

Fusarium Head Blight Forum IBC / UI

Agenda:

- 1) Kelly Olson
- 2) Juliet Marshall
- 3) John Stevenson
- 4) Mike Davis
- 5) Ruth Dill-Macky
- 6) Kevin Smith



Fusarium Head Blight Forum, Jan 9, 2014 - Idaho Falls, ID IBC / UI

Objectives:

- 1) Education of field consultants from barley industry**
- 2) Focus attention on risk reduction
- 3) Learn from researchers in Mid-West
- 4) Anticipate likely future scenarios
- 5) Coordinate strategies

On the Ground FHB Observations and Trends in Western U.S. Malting Barley Production

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Fusarium Head Blight in Idaho



History and Background

- Disease first described in the U.S. in 1884
- Epidemics have occurred in Canada, the midwest and mid-Atlantic states since the 1917 on wheat and barley
- Disease occurs wherever wheat and barley are grown, causing significant yield losses
- Toxins associated with grain infection, and gushing in production of beer

History

- FHB of wheat and barley resulted in greater than \$3 billion losses in US and Canada in the 1990's
- Reduction of barley acreage and malt facilities in the midwest largely due to FHB affected barley
- Shift of barley production and malt facilities to more arid regions

History and Background

- The Midwest is usually the most affected area in the US
- Optimal development of disease between 65 to 85°F with greater than 80% RH
- Crops are most susceptible to infection at anthesis

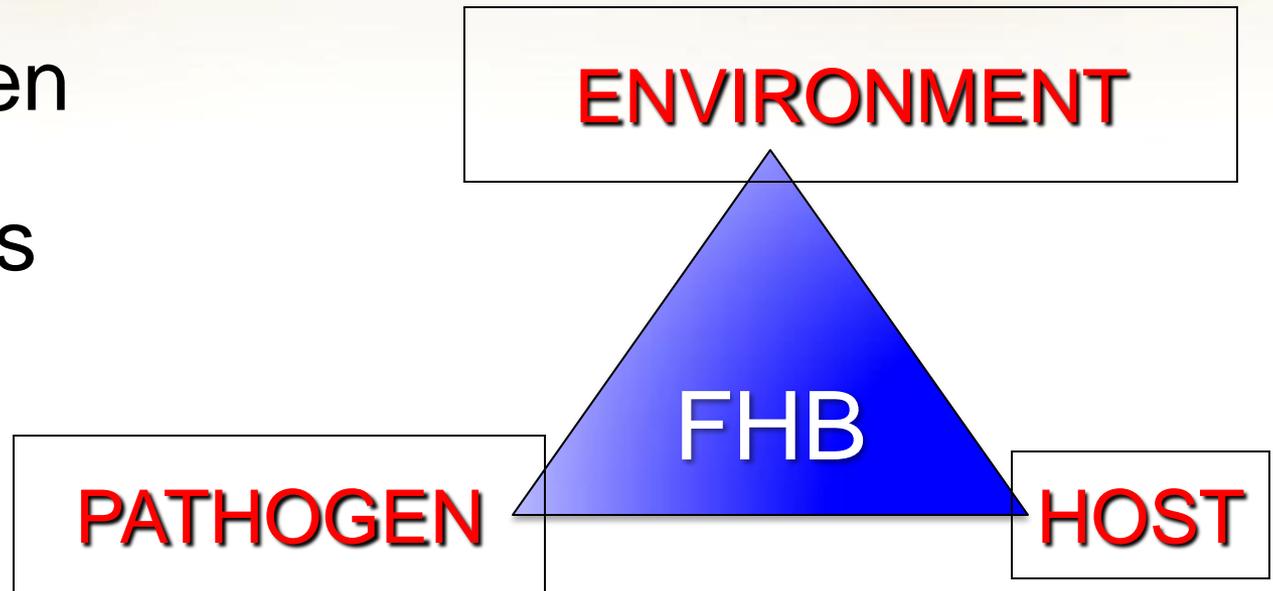


Fusarium Head Blight (FHB) or Scab

- ❖ *Tricothecene toxins produced in wheat and barley: DON and 3-ADON, 15-ADON and NIV chemotypes (nivalenol and derivatives)*
- ❖ Causes vomiting and feed refusal at 10 ppm
- ❖ Reduces feed intake and lower weight gain at levels as low as 1-3 ppm
- ❖ FDA recommendations – less than 1 ppm in human food

