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http://organictransition.umn.edu/

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Small Grains

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under grant number 2013-51106-21005.

Authors
Nicole Tautges
Kristine Moncada
Constance Carlson
Craig Sheaffer

For Organic Systems

Small Grains

I. Introduction
II. Planting
III. Weed management
IV. Disease management
V. Insect pest management
VI. Fertility management
VII. Harvest and storage
VIII. Marketing

Small Grains in the Midwest

Small Grains in the Midwest

Why Include Small Grains in Transition to Organic Systems?

A. Diverse marketing opportunities

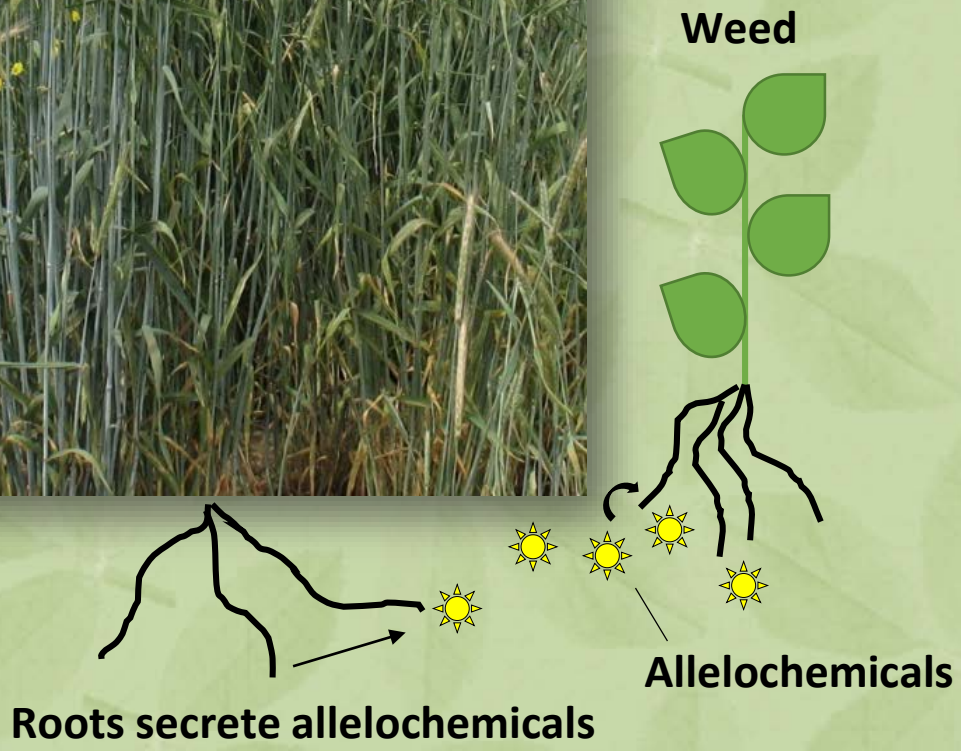
Why Include Small Grains in Transition to Organic Systems?

B. Weed control

C. Soil organic matter building

Small Grains Competitiveness with Weeds

Rye = triticale > barley = oat > wheat



Allelopathy

The ability of a plant to produce biochemical that can affect germination, growth, survival, and reproduction of other plants

Soil Organic Matter Building with Small Grains

- Greater contributions to soil organic matter
- Nutrients requirements lower than corn

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Planting Small Grains

- 1.5 – 2 inch depth
- Winter grains will benefit being planted into stubble
- Avoid planting after another grass crop

