# CERTIFIED CROP ADVISER

## Performance Objectives

## for

## NORTH DAKOTA

**Prepared by the North Dakota Certified Crop Adviser Board**
**revised, 09/2011**

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# *FORWARD

Throughout history, a nation's success has been directly related to the success of its agriculture. Today, with approximately two percent of this nation's population engaged in production agriculture, the margin for error is small, and the effects of mismanagement extend well beyond the farm gate to all segments of society. Producers rely heavily on the advice of others. The Certified Crop Advisers (CCA) Program came into existence to ensure that growers receive sound advice and recommendations.

The CCA Program is built on the concept that there are certain things one must know in order to provide sound advice to producers. The initial, and most critical, state of the program consisted of asking a wide array of agriculturists involved in all aspects of crop production to tell us what a Certified Crop Adviser must know. We used this information to create the Competency Areas and Performance Objectives that follow. By mastering the Performance Objectives, one will possess the knowledge that the agricultural industry has deemed important for a Crop Adviser.

These Performance Objectives are dynamic, and will be upgraded, changed and modified as the needs of the crop production industry evolve. The CCA Program will then remain a viable and useful tool that will recognize the high level of competence displayed by those who choose to earn this designation.

Andrew Seibert
James Vorst
1993

*from National Certified Crop Adviser
Performance Objectives

# INTRODUCTION

As a Certified Crop Adviser (CCA), you can demonstrate your valuable agronomic expertise to the farmers for whom you provide crop production recommendations.

CCA is a voluntary organization of professionals formed to establish a base standard of knowledge, skills, and abilities for individuals who advise farmers on crop management and production inputs. The goal of the CCA program is to demonstrate professionalism in providing economically and environmentally sound production advice to agronomic producers.

The CCA program is coordinated Internationally (US and Canada) by the American Society of Agronomy (www.certifiedcropadvisor.org). It is administered locally by a North Dakota state board composed of representatives from agri-business, agricultural consulting, NDSU Extension Service, state and federal government agencies and farming.

In addition to passing both an international and state test, the applicant must also demonstrate work experience and/or education requirements.

## Performance Objectives

CCA performance objectives are available for both the International and North Dakota examinations and serve two purposes. First, they reflect the base knowledge standards considered to be appropriate for Certified Crop Advisers. Second, they outline the knowledge and skills areas that are covered on each exam. Since the exam questions are based on the performance objectives, they should be used to help you prepare for the examinations.

The North Dakota CCA performance objectives cover the following areas: (1) Nutrient Management, (2) Soil and Water Management, (3) Integrated Pest Management, (4) Crop Production, (5) State Laws and Regulations, and (6) Worker Protection Standards. There has been an effort not to duplicate International and North Dakota CCA performance objectives. However, if a performance objective is stated in the international list, state questions can be based on that objective, even if not stated in the state objectives.

The International CCA performance objectives can be obtained from either the ND State Board or the American Society of Agronomy.

# NUTRIENT MANAGEMENT

## Nutrient Management Competency Areas:

1. Basic soil fertility

2. Nutrient movement in soil and water

3. Soil pH

4. Soluble salts

5. N, P, K plant requirements

6. Secondary and micronutrient plant requirements

7. Soil sampling, interpreting soil test reports and making fertilizer recommendations

8. Forms of fertilizer and application methods

## Expertise Within Each Competency Area:

### Competency Area 1. Basic Concepts of Soil Fertility

1. Understand the relative frequence of deficiency of the 17 nutrients essential for plant growth

2. Recognize or describe deficiency symptoms of the 14 mineral nutrients essential for plant growth (small grains, corn, soybean, edible bean, sunflower, canola)

3. Recognize which compounds or ionic states of the essential nutrients can satisfy plant nutrient requirements

4. Understand the role of cation exchange in retaining and releasing certain nutrients for plants

5. Understand the source of cation exchange capacity (CEC)

6. Understand the process of nutrient uptake and distribution in plants

7. Understand the role of microorganisms in cycling certain nutrients needed for plants through organic matter and residue breakdown, immobilization and release.

8. Define soil organic matter

9. Understand the affect of agronomic practices on soil organic matter levels

**Competency Area 2. Nutrient movement in soil and water**

1. Understand how soil, climatic and nutrient properties affect movement and retention of nutrients in soil and water, and nutrient availability and uptake by plants

2. Understand the importance of landscape position in water movement and factors affecting nutrient availability

**Competency Area 3. Soil pH**

1. Understand the difference between active and reserve acidity

2. Understand how soil pH influences nutrient availability

3. Understand the role of bicarbonate in iron chlorosis

4. Understand the processes which contribute to change in soil pH

**Competency Area 4. Soluble salts**

1. Understand the source of soluble salts

2. Understand the term electrical conductivity as it relates to soil salts

3. Understand the principles in managing soil salinity

4. Know the difference between alkaline, saline, sodic and saline-sodic soils

**Competency Area 5. N, P, and K requirements**

1. Understand how soil properties and nutrient cycling processes affect P and K availability

2. Understand the N cycle in soils and know the effect of the following processes:
    a. ammonification
    b. crop removal
    c. denitrification
    d. erosion
    e. fallow
    f. immobilization
    g. leaching
    h. mineralization
    i. nitrification
    j. volatilization

