact and systemic herbicides.

12. Define weed competition and describe factors that influence competition.

13. Recognize how soil organic matter, clay, soil pH, and soil moisture impact on the degradation and efficacy of herbicides.

14. Describe how herbicide chemical properties, environmental conditions, and application method influence volatilization.

COMPETENCY AREA 3: DISEASE AND NEMOTODE MANAGEMENT

1. For each of the following field crop diseases:
 - a. Describe symptoms and plant parts affected.
 - b. Identify conditions that favour pathogen development.
 - c. Identify appropriate management responses.
 - d. Identify the category of the pathogen (viruses, bacteria, fungi, nematodes).

Field Crop Diseases

Potatoes:	Cereals:	Forage Legumes:
bacterial ring rot bacterial soft rot scab, common and powdery blight, early and late <i>Fusarium</i> wilt <i>Verticillium</i> wilt water (pink) rot potato leaf roll virus (PLRV) potato virus Y (PVY) clover cyst nematode potato cyst nematode root knot nematode root lesion nematode	<i>Fusarium</i> head blight loose smut barley yellow dwarf virus snow mould ergot scald net blotch spot blotch powdery mildew <i>Septoria</i> leaf & glume blotch	clover cyst nematode <i>Verticillium</i> wilt (alfalfa)

2. Define mycotoxin.
3. List the mycotoxins commonly found in cereal grains and describe how they are detected.
4. Describe the impact of mycotoxins on crop quality.
5. Describe strategies for minimizing contamination of commodities by mycotoxins.

COMPETENCY AREA 4: INSECT AND SLUG MANAGEMENT

Important Insect Pests of Atlantic Canada:

armyworm	green peach aphid
bean leaf beetle	potato aphid
black cutworm	potato flea beetle
buckthorn aphid	potato leafhopper
cereal aphids	seed corn maggot
cereal leaf beetle	stink bug
Colorado potato beetle	tarnished plant bug
corn earworm	true armyworm
corn root worm	two spot spider mite
cutworm	western bean cutworm
European corn borer	white grub
European skipper (timothy)	wireworm

1. Identify the pest and the crop injury symptoms for important insect pests of Atlantic Canada.
2. Identify appropriate management responses to important insect pests of Atlantic Canada.

3. Describe how temperature, photoperiod, competition, and moisture influence insect populations.
4. List advantages and limitations of the following cultural controls for insect and slug crop pests:
 - a. resistant cultivars
 - b. rotation
 - c. sanitation
 - d. tillage
 - e. planting date
 - f. harvest date.

COMPETENCY AREA 5: PESTICIDE RESISTANCE MANAGEMENT

1. Define pesticide resistance and cross resistance.
2. Describe how a pest develops resistance to pesticides.
3. Distinguish among the following pest responses to pesticides:
 - a. resistance
 - b. susceptibility
 - c. tolerance.
4. Describe how to minimize pesticide resistance development.
5. Identify Atlantic Canada weeds, insects, and fungal diseases with pesticide resistance.

COMPETENCY AREA 6: PESTICIDE STEWARDSHIP & THE ENVIRONMENT

1. Describe best management practices for pesticide mixing, loading, application, transportation, disposal, and storage.
2. Describe government and industry regulations for safe handling, storage, application, transportation, and disposal of pesticides.
3. Describe components of a pesticide label.
4. Distinguish between spray drift and volatilization.
5. Describe how the following factors influence spray delivery, coverage, and drift:
 - a. boom height
 - b. nozzle orifice size
 - c. droplet size
 - d. spray pressure
 - e. ground speed
 - f. spray viscosity
 - g. nozzle spacing
 - h. spray volume

- i. nozzle type
 - j. wind speed.
6. Describe the advantages of applying pesticides using GPS guidance systems and variable rate application methods.
 7. Describe how in-field weather stations can be used to monitor pest cycles and optimize pesticide applications.

CROP MANAGEMENT

COMPETENCY AREA 1: CROP ADAPTATION

1. Describe corn and soybean responses to a late spring or early fall frost that is severe enough to kill the aboveground portion of the plants.
2. Describe how Crop Heat Units (CHU) differ from Growing Degree Days (GDD).
3. Use a Crop Zone map to select areas in which corn and winter wheat varieties are adapted.
4. Use the critical fall harvest period map and GDD to determine harvest management for alfalfa.
5. Describe soil and climatic factors responsible for successful winter survival of forage legumes, perennial forage grasses, and winter wheat.
6. Describe the relative growing characteristics of perennial forage grass species:
 - a. jointing versus non-jointing
 - b. bunching versus spreading
 - c. seedling vigour
 - d. maturity
 - e. yield and regrowth
 - f. tolerance to close grazing
 - g. sensitivity to poor drainage
 - h. drought and low soil pH.
7. Describe the vernalization process in winter cereals and bi-annual forages crops.
8. Describe the importance of cultivar/hybrid performance trials.

COMPETENCY AREA 2: SEED QUALITY

1. List the advantages of pedigreed seed.
2. List factors used to select hybrids or cultivars of corn, soybeans, canola, dry peas, wheat, barley, oats, forage legumes, and forage grasses.
3. Describe differences between seed germination and seedling vigour.
4. Identify the factors important in determining seed potato quality.
5. Explain the concepts of pedigreed seed, common seed, plant breeders rights, and farm-saved seed.