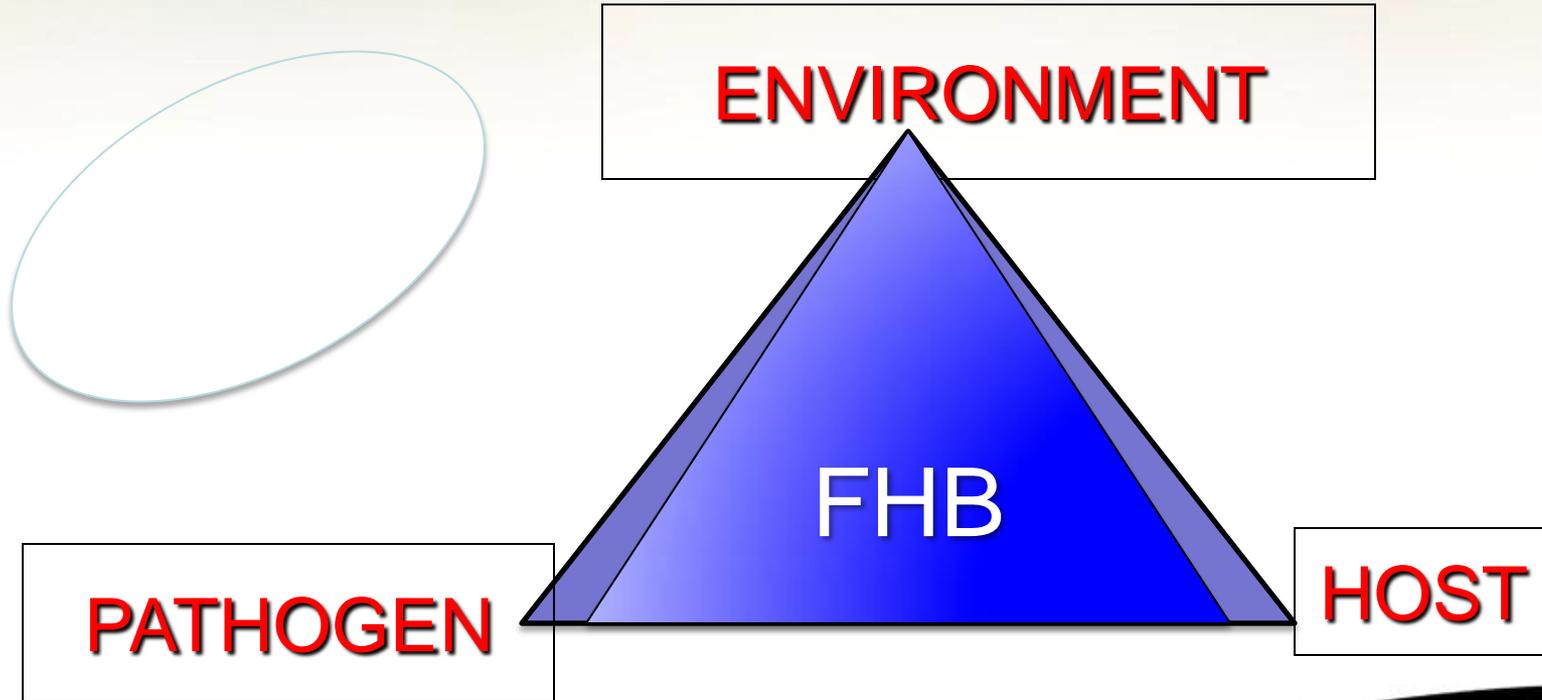
Factors Influencing FHB Infection

- Environment / Climate
- Pathogen
- Varieties



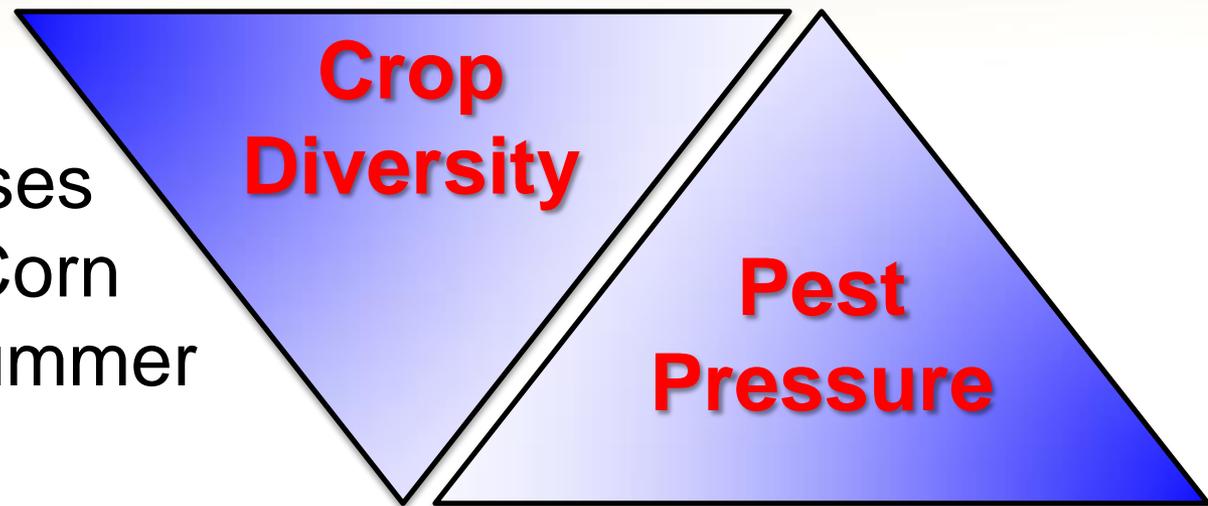
Environment - Crop Rotations

The longer the rotation between types of crops the greater the breakdown of residues and disease organisms



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The longer the rotation between types of crops the greater the breakdown of residues and disease organisms



Broadleaf vs. Grasses
Wheat vs. Barley, Corn
Winter crops vs. Summer
Variety vs. Variety
Fungicide vs. Fungicide?

Environment - Southern Idaho

- Hot, Dry Summers well above 80°F
- May often has the highest levels of precipitation, and dry June, July
- 1982, '84, 2009, 2010, 2011, '12, '13
 - Cool summers, generally less than 80°F
 - Above average rainfall in May, June