3. Understand the process of symbiotic N fixation

4. Understand the source of N from previous crops

**Competency Area 6. Secondary and micronutrient plant requirements**

1. Understand which crops have special requirements for secondary and/or micronutrients and are especially susceptible to deficiency in North Dakota

2. Understand the relationship between soil minerals/organic matter, and secondary and micronutrient availability

**Competency Area 7. Soil sampling, plant sampling, interpreting soil test reports and making fertilizer recommendations**

1. Understand how to obtain a composite field soil sample

2. Understand the difference between grid and zone sampling and the strengths and weaknesses of each approach

3. Understand the depth of sample core required for analyzing each mineral nutrient

4. Understand what a previous crop credit is

5. Interpret a soil test report

6. Given a soil test report and calibration information, make an economically and environmentally correct fertilizer recommendation

7. Understand how the plant part sampled and timing of sampling influences plant tissue analysis

8. Understand how to handle plant samples once they are obtained

**Competency Area 8. Forms of fertilizer and application methods**

1. Recognize the physical form, analysis and describe the advantages and disadvantages of the following most common fertilizers in North Dakota:
    a. anhydrous ammonia
    b. urea
    c. ammonium nitrate
    d. ammonium sulfate
    e. monoammonium phosphate
    f. diammonium phosphate
    g. muriate of potash
    h. elemental sulfur

2. Define chelate and understand how and why they are used

3. Describe the affects of proper timing, placement method and rate of N, P and K for North Dakota crops and soils

4. Given the price per ton and fertilizer analysis, calculate the price per pound of nutrient

5. Identify the advantages and disadvantages of broadcast and banded fertilizer application

6. Define a variable-rate fertilizer application

7. Understand the differences in quality between forms of elemental sulfur and the differences in availability between elemental sulfur and available sulfate fertilizers for sensitive crops such as canola

8. Understand the use and value of the following nutrient sources:
    a. fresh manure
    b. sludges
    c. legumes
    d. broadleaf crops rich in N
    e. soil organic matter
    f. cover crops
    g. composted manure

# SOIL AND WATER MANAGEMENT

**Competency Areas**

**Soil Management**

1. Basic Soil Properties

2. Soil Erosion

3. Residue Management

4. Soil Survey

**Water Management**

5. Water and solute movement

6. Plant/water relationships

7. Irrigation and drainage

8. Water quality

## Expertise Within Each Competency Area:

### Competency Area 1. Basic Soil Properties

1. Understand the meaning of the following soil terms:
    a. texture
    b. bulk density
    c. structure
    d. soil health
    e. available soil water
    f. field capacity
    g. wilting point
    h. compaction
    i. drainage

2. Understand how soil texture affects field capacity, wilting point, and available water.

### Competency Area 2. Soil Erosion

1. Understand the forms of water erosion

2. Understand the components of the revised universal soil loss equation

3. Describe saltation

4. Understand the use of soil conservation practices to reduce wind and water erosion

5. Understand that in North Dakota, more soil is usually lost to wind erosion than through water

### Competency Area 3. Residue Management

1. Estimate percent residue cover using the line transect method

2. Understand how the following tillage practices affect percent residue cover and soil susceptibility to erosion
    a. no-till, zero-till
    b. plow
    c. chisel-plow
    d. field cultivator
    e. disk
    f. undercutter
    g. rod-weeder
    h. strip-till

**Competency Area 4. Soil Survey**

1. Understand that soil surveys provide a soil resource inventory for North Dakota in regard to:
    a. natural drainage class
    b. soil depth
    c. soil slope
    d. parent material
    e. influence of natural vegetation
    f. erosion susceptibility
    g. best land uses

2. Understand the following soil survey terms
    a. soil series
    b. soil type
    c. soil map unit
    d. land suitability

**Competency Area 5. Water and Solute Movement**

1. Understand the principles of point and non-point source pollution and be prepared to recognize examples of each

2. Understand the importance of lateral flow in water movement within landscapes

3. Define preferential flow

4. Know the two most important nutrients in terms of surface water pollution

**Competency Area 7. Plant/Water Relationships**

1. Understand the factors influencing evapotranspiration

2. Understand the effects of soil dryness and soil wetness on plant growth

3. Understand the concept of crop rotation intensity and diversity

**Competency Area 8. Irrigation and Drainage**

1. Understand the components needed to facilitate successful drainage

2. Understand the relationship between irrigation and drainage

3. Understand the consequences of over-watering/under-watering

4. Understand the importance of compatible soils and irrigation water in sustaining successful irrigation

5. Understand the benefits and disadvantages of surface and tile drainage systems

# PEST MANAGEMENT

## Weed Management

### Competency Areas

1. Weed Identification and Biology

2. Herbicide Efficacy

3. Herbicide Classification

4. Integrated Pest Management (IPM) Principles and Practices

5. The Role of Bioengineered Crops in Weed Control

### Expertise Within Each Competency Area

**Competency Area 1. Weed Identification and Biology**

1. Identify characteristics of the following annual and perennial weeds:

| | | |
|---|---|---|
| Absinth wormwood | Nightshade species | Quackgrass |
| Barnyardgrass | Field bindweed | Pigweed species |
| Biennial wormwood | Field sandbur | Russian thistle |
| Canada thistle | Green foxtail | Saltcedar |
| Common cocklebur | Kochia | Knapweed species |
| Common lambsquarters | Ladysthumb | Wild buckwheat |
| Common mallow | Lanceleaf sage | Wild mustard |
| Common ragweed | Leafy spurge | Wild oats |
| Dalmation toadflax | Musk thistle | Wild sunflower |
| Downy brome | Purple loosestrife | Yellow foxtail |
| | | Yellow starthistle |