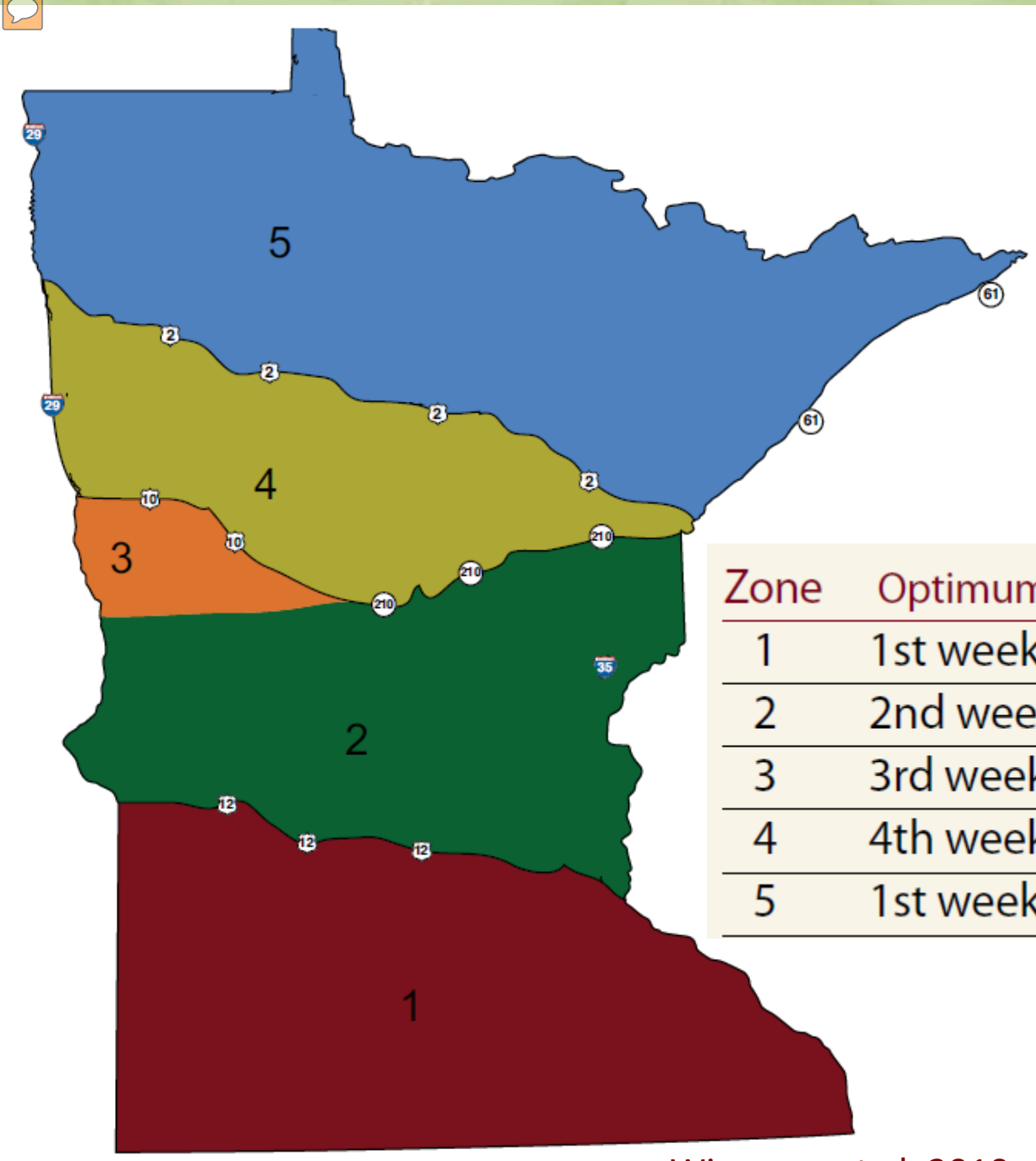
Row Spacing

- Narrow row spacing increases crop competition
- Decreases weed pressure
- As narrow as 6”

High Seeding Rates for Organic

Small Grain Spp.	Conventional Seeding Rates
Barley, Oat, Winter Wheat	150 to 200 lb/acre
Rye	120 to 175 lb/acre
Triticale (winter)	140 to 190 lb/acre
Triticale (spring)	175 to 250 lb/acre
Wheat (spring)	175 to 225 lb/acre