 - Increased humidity esp. under irrigation

The Pathogen - (FHB) or Scab

- ❖ Caused by various *Fusarium* species, but most commonly caused by *Fusarium graminearum*

F. graminearum

F. poae

F. culmorum

F. equiseti

F. avenaceum

F. sporotrichoides

F. acuminatum

F. tricinctum

Produce various tricothecene and fumonisin type toxins

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FHB Causal Organisms

- Replacement of *F. culmorum* with *F. graminearum* in upper elevation areas following introduction of corn production
- *F. graminearum* more aggressive



Symptoms and Signs of FHB

F. culmorum

Signs and Symptoms of *Fusarium graminearum*



F. graminearum

12 subgroups

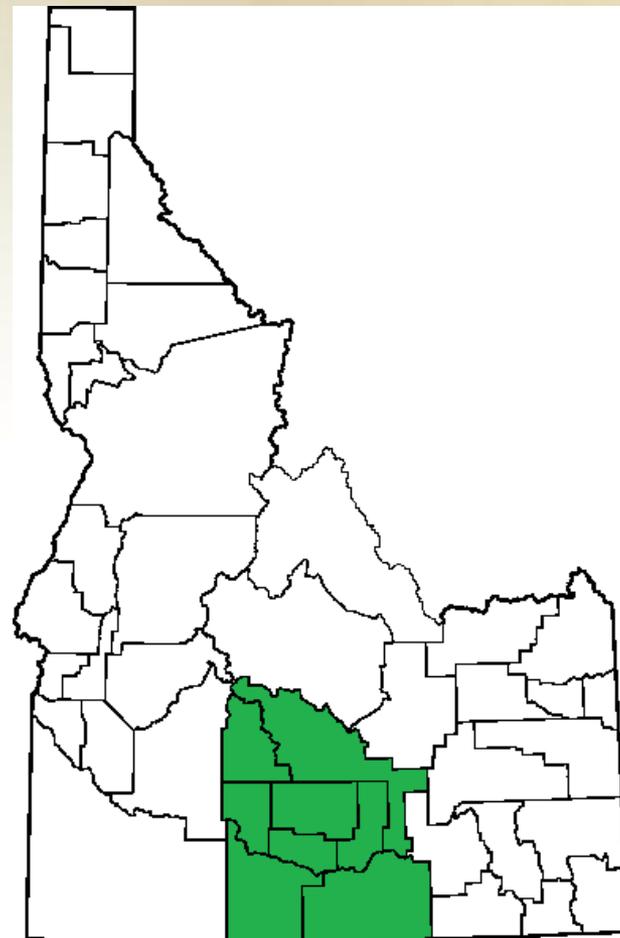
- Sexual and asexual stages
- Perithecia
Gibberella zeae
- Airborne/splashed ascospores
- Conidial spores
- Produces DON, nivalenol

