Integrated Pest Management Academy 2013

SCOUTING SMALL GRAINS IN MICHIGAN

SMALL GRAINS IN MICHIGAN – 2012 ACREAGE

SOURCE: USDA NASS "AGRICULTURE COUNTS" ACREAGE REPORT, JUNE 29, 2012

- Winter wheat, soft red & white – 570,000 acres
- Oats – 50,000 acres (including cover crops)
- Barley – 11,000 acres
- Other – *not reported*
  - Fall Rye
  - Spring wheat
  - Spelt

Photo Michigan Farm Bureau

Based on state-wide acreage, winter wheat is by far the most important small grain grown in Michigan, followed by oats, barley and rye.

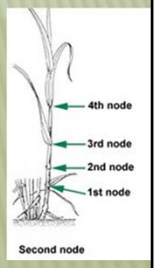
SMALL GRAIN VOCABULARY

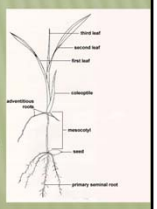
- Anther: The part of the flower that produces the pollen.
- Anthesis: The period during which a flower is fully open and functional.
- Boot stage: The time when the seedhead is enclosed within the sheath of the flag leaf
- Coleoptile: The sheath that encloses the first main shoot leaf and provides protection as it emerges from the soil.
- Flag leaf: The leaf immediately below the head.
- Floret: An individual flower within the head.

Terms needed to discuss small grain development and condition.

SMALL GRAIN VOCABULARY

- Glumes: The pair of bracts located at the base of a spikelet in the head.
- Internode: The part of a stem between two nodes.
- Jointing: Stage of wheat development when stem nodes are first detected above the soil: Zadoks stage 31.
- Leaf blade: The flattened portion of a leaf above the sheath.
- Leaf sheath: The lower part of a leaf enclosing the stem.
- Main shoot: The primary shoot that emerges first from the soil and from which tillers originate.

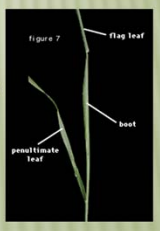


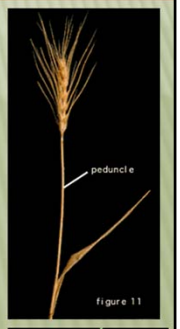


Terms needed to discuss small grain development and condition.

SMALL GRAIN VOCABULARY

- Node (Joint): A region on the stem where leaves are attached.
- Peduncle: The top section of the stem between the flag leaf and the head.
- Penultimate leaf: First leaf below the flag leaf.
- Seminal roots: Roots arising at the level of the seed.
- Spikelet: The flower of a grass consisting of a pair of glumes and one or more enclosed florets.
- Tiller: A shoot originating from the base of the plant.

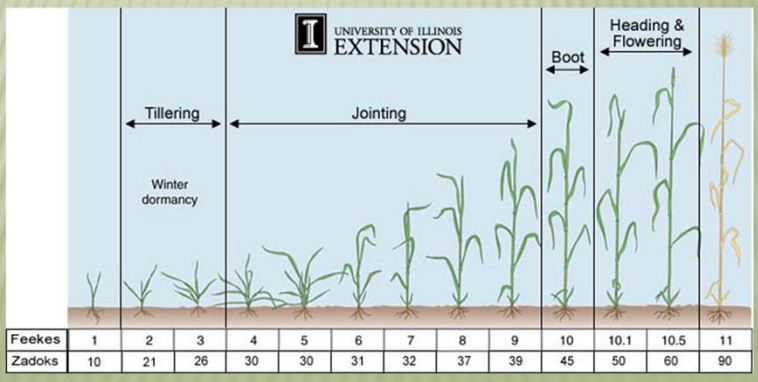




Terms needed to discuss small grain development and condition.