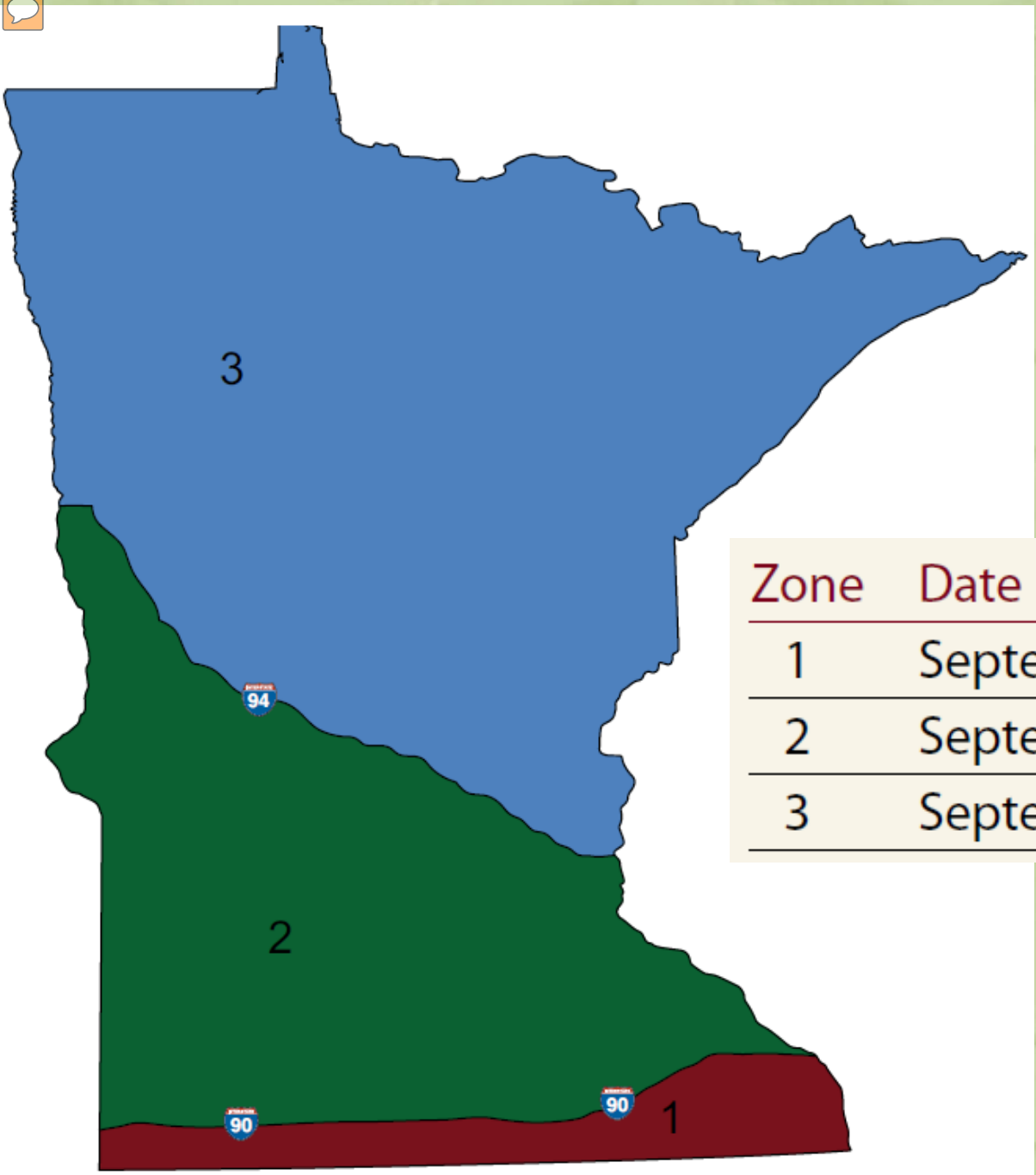
Spring Grains – Seeding Date



Zone	Optimum Planting	Last Planting Date
1	1st week of April	1st week of May
2	2nd week of April	2nd week of May
3	3rd week of April	3rd week of May
4	4th week of April	4th week of May
5	1st week of May	1st week of June

Wiersma, et al, 2010.

Fall Grains – Seeding Date



Zone	Date
1	September 20 to October 10
2	September 10 to September 30
3	September 1 to September 15

Wiersma, et al, 2010.

Variety Selection

Emphasis on:

- Early maturing
- Disease resistance
- Grain quality
- Winter hardiness
- Locally-tested and verified

Alternative Establishment Strategies: Underseeding

Underseed with red clover

Alternative Establishment Strategies: Underseeding/Nurse Crop

Underseed as nurse/ companion crop for alfalfa establishment

Alternative Establishment Strategies: Double/Cross Planting

Plant with double passes at 45 or 90 degree angles

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Tine Weeder in Small Grains

Rotary Hoe in Small Grains

Timing of Mechanical Weeding

Weed size possible to control with post-emergence tillage

Weeds too large for post-emergence tillage

Test Weeding Implements First!

Crop damage from mechanical weeding operation

Perennial Weeds

Crop Rotation for Pest Management

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Managing Diseases with Rotation

Table 2-3. Pests that are affected by rotation and the number of years it takes to break several different pest cycles.

Small grains	Fusarium	1-2 years
Small grains	Septoria leaf glume blotch	2 years
Small grains	Bacterial leaf blight	2 years
Small grains	Common root rot	2 years
Small grains	Ergot	1 year
Small grains	Scab	2-3 years

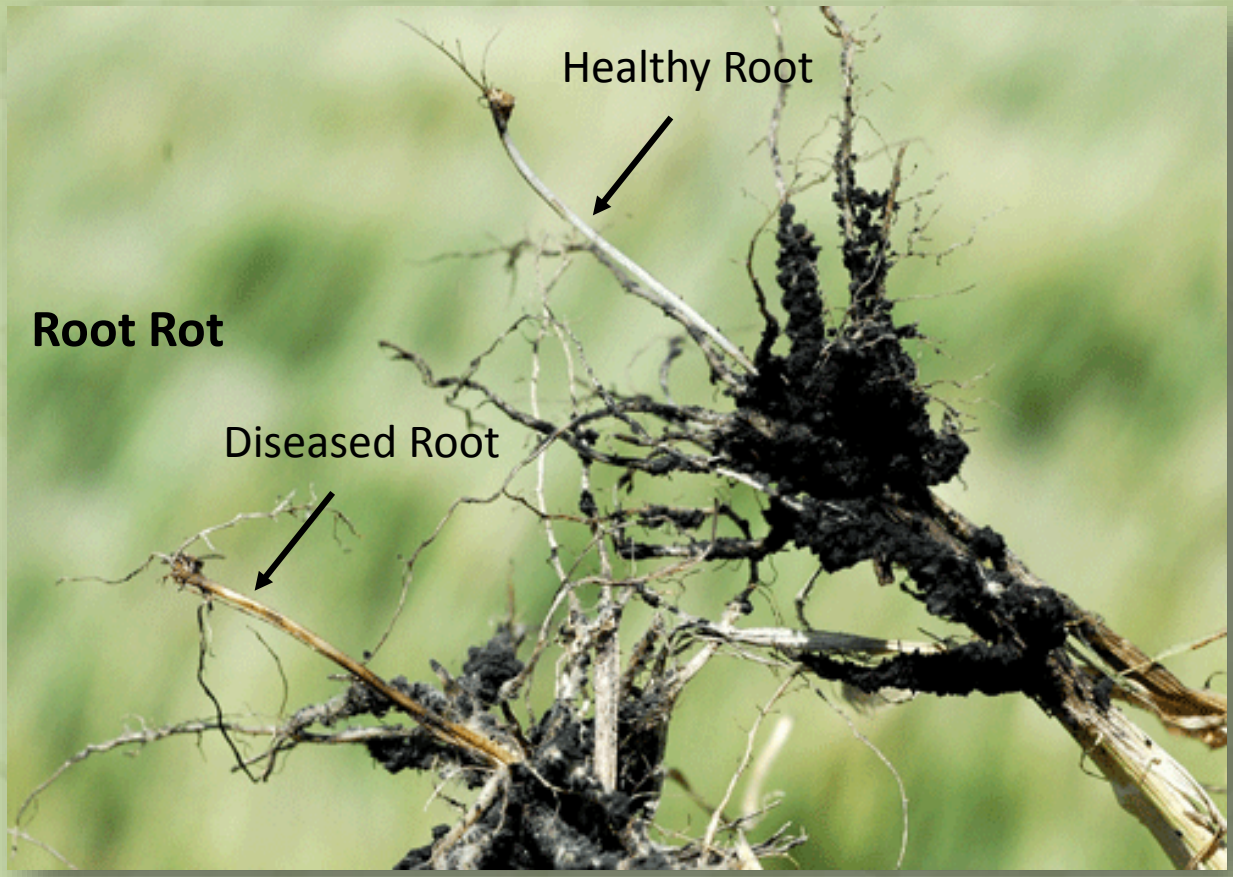
Wiersma, et al, 2010.