COMPETENCY AREA 3: CROP GROWTH AND DEVELOPMENT STAGING

1. Describe the major growth scales commonly used to identify crop development stages of potatoes, cereals, corn and soybeans (e.g., Zadok's, Feekes).
2. Identify critical crop development stages for fertilizer application to increase protein in bread wheat.
3. Describe growth phases critical for drought tolerance for potatoes, corn, soybeans, canola, dry peas, and oats.
4. Describe when the number of seeds in cereal crops is determined.

COMPETENCY AREA 4: TILLAGE SYSTEMS

1. Define no-till, reduced tillage, conservation tillage, strip tillage, and zone tillage.
2. Describe how the following affect the feasibility of conservation tillage systems:
 - a. topography
 - b. soil type and texture
 - c. heat unit availability
 - d. crop species
 - e. cropping sequence.
3. Describe how soil fertility management changes when adopting conservation tillage systems.
4. Describe how pest management changes when adopting conservation tillage systems.
5. Describe the factors to consider when using reduced tillage or no-till corn strategies.
6. Describe the tillage equipment options available for different tillage systems, and their benefits and limitations.
7. List the soil textures suited to fall and spring primary tillage.
8. Describe the advantages and disadvantages of fall and spring primary tillage.
9. Describe the advantages and disadvantages of rotary hoeing and inter-row cultivation after planting.

COMPETENCY AREA 5: SEEDING FACTORS

1. List factors determining seeding rates or spacings for potatoes, cereals, corn, soybeans, and forages.
2. Describe the effect of plant population and row spacing on sunlight interception, weed competition, diseases, lodging, and yield.

3. Describe the purposes of seed treatments.
4. Describe appropriate inoculant materials and inoculant handling methods for soybeans and forage legumes, and dry peas.
5. List criteria to consider when assessing whether to replant corn, soybeans, winter wheat, or alfalfa fields.
6. List criteria to consider when choosing seeding depth for corn, soybeans, winter wheat, forage grasses, forage legumes, and spring cereals.
7. List factors to consider when deciding whether to drill or broadcast seed for forage grasses and legumes.
8. Describe how to adjust seeding rates if environmental conditions cause a planting delay or a replant.
9. List factors that determine optimum seeding dates for potatoes, corn, soybeans, canola, dry peas, winter wheat, spring cereals, and forage legumes.
10. Describe the relationship between seeding date and yield potential for potatoes, corn, corn silage, soybeans, canola, dry peas, and winter and spring cereals.
11. Identify the latest dates of seeding for different cover crops.

COMPETENCY AREA 6: CROP UTILIZATION AND HARVEST QUALITY

1. List optimum development stages to harvest potatoes, corn, corn silage, soybeans, canola, dry peas, and spring and winter cereals.
2. List development stages for harvesting forage legumes and forage grasses at optimum forage quality (crude protein, acid detergent fibre, neutral detergent fibre) and at optimum dry matter yield.
3. Describe the unique characteristics of the following potato types:
 - a. table
 - b. processing (french fry and chip)
 - c. seed
 - d. count packed.
4. Describe how to adjust a combine for optimum harvest efficiency of corn, cereals, soybeans, canola, and dry peas.
5. Describe how to minimize bruising and losses during potato harvest and handling.
6. Describe how to stage corn silage harvest to maximize starch, optimize dry matter, and create a tight silage pack that ferments and keeps well.

COMPETENCY AREA 7: CROPPING SYSTEMS

1. Describe the advantages and disadvantages of a monoculture versus a crop rotation system.
2. Describe the advantages and disadvantages of direct seeding forages compared to seeding with a companion crop.
3. Describe grazing systems that optimize livestock production on pastures.
4. List advantages and limitations of the following cultural practices with respect to control of weeds, pests and diseases:
 - a. crop rotation
 - b. planting time
 - c. use of tramlines
 - d. cover crops
 - e. soil fertility
 - f. nurse crops
 - g. tillage.

COMPETENCY AREA 8: SAFE STORAGE AND QUALITY

1. List the safe moisture levels to store corn silage, haylage, wrapped bales, and cereal silage.
2. Describe how to use silage inoculants to improve silage quality.
3. List the safe moisture levels to store grain corn, wheat, barley, oats, soybean, dry peas and canola.
4. Describe the steps when storing grains or oilseed crops just after harvest.
5. Describe the factors involved in evaluating grade quality of potatoes, corn, soybeans, canola, dry peas, and cereals.
6. Describe the causes and effects of silo gases.

COMPETENCY AREA 9: PRECISION AGRICULTURE TECHNOLOGY

1. Explain how Global Positioning Systems (GPS), Remote Sensing, and Geographic Information Systems (GIS) technologies are used in crop management.
2. Describe why some crops need to be planted with higher GPS accuracies than others.
3. Compare and contrast the data and applications of drone versus satellite imagery.
4. Describe the importance of yield monitors on harvesting equipment.

5. Describe the potential benefits of variable rate seeding as a crop management tool.

COMPETENCY AREA 10: ECONOMICS

1. Define maximum economic yield in terms of the law of diminishing returns.
2. Use Cost of Production (COP) analysis to estimate costs and evaluate cropping alternatives.

COMPETENCY AREA 11: REGULATORY

1. Recognize key components of Crop Insurance programs.
2. Recognize stipulations of the Seeds Act that pertain to crop production.
3. List the prohibited weeds in specific jurisdictions in Atlantic Canada.
4. List the prohibited diseases of potatoes.