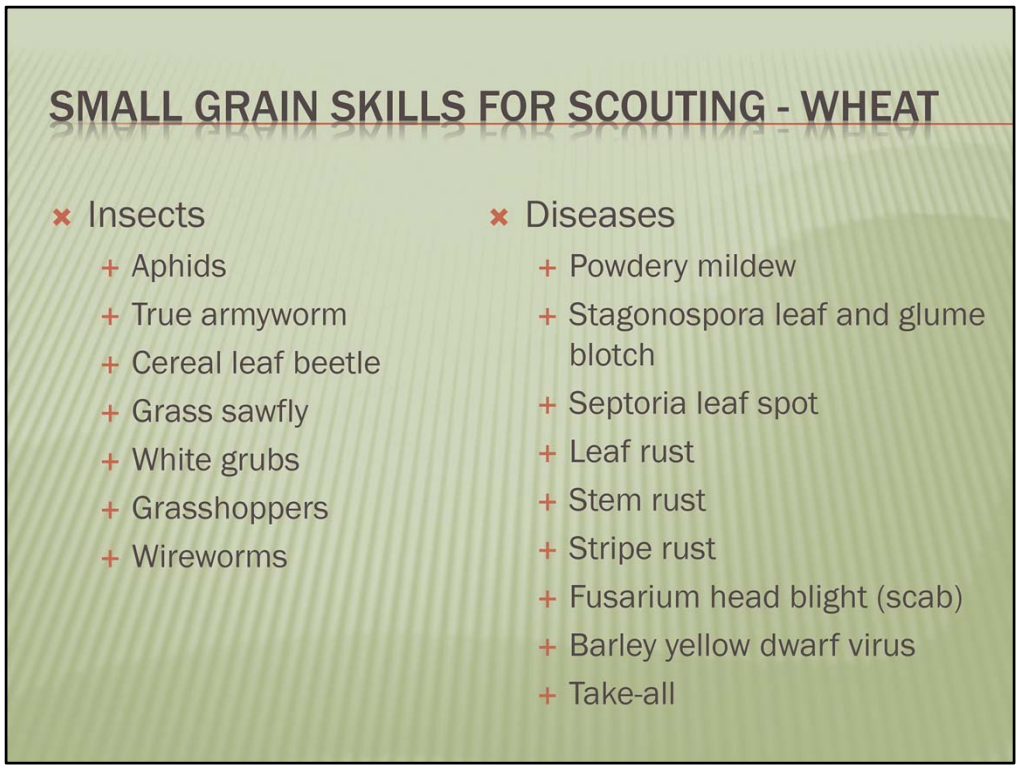
SMALL GRAIN SKILLS FOR SCOUTING

- Small grain growth stages
  - Feekes growth stages
  - Zadoks growth stages



Feekes	1	2	3	4	5	6	7	8	9	10	10.1	10.5	11
Zadoks	10	21	26	30	30	31	32	37	39	45	50	60	90

Familiarity with the growth stages of small grains is important in accurate scouting. The 2 most commonly used scales are Feekes and Zadoks. They are general scales for cereal grains and can be applied to wheat, oats, barley and other small grains.



Many insects and diseases have the capability to damage small grains in Michigan. These are few of the more common ones. Levels of infestation will vary widely from year to year and across locations in Michigan.

SMALL GRAIN INSECTS –APHIDS

Photos U. of Arkansas

- Aphids and green bugs…
  - Carry BYDV (red-leaf)
  - Cause direct plant damage
- Prior to heading, examine 20 stems in each of 5 locations.

- Treatment threshold to prevent direct damage
  - Seedling stage: 30 aphids/stem
  - Boot to heading stage: 50 aphids/stem
- Light-heavy infestation can result in severe red-leaf damage in oats, only heavy infestation cause yellowing and browning
  - Once noticed, it is too late to treat for prevention

Type of Damage: Sucks plant sap from leaves and stems. Heavy infestation may lead to yellowing/browning, stunting, curling of new leaves, and general weakening of plants. Aphids are also virus vectors.
Scouting: See MSU Bulletin E-2549, Insect Management in Wheat and Other Small Grains, for details on the presence/absence scouting method and decision table.
Management: Biological = natural enemies (ladybugs, lacewings, and wasps) and diseases generally keep populations in check

SMALL GRAIN INSECTS –TRUE ARMYWORM

Photos Chris DiFonzo

True Armyworm ID:
Stripey body, may be dark or light in color
Distinct DARK BARS on the PROLEGS
Reticulated head capsule (looks like paving stones)

- **Threshold**
  - *Before heading*: 4 or more larvae/ square foot
  - *At heading*: 2 or more larvae/ square foot
- **When not to treat**
  - If larvae are already large (+1.5 inches), they are ready to pupate and will stop feeding shortly. Spraying probably will not pay at this point.

Life cycle: Likely migrate to Michigan each spring. Eggs are laid on the surfaces of grasses, especially the headlands of small grains. Two to three generations per year, the first generation in late May to early June.
Type of damage: Defoliation by larvae, first generation most damaging. Larvae eat leaves, stems, and sometimes the heads of small grains.
Scouting: Mainly active at night and during overcast days. During the day, larvae can be found at the base of plants and under debris.

SMALL GRAIN INSECTS –CEREAL LEAF BEETLE

Photos Chris DiFonzo

CLB larvae feed by scraping the leaf surface. Feeding gives leaves a white appearance. Typical CLB feeding in Michigan is light and involves a few plants or a small hot spot in a field.

- Threshold early in season: is 3 or more eggs and/or larvae per plant.
- Threshold on larger plants: 1 or more larvae per flag leaf.

Avoid unnecessary insecticide applications to small grains for CLB, aphids, and other insects because broad-spectrum insecticides kill the parasitoids that are responsible for most of the control of CLB in Michigan.

Type of damage: Usually begins on field borders of winter grain, then goes to the preferred spring grain. Defoliation by chewing between leaf veins. Larvae feed on the surface of leaves, while adults feed on the whole leaf. This damage gives a “frosted” appearance to a severely infested field.
Scouting: Begin when temperatures reach 60 degrees. Check 20 stems in five areas of the field.
Management: Cultural- Hairy varieties are less likely to be infested. Biological- wasp parasitoids, lady beetles and various other natural enemies.