F. culmorum

- Asexual stage
- Chlamydospores
- Rain-splashed conidia
- Produces DON, nivalenol
- Endemic in Idaho

FHB Development in Idaho

- First reported in 1982 and 1984
- Magic Valley
- Infection due to *F. culmorum* primarily
 - *F. graminearum* was one of several secondary contributors

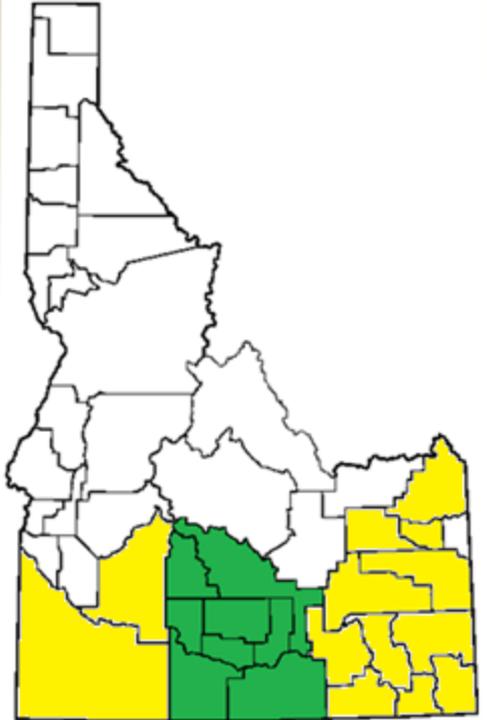
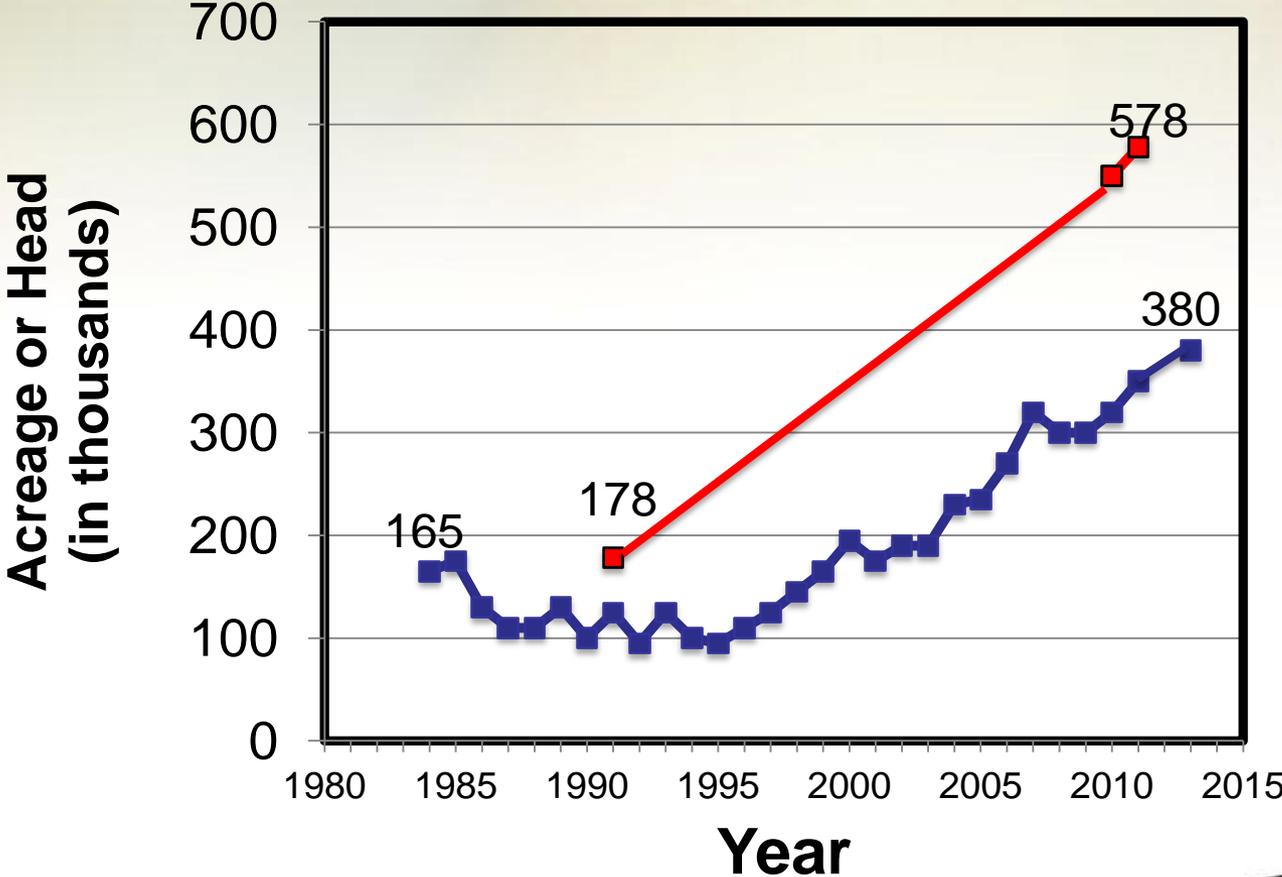