2. Describe the life cycle, reproductive capacity, viability and dispersal of seed for the weeds listed in 1.1.

**Competency Area 2. Herbicide Efficacy**

1. Describe how the following factors affect soil-applied herbicide efficacy and persistance.

2. Describe how the following factors affect post-emergence herbicide efficacy, persistence and drift.

a. Rainfall and soil moisture
b. Soil characteristics (pH, organic matter, fertility, clay content, and CEC)
c. Soil temperature, air temperature and humidity
d. Herbicide volatility
e. Rate and method of herbicide degradation
f. Herbicide uptake, translocation and fate in plants
g. Adjuvant function and specificity
h. Mechanisms of herbicide selectivity
i. Application technique and incorporation
j. Optimum crop and weed growth stage for herbicide application

**Competency Area 3. Herbicide Classification**

Know chemical family, mode of action, symptomology and selectivity of herbicides used in North Dakota

**Competency Area 4. Integrated Pest Management (IPM) Principles and Practices**

Know and understand cultural, mechanical and biological methods of weed control and how they can influence the use and effectiveness of chemical methods of control. Also, know herbicide-resistant management strategies for weeds.

**Competency Area 5. The Role of Bioengineered Crops**

1. Understand the meaning of transgenic crops

2. Understand the advantages and disadvantages of genetically altered herbicide resistant crops

# PEST MANAGEMENT

## Management of Insects

### Insect Management Competency Areas

1. Insect Identification and Biology

2. Insect Management Strategies

3. The Role of Bioengineering in Insect Management

### Expertise Within Insect Competency Areas

**Competency Area 1. Insect Identification and Biology**

1. Identify the following economically important insect pests in North Dakota

**General insects:**
grasshoppers
cutworms
wireworms

**Small grain insects:**
armyworms
cereal aphids
barley thrips
Hessian fly
wheat stem sawfly
wheat stem maggot
orange blossom
wheat midge

**Forage insects:**
Sweetclover weevil
blister beetles

**Corn insects:**
European corn borer
corn rootworms
white grubs

**Sunflower insects:**
sunflower beetle
sunflower midge
spotted stem weevil
red seed weevil
grey seed weevil
banded sunflower moth
thistle caterpillar

**Sugarbeet insects:**
sugarbeet root maggot
lygus bug

**Potato insects:**
leafhoppers
Colorado potato beetle
green peach aphid

**Canola insects:**
flea beetles
diamond back moth
Bertha army worm

**Beneficial insects:**
ladybird beetles
green lacewing
syrphid fly

**Soybean insects:**
aphid

2. Understand insect life cycles; recognize gradual and complete metamorphosis, and be familiar with life cycle events throughout the growing season

3. Understand insect reproductive habits: egg-laying, live bearing insects, and the role of pheromones and their use in monitoring population activity

4. Be familiar with insect morphology and feeding injury; recognize the relationship between types of insect mouthparts and the types of feeding injury that can be inflicted

**Competency Area 2. Insect Management Strategies**

1. Understand types of control and the advantages and disadvantages of cultural, natural, biological, and chemical control

2. Understand the concept and use of economic threshold

3. Understand insect scouting procedures; random vs. sequential sampling, sample size, pheromone trap monitoring

4. Describe factors that influence performance of insecticides

5. Describe how insect resistance develops

**Competency Area 3.** The Role of Bioengineered Crops in Insect Management

1. Understand the types of genetically altered crops available and the types of insects they control

2. Understand that components of crops or the entire crop may contain genetically incorporated insecticidal properties

# PEST MANAGEMENT

## Management of Diseases

### Disease Management Competency Areas

1. Plant Disease Identification

2. Plant Disease Development

3. Plant Disease Management

### Expertise in Disease Management Competency Areas

**Competency Area 1. Plant Disease Identification**

Recognize the signs and symptoms of the following major crop diseases in North Dakota, and understand how each disease develops and how it is managed

a. Wheat tan spot
b. Wheat Septoria leaf and glume blotch
c. Fusarium head scab of small grains
d. Common root rot of small grains
e. Wheat streak mosaic virus
f. Leaf and stem rust of small grains
g. Sclerotinia (white mold) of broadleaf crops
h. Cercospora leafspot of sugarbeet
i. Early and late blight of potato
j. Common and halo blight of dry bean
k. Dry rot of potato
l. Sunflower and dry bean rust
m. Black leg and soft rot of potato
n. Downy mildew
o. Ergot of cereals
p. Soybean rust
q. Canola blackleg
r. Flax pasmo
s. Powdery mildew of field pea
t. Ascochyta of pulse crops

**Competency Area 2. Plant Disease Development**

1. Differentiate infectious and non-infectious diseases

2. Know the disease triangle, and how pathogens infect, are disseminated and survive

**Competency Area 3. Plant Disease Management**

1. Understand the principles of Integrated Pest Management

2. Know which seed treatments and foliar fungicides are used in North Dakota for the diseases listed in 1.1; understand whether they are systemic or non-systemic.