SMALL GRAIN INSECTS –GRASS SAWFLY

Photos Chris DiFonzo

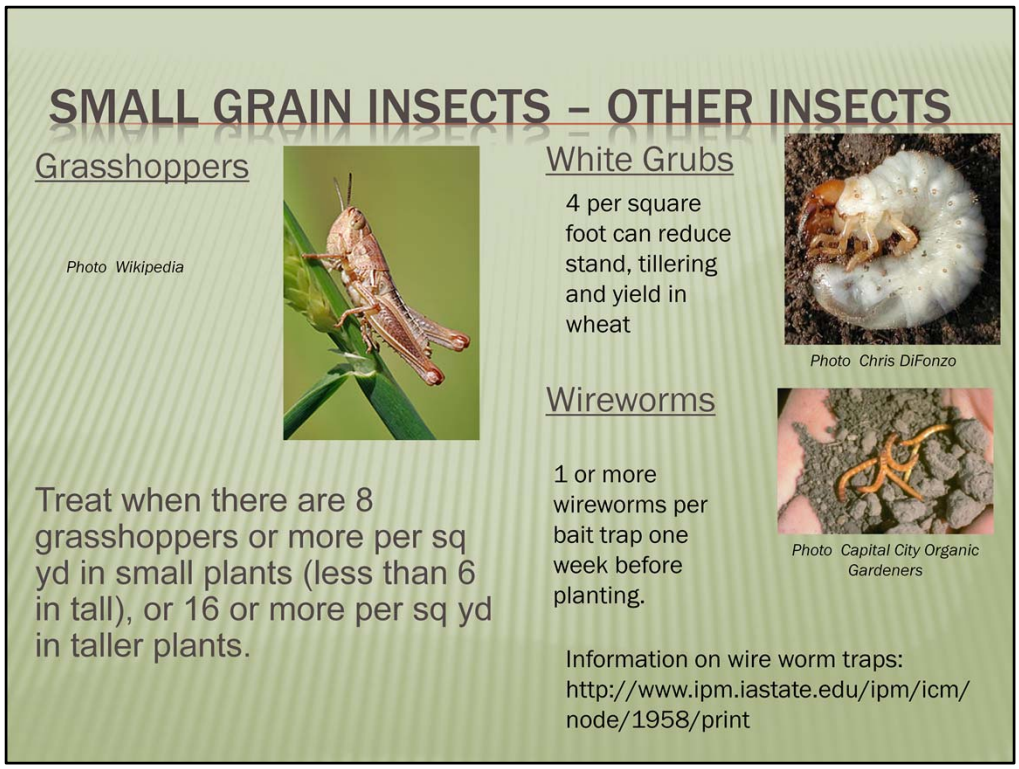
Outbreaks usually occur after an abnormally warm spring creates ideal egg-laying conditions.

reduced and no-till acres in ag production may favor its survival

- Simple threshold: Apply the at-heading threshold for armyworm (2 per square foot) to mixed populations of armyworm and sawfly.
- More exact threshold: Larvae are smaller than ¾ inch AND number more than 0.4 per linear ft of row or 0.7 per square ft

It is important to catch sawflies early before they clip heads. Scout wheat in early May by shaking stems so larvae drop, then examine the ground for both armyworms and sawflies. If larvae are present, then do a more thorough examination of the field to determine # of larvae per square foot. Use one of the guidelines above to make a spray decision.

Grass sawflies can occur at the same time, and in the same fields, as true armyworm, but the two pests differ in color, number of prolegs (true armyworm = 5 pairs, *Pachynematus*= 8 pairs), and activity time. Armyworms are most active at night and on cloudy days, while sawflies feed during the day.Sawfly larvae feed on leaves of small grains, but more importantly they clip heads. In Michigan in 2010, an increase in head-clipped wheat was attributed to sawflies. Even in mixed populations of armyworm and sawfly, sawflies appeared to be responsible for most of the clipping. One sawfly larva may clip 10 to12 heads before it matures and drops to the ground.



Grasshoppers:
Type of damage: Defoliation (chewing) by nymphs and adults.
Conditions favoring damage: Unplowed or fallow areas next to fields are preferred egg-laying sites, and may contribute to populations in a nearby field. Dry, warm weather often enhances survival of nymphs.
Management: Cultural- plowing and cultivation to destroy eggs. Biological – a fungal pathogen can kill many eggs and nymphs under wet spring conditions. Natural enemies include birds, rodents, amphibians, parasitic wasps, and ground beetles.

White grubs:
White grubs, particularly European chafer, are a localized problem, often depending on soil type.
White grubs build up in undisturbed soil and are damaging to crops planted in fields broken from sod. European chafer, an introduced grub species, has a history of infesting winter wheat planted after soybean. MSU field trials suggest that a grub density of 4 per square foot reduces stand, tillering, and yield of winter wheat. No insecticides are labeled for white grub control in small grains. Fall and spring plowing of old pasture or other established grasses with a season of clean fallow before a crop is planted is recommended.

Wireworms:
Type of damage: Feeds on germinating seed.
Sampling/ scouting: Scout for wireworms with a bait trap

(http://www.ipm.iastate.edu/ipm/icm/node/1958/print) at least one week before planting.
Management: Cultural – spring and fall plowing of established sod is recommended before crop planted, where practical.

Foliar diseases like powdery mildew and rusts should be noted at all growth stages, but are most damaging to wheat yield and quality when the flag leaf is affected.

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WHEAT DISEASES

Septoria tritici blotch

This fungal disease causes tan, elongated lesions on wheat leaves. Lesions may have a yellow margin, but the degree of yellowing varies among varieties. The dark, reproductive structures produced by the fungus are key diagnostic features and can often be seen without magnification. This disease is also known as speckled leaf blotch.

Management: Genetic resistance, foliar fungicides, crop rotation.

Source: "Wheat Disease Identification", USDA-NIFA Extension Integrated Pest Management Program, 2011

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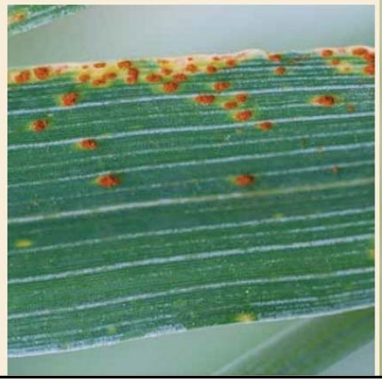
WHEAT DISEASES

Leaf rust

Small, orangish-brown lesions are key features of leaf rust infections. These blister-like lesions are most common on leaves but can occur on the leaf sheath, which extends from the base of the leaf blade to the stem node. Lesions caused by leaf rust are normally smaller, more round, and cause less tearing of the leaf tissue than those caused by stem rust.