Managing Diseases with Rotation

Healthy resistant barley (right) and susceptible barley showing symptoms of Fusarium head blight (left).

Fungal Diseases

Fungal Diseases



Michael McMullen, North Dakota State University

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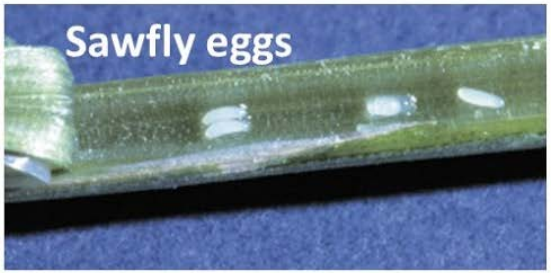
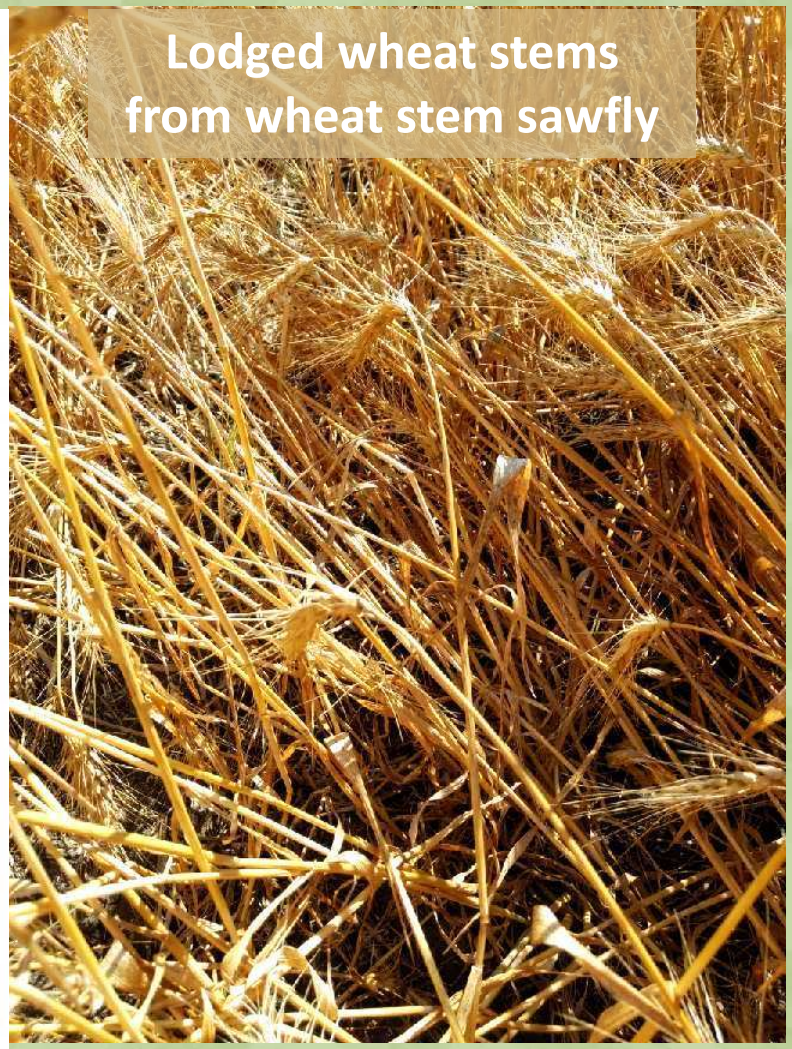
Insect Pests





Phil Glogoza, University of Minnesota Extension

Wheat Stem Sawfly

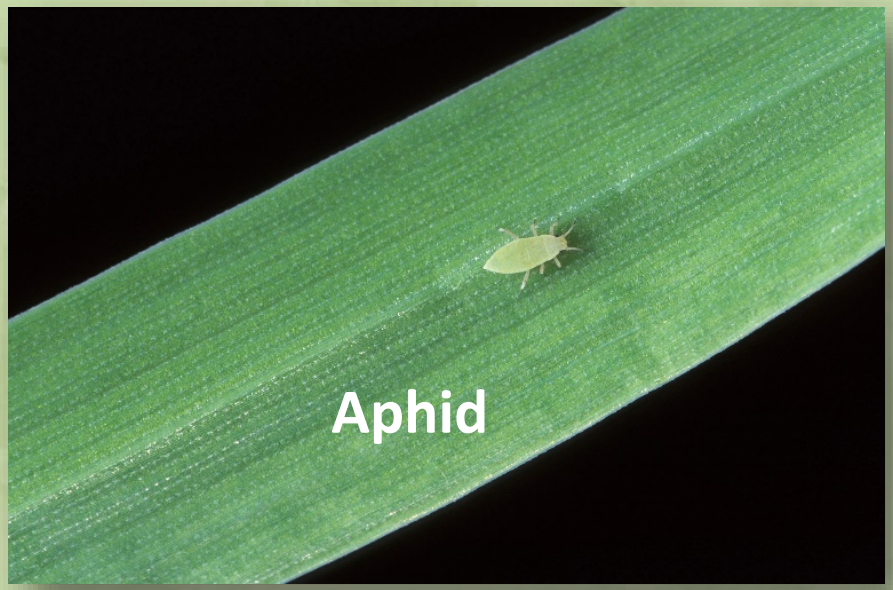
Phil Glogoza, University of Minnesota Extension