3. Understand how to manage fungicide resistance

4. Understand the importance of rotation to break pest cycles.

# CROP PRODUCTION

### Crop Production Competency Areas

1. Seeding

2. Growth and Development

3. Harvest and Storage

### Expertise in Crop Production Competency Areas

**Competency in Area 1. Establishment**

1. Know the factors that influence the seeding practices of major crops (wheat, durum, barley, oats, corn, field pea, flax, alfalfa, sunflower, dry edible bean, soybean, sugarbeet, canola and potato).

2. Be familiar with recommended crop rotations.

3. List recommended planting rates and the factors that influence plant populations of major crops including date of planting, planting depth and row spacing.

4. Recognize how tillage systems impact crop production and management

5. List the criteria for selection of a hybrid or cultivar for all major crops

**Competency in Area 2. Growth and Development**

1. Describe plant growth and development stages of these major crops:
    - a. small grains
    - b. corn
    - c. soybean
    - d. sunflower
    - e. alfalfa
    - f. dry edible bean
    - g. canola
    - h. field pea

2. Define the term “growing degree day” and describe how it is used in crop production. Know the base temperatures for wheat, sunflower and corn. Calculate growing degree days for a given period if given the necessary background temperature information

3. Describe how temperature extremes affect the growth and development of the crops in 2.1

4. Identify damage to crops from high temperatures, hail, frost, flooding, drought and wind

5. Know how to take a plant population count in a field

6. Compare and contrast monoculture crop systems and a crop rotation

7. Describe climatic and plant factors which influence a plant’s ability to resume growth after being injured

8. Describe how the water and nutrient needs of major North Dakota crops change during their growth and development

**Competency Area 3. Harvest and Storage**

1. Know when the crops in 2.1 are physiologically mature

2. Recognize how drying temperature, handling, storage time and storage conditions affect seed quality

3. Know the best management practices for residue management, pest control and soil water management following harvest of the crops in 2.1

4. Physiologically, what is the best timing for harvest of corn silage, forage crops, small grains, grain corn, soybean, dry edible bean, sugarbeet and potato for best grain, forage, storage characteristics and processing quality?

5. Define forage quality and the management necessary to achieve top quality forages

# LAWS AND REGULATIONS AFFECTING PESTICIDES, FERTILIZERS, AND NOXIOUS WEEDS

## Competency Areas in Laws and Regulations

1. North Dakota Pesticide Act (Chapter 4-35 NDCC) with Regulations

2. Label Knowledge and Comprehension, EPA

3. North Dakota Noxious Weed Law (NDCC Chapter 4.7-47) and Regulations

4. North Dakota Seed Law and Regulations (NDCC Chapters 4-09 and 4-25)

## Expertise Within Each Law and Regulations Competency Area

### Competency Area 1. North Dakota Pesticide Act

1. Understand the general provisions of this law and regulations

2. Define the following terms
   - a. pesticide
   - b. restricted use pesticide
   - c. certified applicator
   - d. commercial applicator
   - e. private applicator
   - f. pesticide label and labeling
   - g. bulk pesticide

3. Know the regulations regarding pesticide application, posting, storage, transportation and disposal

4. Know the requirements for chemigation

5. Know the penalties and consequences of non-compliance with the North Dakota Pesticide Act and regulations

### Competency Area 2. Label Knowledge and Comprehension

1. Know the format of a pesticide label and comprehend the meaning of the warnings, precautions, signal words, and symbols used

2. Know how to identify a Restricted Use Pesticide and know which herbicides used for the major crops (wheat, barley, dry edible bean, soybean, corn, sugarbeet, potato, canola and sunflower) are restricted

3. Define the following terms

   - a. signal word
   - b. days to harvest interval
   - c. restricted entry interval
   - d. statement of practical treatment
   - e. precautionary statements
   - f. environmental hazards

4. Know the importance of using a pesticide only in a manner consistent with its labeling

5. Understand when it is legal for not using a pesticide according to label directions

### Competency Area 3. North Dakota Noxious Weed Law

1. Know the general provisions and requirements of this law and regulations

2. Know the common names of the North Dakota noxious weeds and be able to identify them

**Competency Area 4. North Dakota Seed Law**

1. Know the general provisions and requirements of this law and regulations

2. Know the requirements for labeling agricultural seed

3. Know the prohibited noxious weed seeds and restricted noxious weed seeds

4. Know about the seed certification system, its responsibilities and the terms breeder, foundation, registered, and certified seed

5. Know the requirement for the sale of seeds covered by the Plant Variety Protection Act

# WORKER PROTECTION STANDARDS, US EPA

1. Know the general provisions of the Worker Protection Standards

2. Know where to find pesticide label information about personal protective clothing or equipment, and restricted entry intervals

3. Know what situations and conditions crop advisers and persons working under the direct supervision of a crop adviser are exempted from and what situations or conditions do not allow them an exemption

4. Know what the certified crop adviser worker protection standard responsibilities are to employees

5. Know the EPA meaning of the phrase “persons under the direct supervision of a crop adviser”

# NORTH DAKOTA CERTIFIED CROP ADVISERS
# RESOURCE LIST

State Exam

## Soil Fertility & Nutrient Management
## and Soil & Water Management Resource List

1. **NDSU Crop Production Website**: www.ag.ndsu.nodak.edu/cropprod.htm

2. **The North Dakota Fertilizer Handbook**. Franzen, D.W., Extension Bulletin EB-65, $10, 2002.