Then and Now in the Magic Valley

	Total	<i>Fusarium graminearum</i>	<i>Fusarium culmorum</i>	<i>Fusarium spp.</i>
1989	298	2%	76%	22%

Crop Rotation – Corn in Southern Idaho

Corn Acreage Planted and Head of Dairy Cattle



Then and Now in the Magic Valley

	Total	<i>Fusarium graminearum</i>	<i>Fusarium culmorum</i>	<i>Fusarium</i> spp.
1989	298	2%	76%	22%
2011	306	76%	7%	17%

- Direct shift in species dominance
- Same area where corn and cow production have dominated

Host – Cereal Varieties

- ❖ *Moderate levels of resistance exists in a few varieties*
- ❖ Plant varieties with different flowering dates to lessen the likelihood that all the crop is flowering simultaneously

Wheat

Volt HRS

UI Stone

Barley

Quest

Celebration

FHB - Varieties

No true “resistance” in wheat or barley

Have degrees of susceptibility

Spring wheat more vulnerable than winter

barley < soft wheat < hard wheat < durum

Volt – hrs (protein)

UI Stone – sws

Quest - 6 row barley

Celebration – 6 row barley

Evaluating Field Resistance: Disease Severity (%) in Fargo, ND

Trt#	ID	Rep avg%	Trt#	ID	Rep avg%
260	Copeland	7.1	255	Tetonia	19.7
275	Quest	10.3	252	Champion	20.6
258	ABI Voyager	11.2	261	Harrington	22.0
278	ND20493	11.7	251	CDC Fibar	22.4
266	Odyssey	12.1	265	Moravian 69	22.9
257	Xena	12.1	284	ND18172	24.3
259	Conrad	13.0	253	RWA 1758	25.1
264	Metcalfe	13.0	267	Overture	27.3
269	Conlon	13.7	287	MNBrite	30.1
263	Merit 57	15.3	272	Robust	39.0
262	Hockett	15.7	250	Herald	39.7
254	Spaulding	16.6	281	Stander	43.8
256	Transit	17.9	249	Goldeneye	50.2