Lodged wheat stems from wheat stem sawfly damage

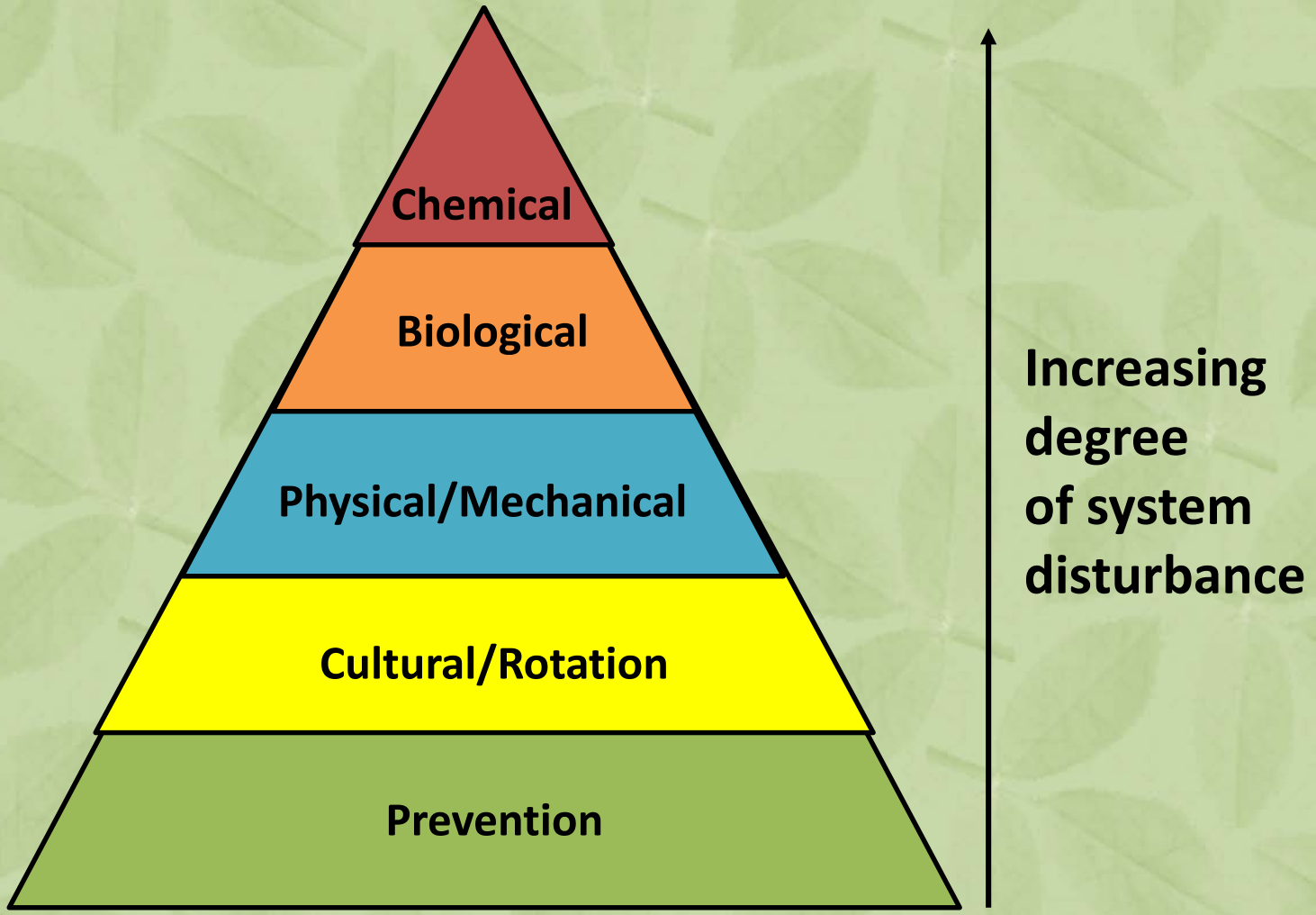
Wheat Stem Sawfly

Hessian Fly

Aphids and Mites

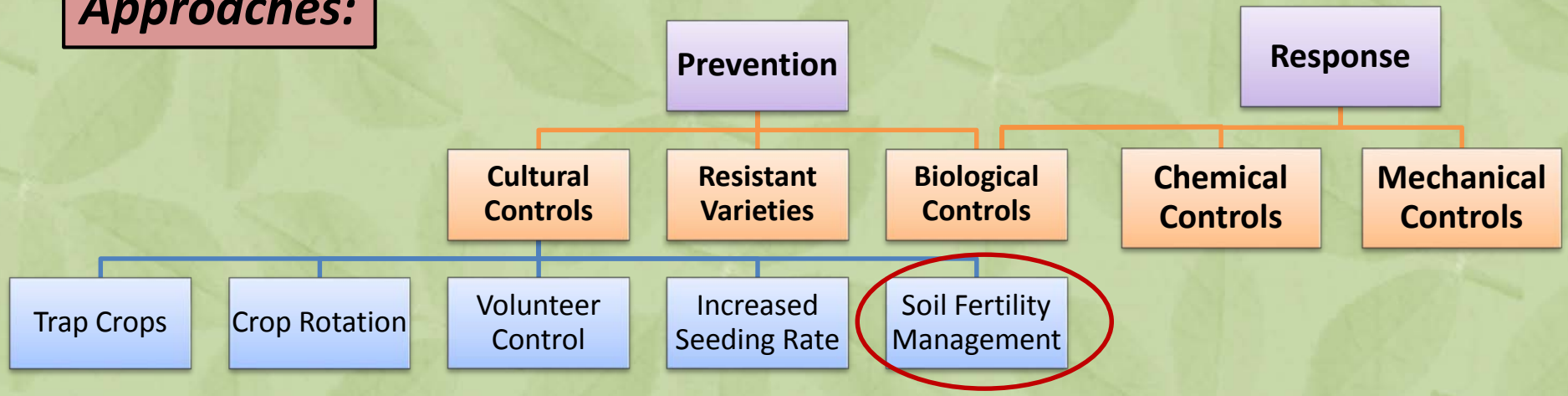


Integrated Pest Management



Integrated Pest Management for Small Grains

Approaches:



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Organic Soil Fertility Management

Kristy Borrelli, Pennsylvania State University