3. **Calculations for Fertilizer Blends to Meet Soil Test Recommendations**, C. Fanning, NDSU Extension Circular SF-961, 1988, 3 pages.

4. **The Nature and Property of Soils**, Nyle C. Brady, 10th Edition, Macmillan Publication Co.,N.Y., 1990. 620 pages.

5. **North Dakota Fertilizer Recommendation Table and Equations**. D.W. Franzen and L.J. Cihacek. Extension Bulletin SF-882, 2003.

6. **Protecting Fields with Windbreaks**. V. Quam and B. Wight, NDSU Extension Circular F-1054, 1993.

7. **Salinity and Sodicity in North Dakota Soils**. B.D. Seelig and J.L. Richardson, Extension Bulletin EB-57, November 2000.

8. **Managing Nitrogen Fertilizer to Prevent Groundwater Contamination**. D.Weston and B. Seelig, Extension Bulletin EB-64, April 1994.

9. **Soil Fertility and Fertilizers.** S.I.Tisdale, W.L. Nelson and J.D. Beaton, 4th Edition, Macmillan Publication Co., N.Y.

10. **Soil Sampling for Fertilizer Recommendations**. L.J. Cihacek, L.J. Swenson, and W.C. Dahnke, Extension Bulletin SF-990, March 1998. 4 pages.

11. **Soil Survey: The Foundation for Productive Natural Resource Management**. B.D. Seelig, NDSU Extension Bulletin No. 60, 1993.

12. **Soil, Water, and Plant Characteristics Important to Irrigation**. T.F. Scherer, B. Seelig and D. Franzen, NDSU Extension Bulletin EB-66, February 1996.

13. **Managing Saline Soils in North Dakota**. D. Franzen, C. Fanning and T. Gregoire, NDSU Extension Service Circular SF-1087, November 2003.

14. **Persistence and Mobility of Pesticides in Soil Water**. NDSU Extension Service Circular EB49.1988.($0.25)

15. **Fertilizer Application with Small Grain Seed at Planting**. NDSU Extension Service Circular EB-62. PDF Version (69 KB). 1994.

## Weed Management Resource List

1. **North Dakota Weed Control Guide**. NDSU Extension Service Circular W-253. Zollinger, R.K. et. al. Annual

2. **Perennial and Biennial Thistle Control**. NDSU Extension Circular W-799. 12p. Lym, R.G. and R.K. Zollinger. 2000.

3. **Herbicide Handbook**. Ninth Edition (2007). Weed Science Society of America. 1508 W. University Ave., Champaign, IL 61821-3133. 352p N.E. Humburg, Ed. 1994

4. **Herbicide Mode of Action and Injury Symptoms**. North Central Regional Extension Publication 377. Available from NDSU Extension Service.($3.00) 18 p. Gunsolus, J.L. 1994. NCR 377

5. **Herbicide Resistant Weeds**. North Central Regional Extension Publication 468. Available from the NDSU Extension Service. ($1.50) 10 p. Gunsolus, J.L. 1994.

6. **Herbicide Spray Drift**. NDSU Extension Service Circular A-657, 8p. Dexter, A.G. 1993

7. **Managing Pesticides to Prevent Groundwater Contamination**. NDSU Extension Service Bulletin E-979. 12p. McBride, D.K. 1989.

8. **Weeds of the West**. Western Society of Weed Science. Available from the NDSU Extension Service. ($19.50) 630p. Whitson, T.D., Editor 2001

9. **Sprayer Equipment and Calibration**. NDSU Extension Service Circular AE-73. 1997.

10. **Herbicide Spray Drift**. NDSU Extension Service Circular A-657. 1993.

11. **North Dakota Noxious and Troublesome Weeds**. NDSU Extension Service Circular W-1103. PDF Version (1,068KB). 2009. ($4.00).

12. **Herbicide and Nonherbicide Injury Symptoms in Wheat and Barley**. NDSU Extension Service Circular W-1141. 1998. ($3.50).

## Insect Management Resource List

1. **Aphid Management in Small Grains, Corn and Sorghum**. NDSU Extension Service Circular E-493. 4p. McBride, D.K. and P.A. Glogoza. 1993.

2. **Armyworm and Army Cutworm**. NDSU Extension Service Circular E-830. 4p. McBride, D.K. 2000.

3. **Banded Sunflower Moth**. NDSU Extension Service Circular E-823. 2p. Charlet, L. 2002.

4. **Biology and Management of Barley Thrips**. NDSU Extension Service Circular E-1007. 8p. Bates, B.A., M.J. Weiss and D.K. McBride. 1991.

5. **Corn Insects in North Dakota**. NDSU Extension Service Circular E-631. McBride, D.K., 1990.