Management: Genetic resistance, foliar fungicides.



Source: "Wheat Disease Identification", USDA-NIFA Extension Integrated Pest Management Program, 2011

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Stem rust

Stem rust causes blister-like lesions on leaves, leaf sheaths, and stems. Infection of glumes and awns is also possible. The reddish-brown spores of the fungus cause considerable tearing as they burst through the outer layers of the plant tissues. Mature stem rust lesions are more elongated than those of leaf rust.

Management: Genetic resistance, foliar fungicides.

WHEAT DISEASES

Source: "Wheat Disease Identification", USDA-NIFA Extension Integrated Pest Management Program, 2011

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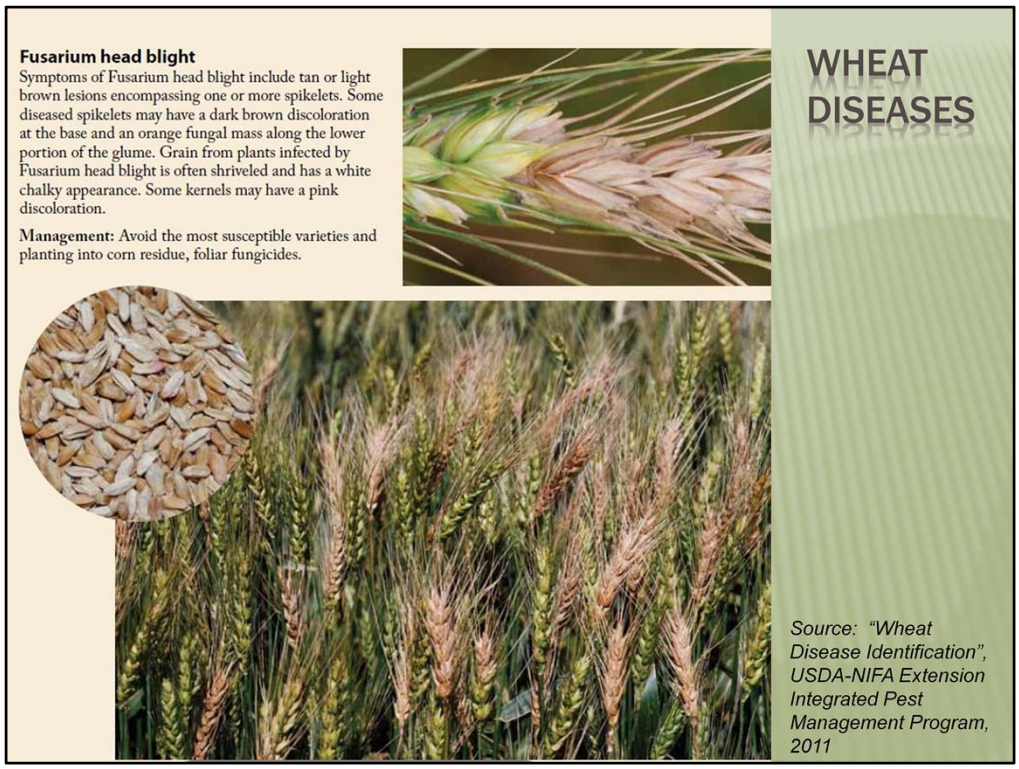
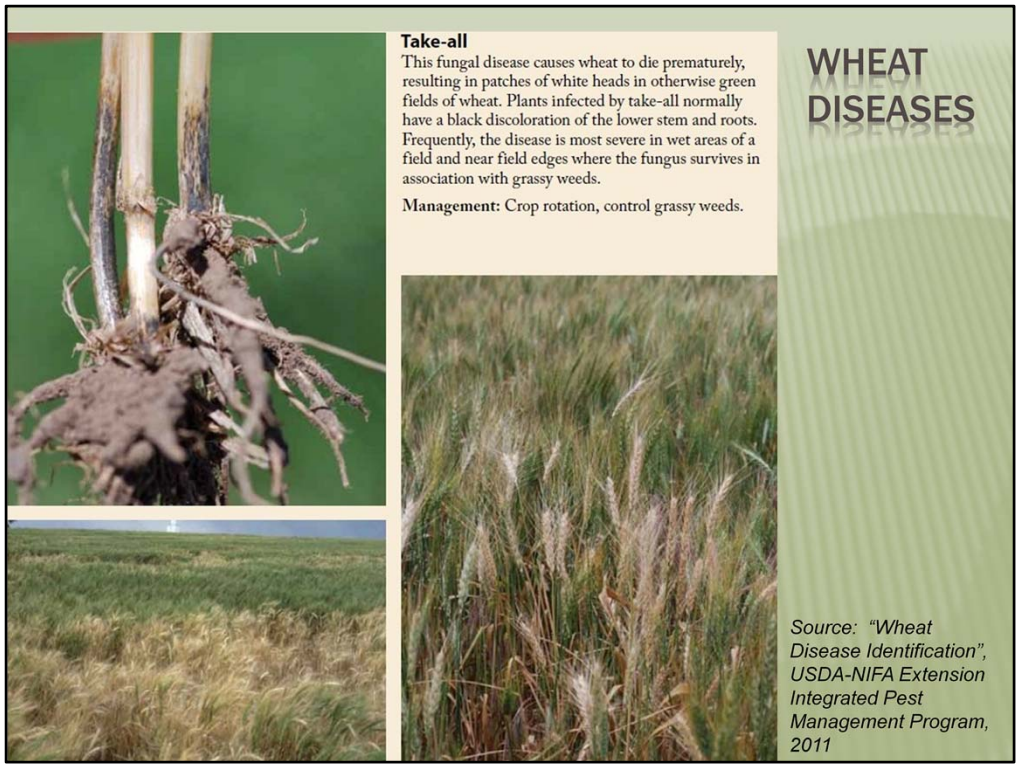


Fusarium head blight impact both yield and quality. The grain infected contains DON, or vomitoxin, and can be docked or rejected when tested at point of sale.