Fertilized w/ manure

Non-fertilized

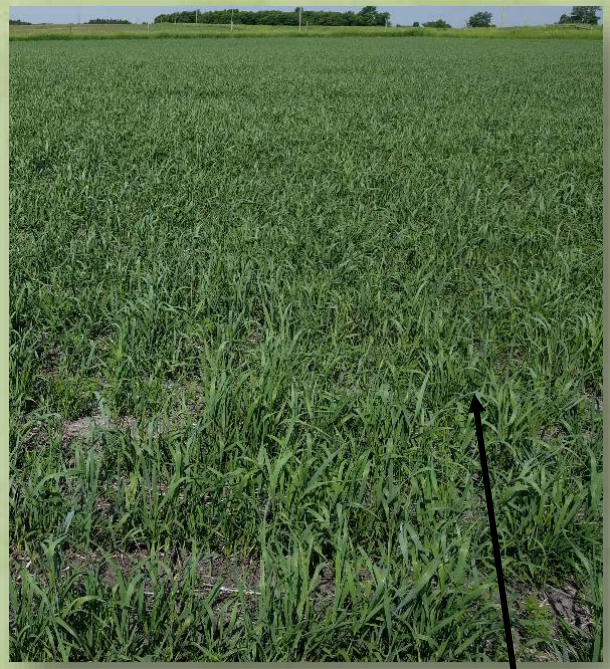
- Nitrogen is often most limiting nutrient
- Nitrogen deficiency contributes to yield losses from weed competition

Organic Soil Fertility Management

N deficiency symptoms:

- Yellowing
- Stunting

Deficiency

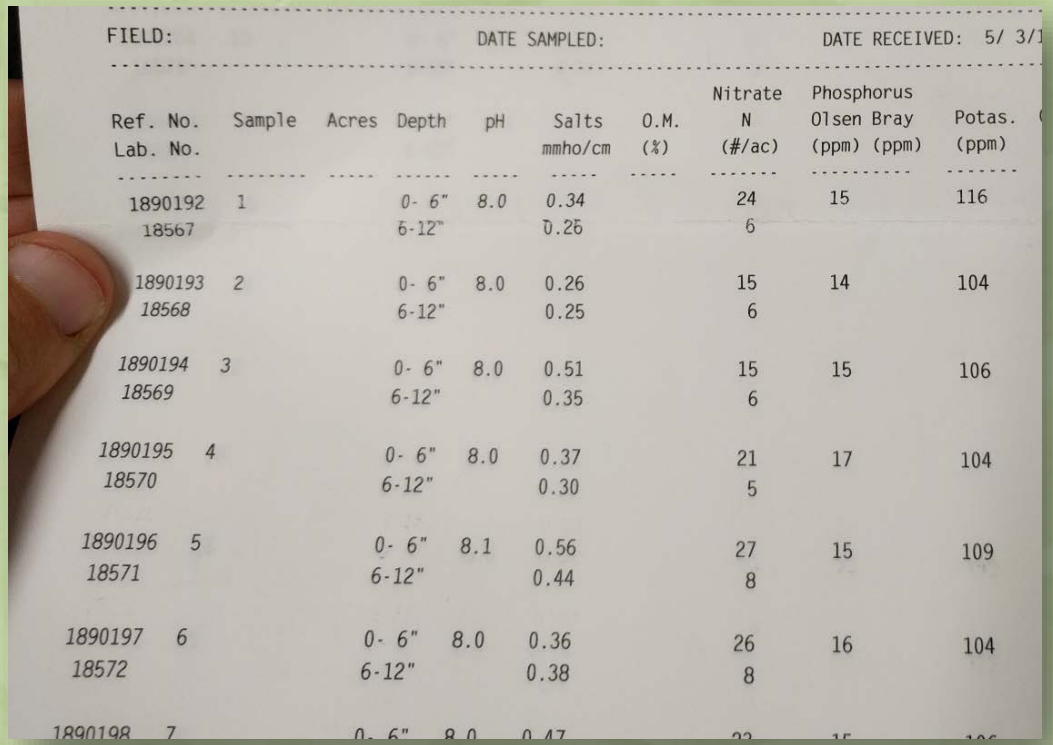


Healthy Stand

Organic Soil Fertility Management

Fertilizing Considerations:

- Immediately available N (nitrate + ammonium) vs. N available in long term
- At planting + tillering



FIELD: DATE SAMPLED: DATE RECEIVED: 5/ 3/1

Ref. No. Lab. No.	Sample	Acres	Depth	pH	Salts mmho/cm	O.M. (%)	Nitrate N (#/ac)	Phosphorus Olsen Bray (ppm)	Potas. (ppm)
1890192	1		0- 6"	8.0	0.34		24	15	116
18567			6-12"		0.26		6		
1890193	2		0- 6"	8.0	0.26		15	14	104
18568			6-12"		0.25		6		
1890194	3		0- 6"	8.0	0.51		15	15	106
18569			6-12"		0.35		6		
1890195	4		0- 6"	8.0	0.37		21	17	104
18570			6-12"		0.30		5		
1890196	5		0- 6"	8.1	0.56		27	15	109
18571			6-12"		0.44		8		
1890197	6		0- 6"	8.0	0.36		26	16	104
18572			6-12"		0.38		8		
1890198	7		0- 6"	8.0	0.47		22	15	106

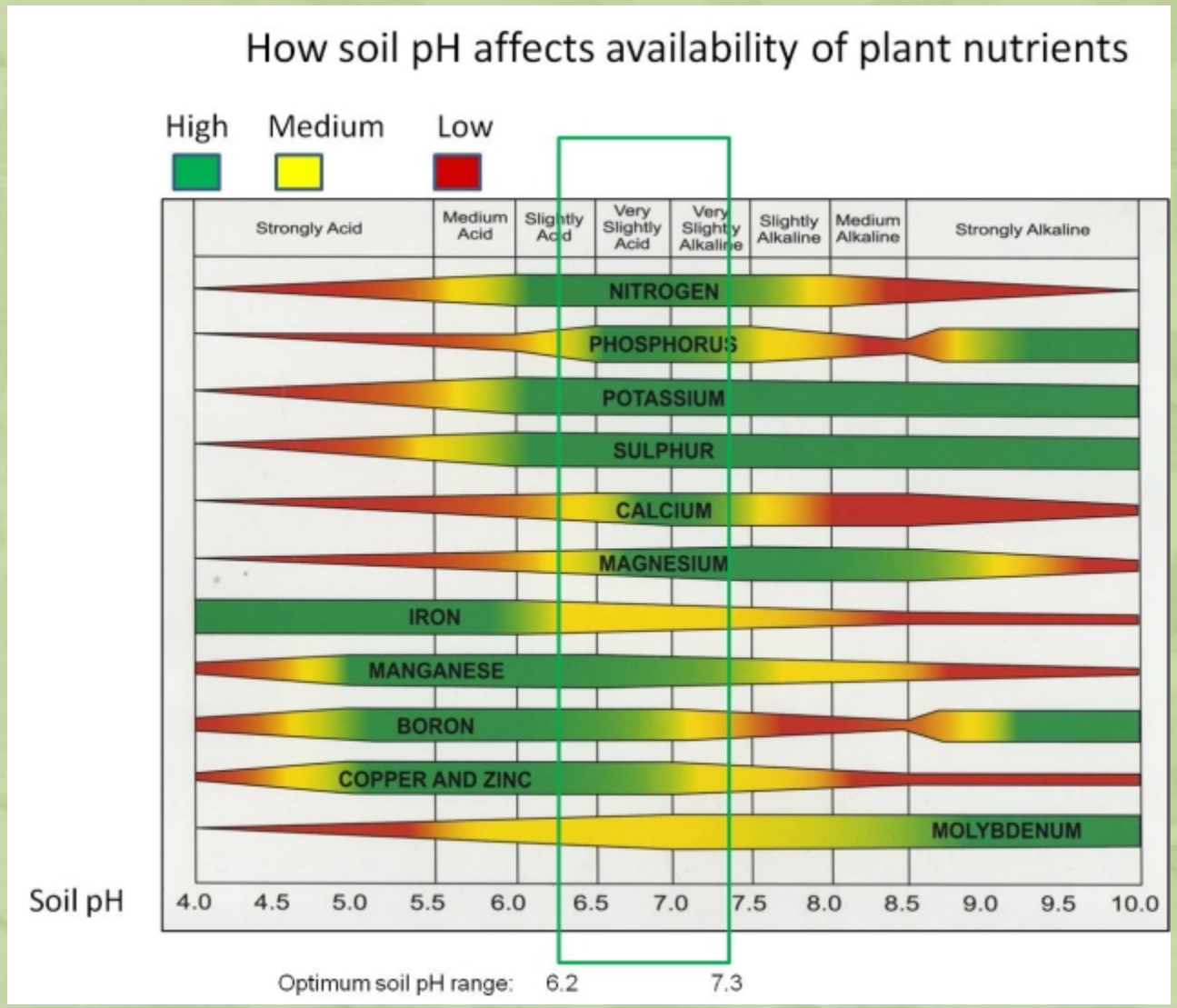
Green Manures or Legumes in Rotation

Previous Crop	1st Year N Credit lb. N/ac
Soybean	20
Edible Beans, Field Peas	10
Harvested Sweet Clover	10
Harvested Alfalfa[1/] or non- Harvested Sweet Clover	
4- 5 plants/ft²	75
2- 3 plants/ft²	50
1- 2 plants/ft²	25
1 or fewer plants/ft²	0
Harvested red clover	35