6. **Grasshopper: Biology and Management**. NDSU Extension Service Circular E-272. 12p. Glogoza, P. and M. Weiss. 1997.

7. **North Dakota Field Crop Insect Management Guide**. NDSU Extension Service Circular E-1143. Available from NDSU Extension Entomology, PO Box 5346, NDSU, Fargo, ND 58105-5346. 45p. P.A. Glogoza. Annual.

8. **Potato Production and Pest Management in North Dakota and Minnesota**. NDSU and Minnesota Extension Service EB-26. ($7.50) 124p. Bissonnette, H.L., D.Preston and H.A. Lamey. 1993.

9. **Sunflower Beetle**. NDSU Extension Service Circular E-824. 4p. McBride, D.K. and L.D. Charlet. 2000.

10. **Sunflower Midge**. NDSU Extension Service Circular E-800. 4p. Glogoza, P., G.Brewer and L. Charlet. 1997.

11. **Sunflower Production.** NDSU Extension Service Bulletin EB-25. ($8.00) 98p. Berglund, D., et al. 1994.

12. **Sunflower Seed Weevil Management.** NDSU Extension Service Circular E-817. 8p. Peng, C., G.J. Brewer, L.D. Charlet and P. Glogoza. 1997.

13. **Sunflower Stem Weevils.** NDSU Extension Service Circular E-821. 4p. Glogoza, P., and L.D. Charlet. 2002.

14. **Wheat Stem Insect Pests and Management Practices**. NDSU Extension Service Circular E-680. 8p. McBride, D.K., D.D.Kopp and C.W. Nyegaard. 1989.

15. **Wireworm Management for ND Field Crops.** NDSU Extension Service Circular E-188. 4p. Glogoza, P. 2001.

## Plant Disease Resource List

1. **Cercospora Leafspot of Sugarbeet**. NDSU Extension Circular PP-764 (revised). 4p. Lamey, H.A., A.W.Cattanach, W.M.Bugbee and C.E. Windels. 1996.

2. **Crop Rotations for Managing Plant Disease**. NDSU Extension Circular PP-705 (revised). 4p. Lamey, H.A. and M.P. McMullen. 1999.

3. **Dry Edible Bean Diseases**. NDSU Extension Circular PP-576 (revised). 8p. Venette, J.R. and H.A.Lamey. 1998.

4. **Head Blight (Scab) of Small Grains**. NDSU Extension Circular PP-804 (revised). 4p. McMullen, M.P. and R.W. Stack. 1999.

5. **Integrated Pest Management in North Dakota Agriculture**. NDSU Extension Circular PP-863. 2 p. McMullen, M.P. and Jan Knodel. 1999.

6. **Plant Diseases**: Development and Management. NDSU Extension Bulletin EB-31 (revised) 12 p. Lamey, H.A. abd M.P. McMullen. 2001.

7. **Potato Production and Pest Management in North Dakota and Minnesota**. NDSU Extension Bulletin EB-26 (revised). ($7.50) 124 p. Bissonnette, H.L., D. Preston and H.A. Lamey. 1993.

8. **Root and Crown Rots of Small Grains**. NDSU Extension Circular PP-785. 8p. Stack, R.W. and M.P. McMullen. 1999.

9. **Symptoms and Controls of Crop Diseases**. NDSU Extension Circular PP-533 (revised). 28 p. McMullen, M.P. and H.A. Lamey. 1999.

10. **Wheat Health Management**. American Phytopathological Society Press. 152 p. R.J. Cook and R.J. Veseth.

11. **Wheat Leaf Rust**. NDSU Extension Circular PP-589 (revised). 4 p. Marcia McMullen and Jack Rasmussen. 2002.

12. **Wheat Streak Mosaic**. NDSU Extension Circular PP-646 (revised). 4p. McMullen, M.P. 2002.

13. **Field Crop Fungicide Guide**. NDSU Extension Circular PP-622 (revised). 33 p. M.P. McMullen and H.A. Laney. Annual.

14. **Blackleg of Canola, Biology and Management**. NDSU Extension Service Circular PP-1024 (revised). 4p. Lamey, H.A. 1996.

15. **Identification and Control of Seedling Diseases, Root Rot, and Rhizomania on Sugarbeet**. NDSU Extension Service Circular PP-1142. 20 p. C.E. Windels and H.A. Lamey. 1998. $2.00

16. **Guidelines for Seed Potato Selection, Handling and Planting**. NDSU Extension Service Circular PP-877 (revised). 8p. G.A. Secor, N.C. Gudmestad, D.A. Preston and H.A. Lamey. 1997.

17. **Common Barley Diseases in North Dakota*Hosts-Symptoms-Controls**. NDSU Extension Service Circular PP-894. 1990.

18. **Sclerotinia Stem Rot (White Mold)of Soybean**. NDSU Extension Service Circular PP-1018. 1991.

19. **Sclerotinia Stem Rot of Canola**: **Biology and Management.** NDSU Extension Service Circular PP-1201. PDF Version – (1,307KB). 2000.

20. **Tan Spot and Septoria/Stagonospora Diseases of Wheat**. NDSU Extension Service Circular PP-1249. PDF Version (326KB). 2003.

21. **Recognition and Management for Dry Bean Production Problems**. NDSU Extension Service Circular NCR-198. 1983. ($5.00).