BYDV is also referred to as 'red leaf' in oats.



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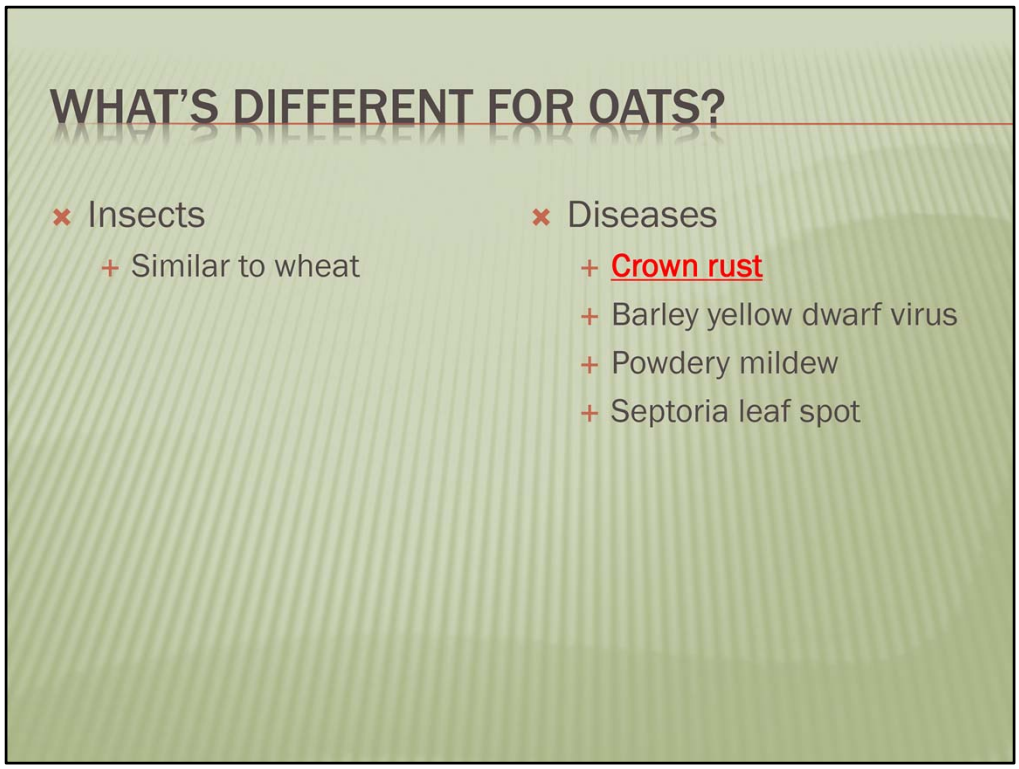
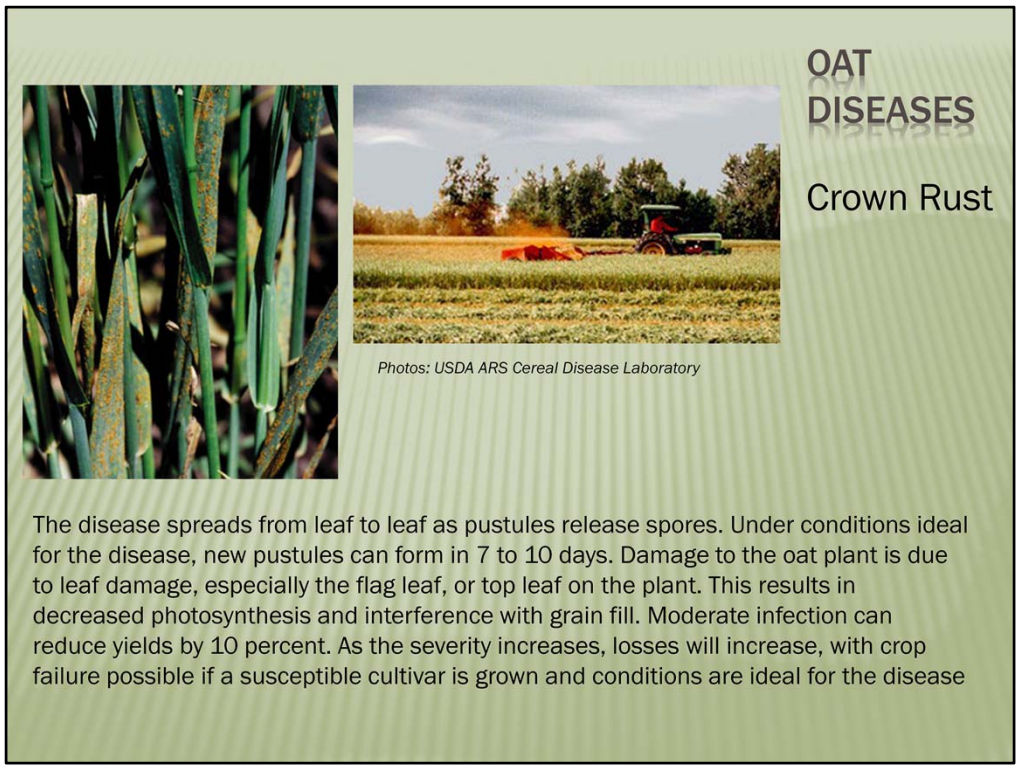
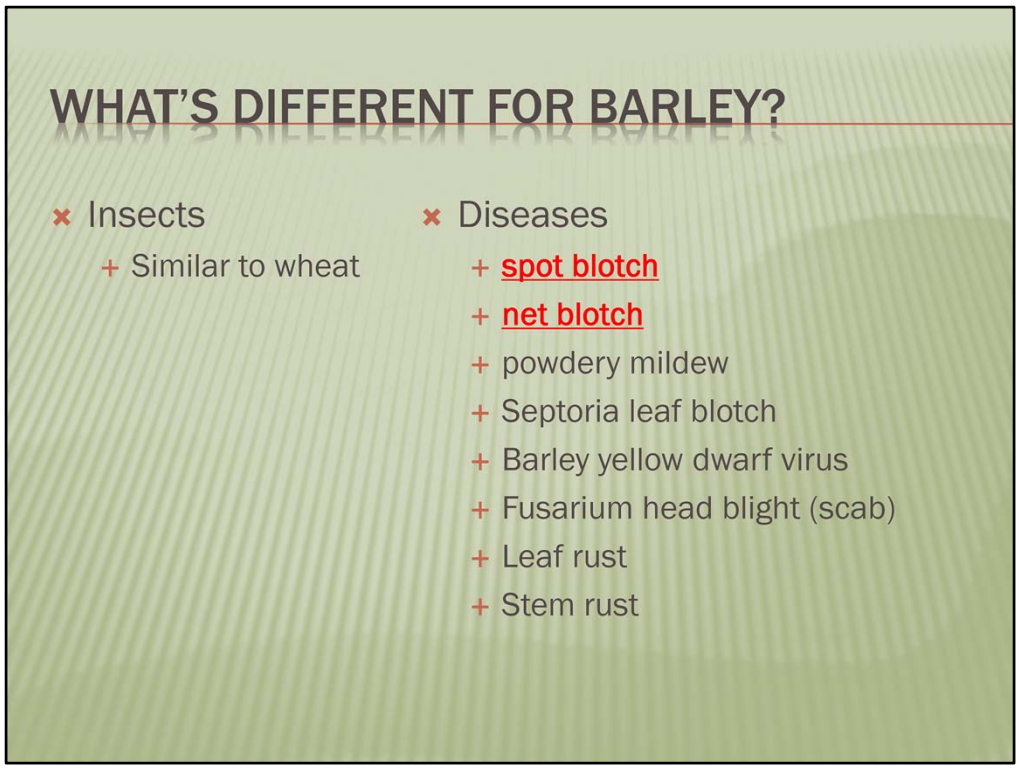