Kaiser, et al., 2013

Green Manures or Legumes in Rotation

Phosphorus


How soil pH affects availability of plant nutrients
High
Medium
Low
Strongly Acid
Medium Acid
Slightly Acid
Very Slightly Acid
Very Slightly Alkaline
Slightly Alkaline
Medium Alkaline
Strongly Alkaline
NITROGEN
PHOSPHORUS
POTASSIUM
SULPHUR
CALCIUM
MAGNESIUM
IRON
MANGANESE
BORON
COPPER AND ZINC
MOLYBDENUM
Soil pH
4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0
Optimum soil pH range: 6.2 7.3

Phosphorus Fertilizers

- Rock phosphate
- Manure
- Compost
- Fish emulsion
- Bone meal

Rotating for Phosphorus

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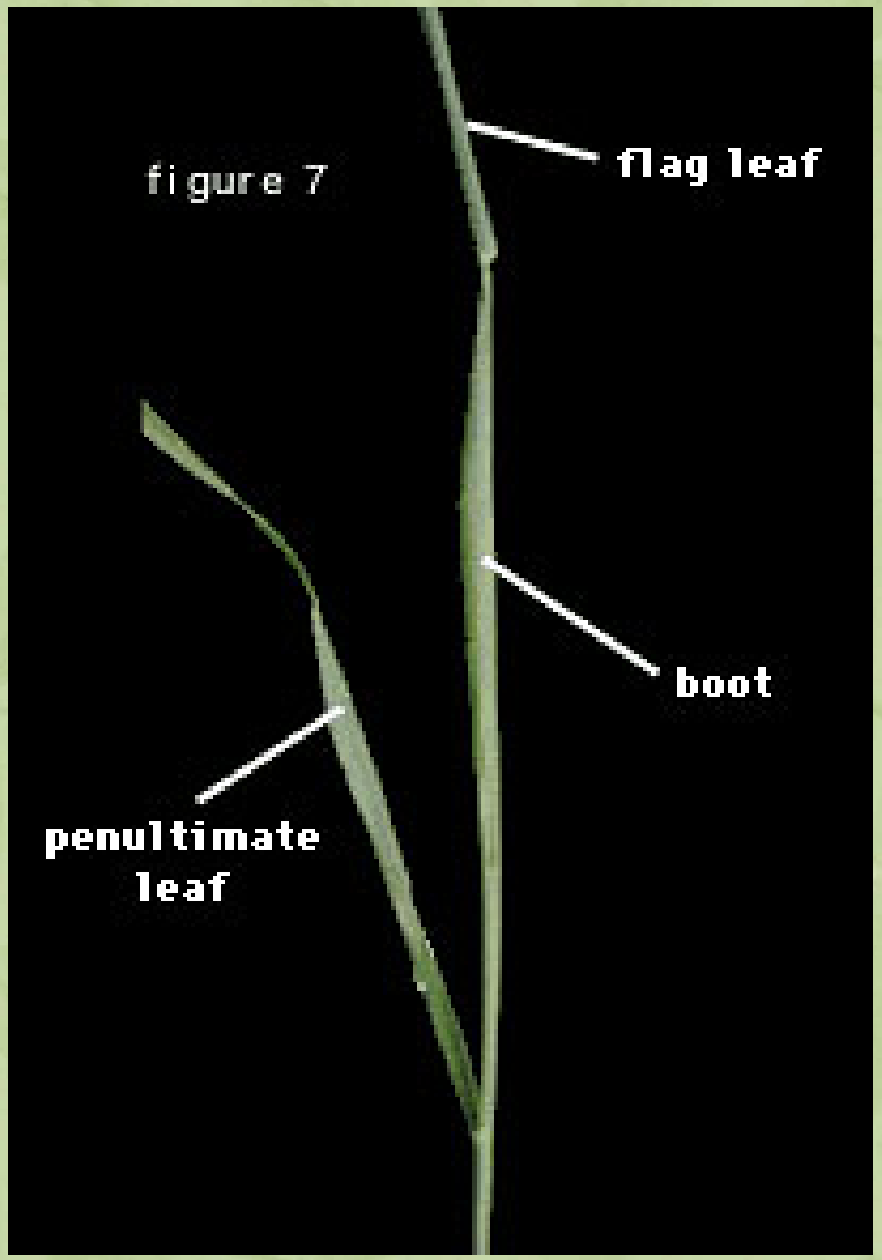
Harvesting for Forage

- Good quality hay or silage
- Harvest at boot stage or dough stage



Harvesting for Forage

- Grazing harvest
- Weed control

Harvesting Small Grains

- Swath when stalk 1 inch below the spike is yellow
- Swath when grain moisture is 35 to 40%

Harvesting Small Grains

- Combine when grain moisture <15%
- Use a Draper combine header

Quality Control

Storage

- Target moisture: 13%
- Damaging temperatures for airflow rates of 100-150 cubic feet/minute/square foot
  - 160 degrees for 16% moisture
  - 140 degrees for 20% moisture
  - 120 degrees for 24% moisture

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Grain Quality

Quality Parameters:

- Pre-harvest sprouting
- Protein
- Vomitoxin content

Selling Organic Grain

Marketing occurs on individual basis

Alternative Small Grain Crops
“Ancient Grains”

Spelt

Alternative Small Grain Crops
“Ancient Grains”

Einkorn

Conclusions

- Life cycle diversity
- Competitive with weeds
- Efficient nutrient users
- Diverse end uses

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