## Crop Production Resource List

**CROPS (General)**

1. **Farmers's Guide for Seed Buying**. NDSU Extension Service Circular A-353. 2 pp.Helm, J.L. and L.A. Spilde. 1990.

2. **Crop Rotations for Managing Plant Disease.** NDSU extension Service Circular PP-705, 4pp. Lamey, H.A. and Marcia P. McMullen. 1999.

3. **Crop Rotations for Increased Productivity**. NDSU Extension Service Bulletin EB-48 (revised) 16 pp. Michael D. Peel. 1998.

4. **Crop Production Guide.** NDSU Extension Service, No. 12. Annual.

**SMALL GRAINS & OILSEEDS**

1. **Replanting After Early Season Crop Injury**. NDSU Extension Service Bulletin A-934. Peel, Michael D. and Greg Endres. 1997.

2. **Growth Staging of Wheat, Barley, and Wild Oat.** NDSU Extension Service Bulletin, 26 pp. Nelson, J. et al. 1992. $2.50

3. **How Cereal Crops Grow.** NDSU Extension Service Bulletin EB-3, 39 pp. Deckard, E.L. et al. (1989).

4. **Selecting Quality Seed of Cereal Grains.** NDSU Extension Service Circular A-500. 4pp. Helm, J.L. and L.A. Spilde (1990).

5. **Winter Wheat Production in North Dakota.** NDSU Extension Service Bulletin EB-33 (revised). 8pp. Michael D. Peel and B. Riveland.

6. **Stages of Sunflower Development.** NDSU Extension Service Circular A-3-3, 2pp. Schneiter, A.A. et al. (1992).

7. **Sunflower Production.** NDSU Extension Service Bulletin 25. ($8.00) 98 pp. Berglund, D.R. et al. (1994).

8. **Canola Production.** NDSU Extension Service Circular A-686. 8pp. Berglund, D. and K. McKay. (2002).

9. **Flax Production.** NDSU Extension Service Circular A-1038, 4pp.. Helm, J. and D. Berglund. (2002).

10. **Canola Flowering and Fungicide Application Timing.** NDSU Extension Service Circular A-1208. PDF Version (697KB). 2001.

11. **Tips for Improved Fungicide Spraying for Wheat/Barley Head Scab Control**. NDSU Extension Service Circular ER-56. 1999.

**ROW CROPS**

1. **Corn Production for Grain and Silage**. NDSU Extension Service circular A-834. Berglund, D.R. and H.Z. Cross (1999).

2. **Dry Bean Production Guide**. NDSU Extension Circular A-1133 (1997).

3. **Growing Irrigated Potatoes.** NDSU Extension service Circular AE-1040. 12pp. Scherer, T.F. et al (1999).

4. **Potato Production and Pest Management in North Dakota and Minnesota.** NDSU Extension Service Bulletin 26 and Minnesota Extension Service Bulletin AG-BU-6109-S.($7.50) 124 pp. Bissonnette, H.L. et al. (1993).

5. **Soybean Production.** NDSU Extension Service Circular A-250. Berglund, D.R. and T.C. Helms (2003).

6. **Sugarbeet Research and Extension Reports.** Available from Extension Soils, 701-231-8881. NDSU Extension Service and Minnesota Extension Service. 380pp. (Annual).

7. **Herbicide Mode of Action and Sugarbeet Injury Symptoms.** NDSU Extension Service Circular A-1085. 1999.

8. **Soybean Soil Fertility.** NDSU Extension Service Circular SF-1164. 1999.

9. **Field Pea Production.** NDSU Extension Service Circular A-1166. PDF Version (348KB). 2003.

10. **Corn Growth and Management Quick Guide.** NDSU Extension Service Circular A-1173. 1999.

11. **Soybean Growth and Management Quick Guide.** NDSU Extension Service Circular A-1174. PDF Version (141KB). 2004.

12. **Profitable Midwest No-Till Soybean Production**. NDSU Extension Service Circular NCR-580. 1996. ($2.50)

**HAY-PASTURE-FORAGE**

1. **Alfalfa Management in North Dakota.** NDSU Extension Service Circular R-751. Meyer, D. and J.L. Helm. (1994).

2. **Alfalfa Seed Germination, Seedling Growth and Vegetative Development.** NDSU Extension Service Circular R-648. 4 pp. Helm, J.L. and D.W. Meyer. (1999).

3. **Forage Establishment.** NDSU Extension Service Circular R-563. 8 pp. Meyer, D.W. et al. (1999).

4. **Pure Live Seed – Seeding Rats for Grasses and Legumes**. NDSU Extension Service Circular R-703. 4pp. Dodd, D.L. (1981).

5. **Grass Varieties for North Dakota**. NDSU Extension Service Circular R-794. PDF Version (835 KB). 2001

6. **Haylage and Other Fermented Forages**. NDSU Extension Service Circular AS-1252. PDF Version (193 KB). 2004.

7. **Corn Silage Management**. NDSU Extension Service Circular AS-1253. PDF Version (180KB). 2004.

8. **Stress-Damaged Crops.** NDSU Extension Service Circular AS-1256. PDF Version (88KB). 2004.

9. **Selected North Dakota and Minnesota Range Plants**. NDSU Extension Service Circular EB-69. 1998.