Self-explanatory



Crown rust is the primary disease problem in Michigan oats.



Barley is susceptible to most wheat disease problems. Net blotch is specific to barley. Wheat and other cereal crops are affected by spot blotch, but to a lesser extent.

BARLEY DISEASES

Symptoms of Spot Blotch on barley

Spot Blotch

Symptoms

Elongated brown spots, 2 to 10mm in length appear on the leaves and stems. Brown areas are surrounded by yellow tissue.

Caused by: *Bipolaris sorokiniana*

Control measures:

- Resistant varieties
- Reduction of continuous barley
- Reducing infected stubble
- Use of fungicides

Source: North Dakota State University Dept of Plant Pathology "Barley Project"

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BARLEY DISEASES

Symptoms of Net Blotch on barley

Net Blotch

Symptoms

Light brown spots with distinctive, dark brown net-like patterns appear on the leaves. As they enlarge they join to form dark-brown stripes in a 'net' formation that distinguishes it from spot blotch.

Caused by: *Pyrenophora teres*

Control measures:

- Resistant varieties
- Reduction of weed hosts
- Reduction of continuous barley
- Reducing infected stubble
- Use of fungicides

Source: North Dakota State University Dept of Plant Pathology "Barley Project"

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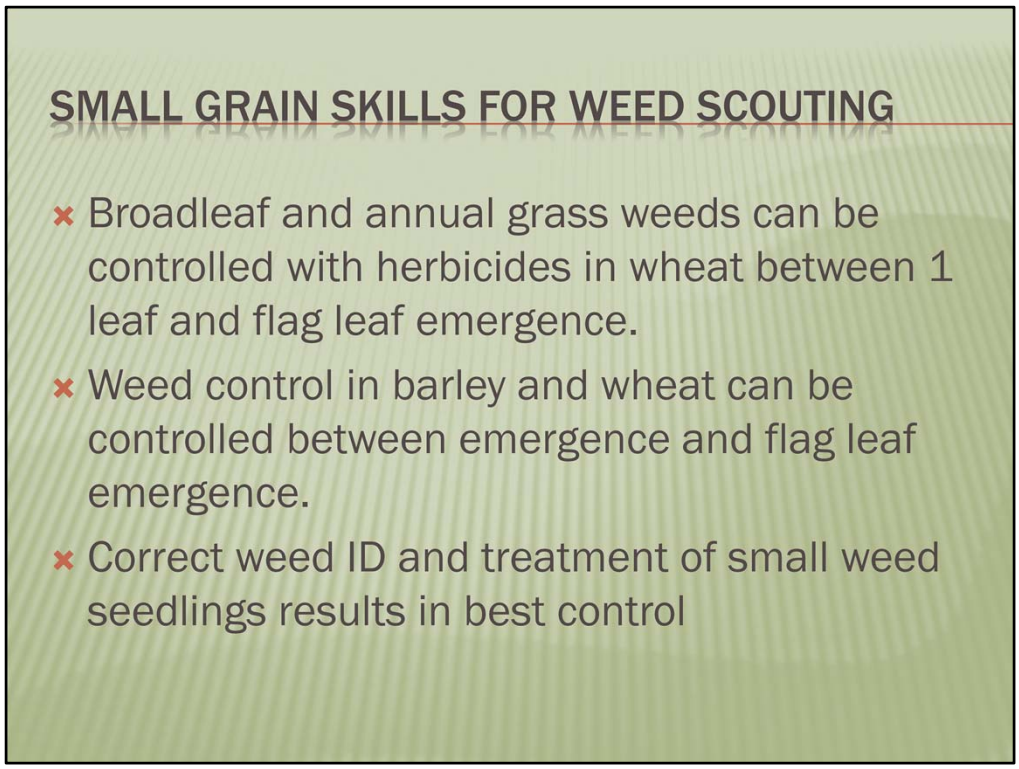
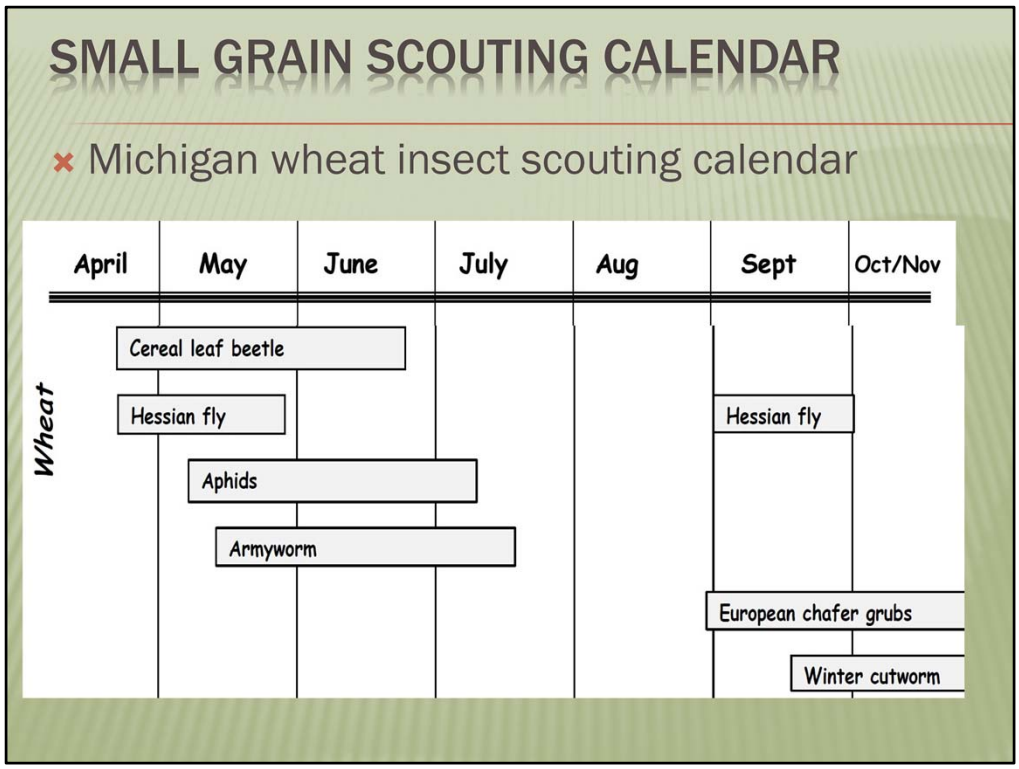


Weed scouting is included in a different segment of the program. Management details can be found in the MSU Weed Control Guide for Field Crops.



This chart gives a good idea about the times to be alert for particular insect problems. Times will vary between southern and northern parts of the state.

SMALL GRAIN SCOUTING CALENDAR

- Sample insect scouting calendars

Purdue

Timing Stage	Growth Stage (Zadoks)	Agronomic	Scouting Activities Weeds	Insects	Diseases
2-Leaf Stage	12	Stand Count	Scout for Weeds	--	--
4-5 Leaf Stage	14-15	Est. yield (If jointing has started)	Scout for weeds	Scout aphids & Grass-hoppers	Scout for leaf diseases (powdery mildew)
Flag Leaf Emergence	37	--	--	Scout for aphids & other insects (army worms)	Scout for leaf diseases
Anthesis	60	Estimate Yield	--	Scout for OWBM	Evaluate need for FHB treatment
Physio-logical Maturity	90	--	Evaluate for pre-harvst herbicide	--	--

University of Minnesota

Note:
OWBM = Orange wheat blossom midge, a problem in N. Dakota – not currently an issue in Michigan

The Minnesota small grain scouting calendar combines growth stage, agronomic scouting tasks, weed/insect/disease scouting tasks.

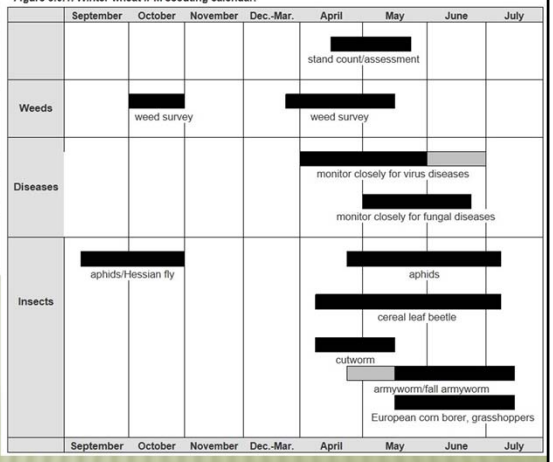
NEW YORK SMALL GRAIN SCOUTING CALENDAR

Table 5.6.1. Winter wheat pests and crop monitoring activities.

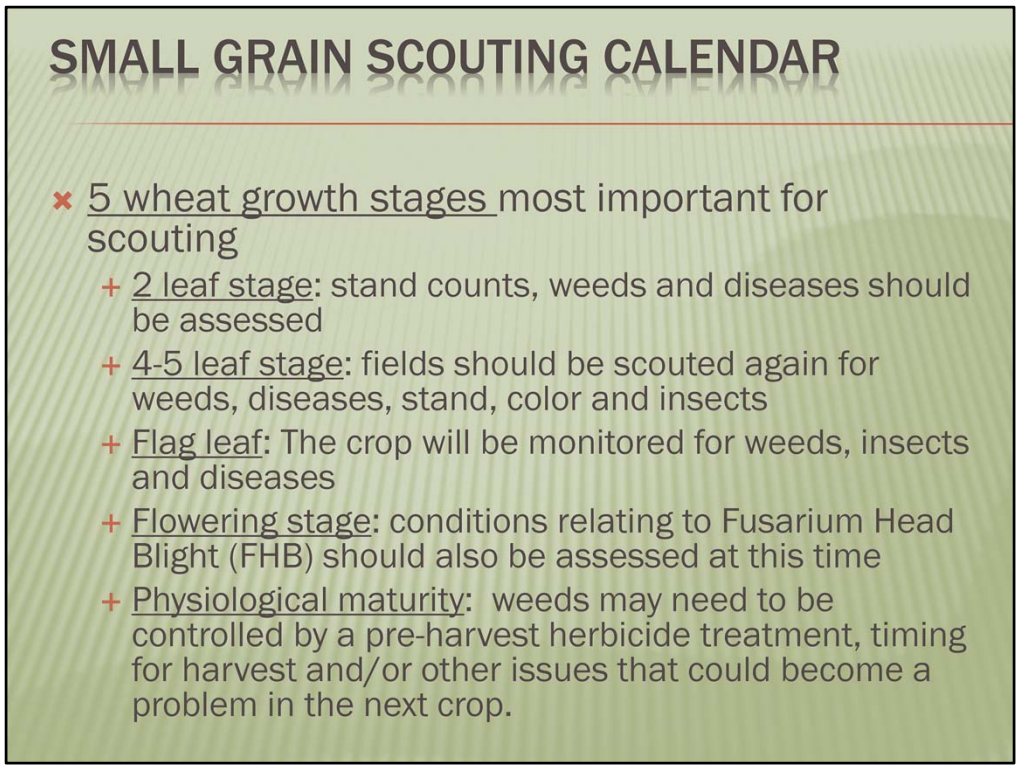
Routine	Occasional
Planting to Freeze Dormancy	
Weed survey, stand count, establishment problems, seed diseases/damping off (Pythium, Phytophthora, Rhizoctonia), aphids, Hessian fly, watch for "occasional" pests/problems	Planter problems, poor seed germination, poor soil conditions, vertebrate damage (birds, rodents), herbicide injury, cereal leaf beetle
Early Spring (break dormancy to tillering)	
Stand count, overwintering problems, weed survey, virus diseases (soil borne viruses, wheat spindle steak mosaic, yellow dwarf), eyespot, powdery mildew, white grub, wireworm, aphids, cutworms, armyworm, cereal leaf beetles, vertebrate damage (geese), watch for "occasional" pests/problems	Snow mold, herbicide injury, hail, frost/freeze, drought
Stem extension (jointing to boot stage)	
Leaf spots (Septoria nodorum blotch, tan spot, powdery mildew, leaf rust), cereal leaf beetles, watch for "occasional" pests/problems	Herbicide injury, hail, frost/freeze, drought, armyworm, aphids, cutworms, fall armyworm, grasshoppers
Flowering to Grain Ripening	
Root and crown rots, cutworms, armyworm, Fusarium head blight / scab, viruses, bunt, smut, leaf spots (powdery mildew, Stagonosporanodorum blotch, Tan spot, leaf rust), cereal leaf beetles, watch for "occasional" pests/problems	Wind, excessive nitrogen, lodging, nutrient deficiency, stripe rust, armyworm, stalk borer, European corn borer, fall armyworm, wheat stem sawfly, grasshoppers, white grub, wireworm, flea beetles

Source: Crop and Pest Management Guidelines, Cornell Cooperative Extension

Figure 5.6.1. Winter wheat IPM scouting calendar.



Sample small grain scouting from Cornell University, New York



Basing scouting activities on growth stage makes sense and can be applied in any location. These are the 5 growth stages most important for scouting.

THANK YOU

Additional photo credits:

- Purdue University
- North Dakota State University
- Manitoba Ministry of Agriculture
- Oregon State University
- University of Minnesota Extension