**HARVESTING AND STORAGE**

1. **Crop Storage Management**. NDSU Extension Service Circular AE-791. 7pp Kenneth J. Hellevang. (1990).

2. **Grain Drying**. NDSU Extension Service Circular AE-701, 22 pp. Kenneth J. Hellevang. (1994).

3. **Grain Moisture Content Effects and Management**. NDSU Extension Service Circular AE-905. 7pp. Kenneth J. Hellevang. (1995).

4. **Natural Air/Low Temperature Crop Drying**. NDSU Extension Service Bulletin 35. 29 pp. Kenneth J. Hellevang. (1993).

## Laws & Regulations Resource List

1. **Absinth Wormwood Control**. NDSU Extension Service Circular W-838. 2p. Lym, R.G., C.G. Messersmith, and A.G. Dexter. Revised 2002.

2. **Agricultural Weed Control Guide.** NDSU Extension Service Circular W-253. 82p. Zollinger, R.K. et al. Annual.

3. **Apply Pesticides Correctly.** A guide for Private and Commercial Applicators. Extension Service, USDA and U.S. Environmental Protection Agency. Available from NDSU Extension Pesticides, PO Box 5051, NDSU, Fargo, ND 58105-5051. ($5.00) 152 p. Revised 1991.

4. **Perennial and Biennial Thistle Control.** NDSU Extension Service Circular W-799. 12p. Lym, R.G. and R. Zollinger. (2000).

5. **Documentation for Suspected Herbicide Damage.** NDSU Extension Service Circular WC-751. 2p. Dexter, A.G. 1999.

6. **Field Crop Fungicide Guide.** NDSU Extension Service Circular PP-622. Lamey, H.A. and M.P. McMullen. 39p. Annual.

7. **Identification and Control of Field Bindweed.** NDSU Extension Service Circular W-802. 4p. Zollinger, R.K. and R.G. Lym. (2000).

8. **Integrated Management of Leafy Spurge.** NDSU Extension Service Circular W-866. 2p. Lym, R.G. and D.E. Peterson. (1995).

9. **Leafy Spurge Identification and Control.** NDSU Extension Service Circular W-765. 7p. Lym, R.G., C.G. Messersmith, and R.K. Zollinger. (2000).

10. **North Dakota Field Crop Insect Management Guide.** NDSU Extension Service Circular E-1143. Available from NDSU Extension Entomology, PO Box 5346, NDSU, Fargo, ND 58105-5346. 45p. P.A.Glogoza. Annual.

11. **North Dakota Pesticide Act Chapter 4-35 NDCC with Regulations As Amended**. North Dakota Department of Agriculture, 600 East Boulevard Avenue, 6th Floor, Bismarck, N.D. 58505-0020; telephone 800-242-7535. www.agdepartment.com
43 p. 2009.

12. **North Dakota's Noxious Weed Law and Regulations**. North Dakota Department of Agriculture, 600 East Boulevard Avenue, 6th Floor, Bismarck, ND 58505-0020; telephone 800-242-7535. www.agdepartment.com

13. **North Dakota Seed Laws, Chapter 4-09 and 4-25 of the North Dakota Century Code**. **Bulletin No. 73**. North Dakota State Seed Department, NDSU campus; telephone 701-239-7210. Revised July 1991. www.agdepartment.com

14. **Spotted Knapweed.** NDSU Extension Service Circular W-842. 2p. Lym, R.G. and R.K. Zollinger. 1992.

15. **Weeds of the West.** Western Society of Weed Science. Available from NDSU Extension Service. ($19.50) 630p. Whitson, T.D., Editor. 2001.

16. **Pesticide Container Rinsing and Water Quality.** NDSU Extension Service Circular AE-1052. 1993.

17. **Pesticides: Learning about Labels.** NDSU Extension Service CircularA-1098. 1995.

## U.S. EPA Worker Protection Standard Resource List

1. **The EPA Worker Protection Standard.** United States Code of Federal Regulations 40 CFR Part 170. A reference copy is available at the North Dakota State University Library. Photocopies are available from the North Dakota Department of Agriculture, 600 East Boulevard Avenue, 6th Floor, Bismarck, ND 58505-0020; telephone 800-242-7535 or from NDSU Extension Pesticides, PO Box 5051, Fargo, ND 58105-5051, or website: www.ndsupesticide.org.

2. **The Worker Protection Standard for Agricultural Pesticides** – How to Comply, What Employers Need to Know. U.S. EPA Revised 2005. Source: U.S. Government Printing Office, Gemplers, telephone 800-382-8473. Limited copies available from the North Dakota Department of Agriculture, 600 East Boulevard Avenue, 6th Floor, Bismarck, ND 58505-0020. Telephone: 800-242-7535 or the NDSU Extension Service. The document information is also located on the internet.

3. **The EPA Crop Adviser Exemption Federal Register Notice**, May 3, 1995. Photocopies are available from the North Dakota Department of Agriculture, 600 East Boulevard Avenue, 6th Floor, Bismarck, ND 58505-0020; telephone: 800-242-7535, or from NDSU Extension Pesticides, PO Box 5051, Fargo, ND 58105-5051; website: www.ndsupesticides.com or www.epa.gov/