5 individual heads were rated on a scale 0-5

0- no disease - 5 most disease

0 = 0% 3= 30%

1=3% 4=50%

2= 10% 5=75%

DON levels to be tested
By Brueggeman's lab



Symptoms and Signs of FHB

Fusarium Head Blight or Scab of Barley



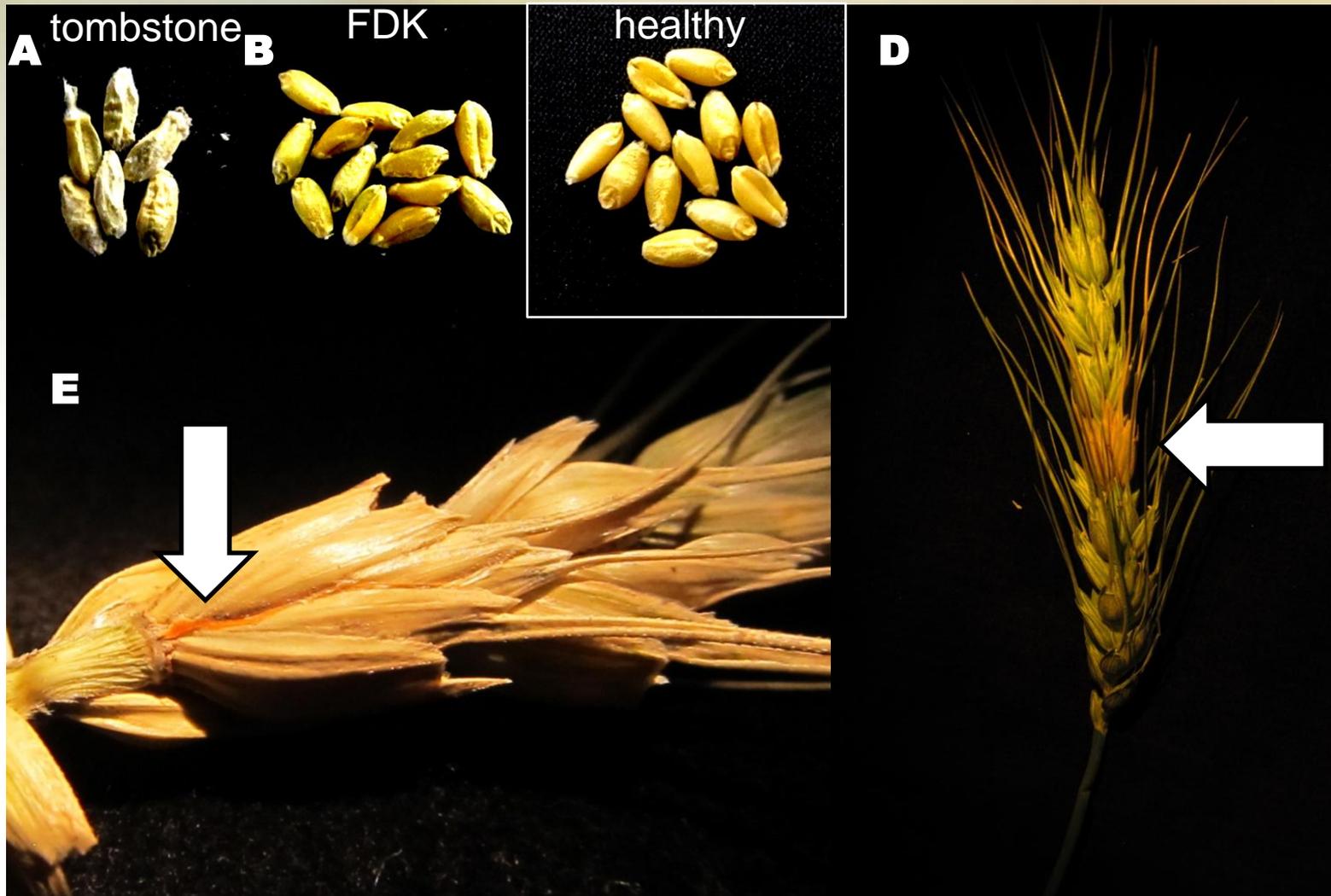
b: Hulless - sound
c: Hulless - light symptoms
d: Hulless - moderate symptoms
e: Hulless - severe symptoms
f: Sound
g: Black perithecia
h: Orange sporodochia



Dr. Jianli Chen

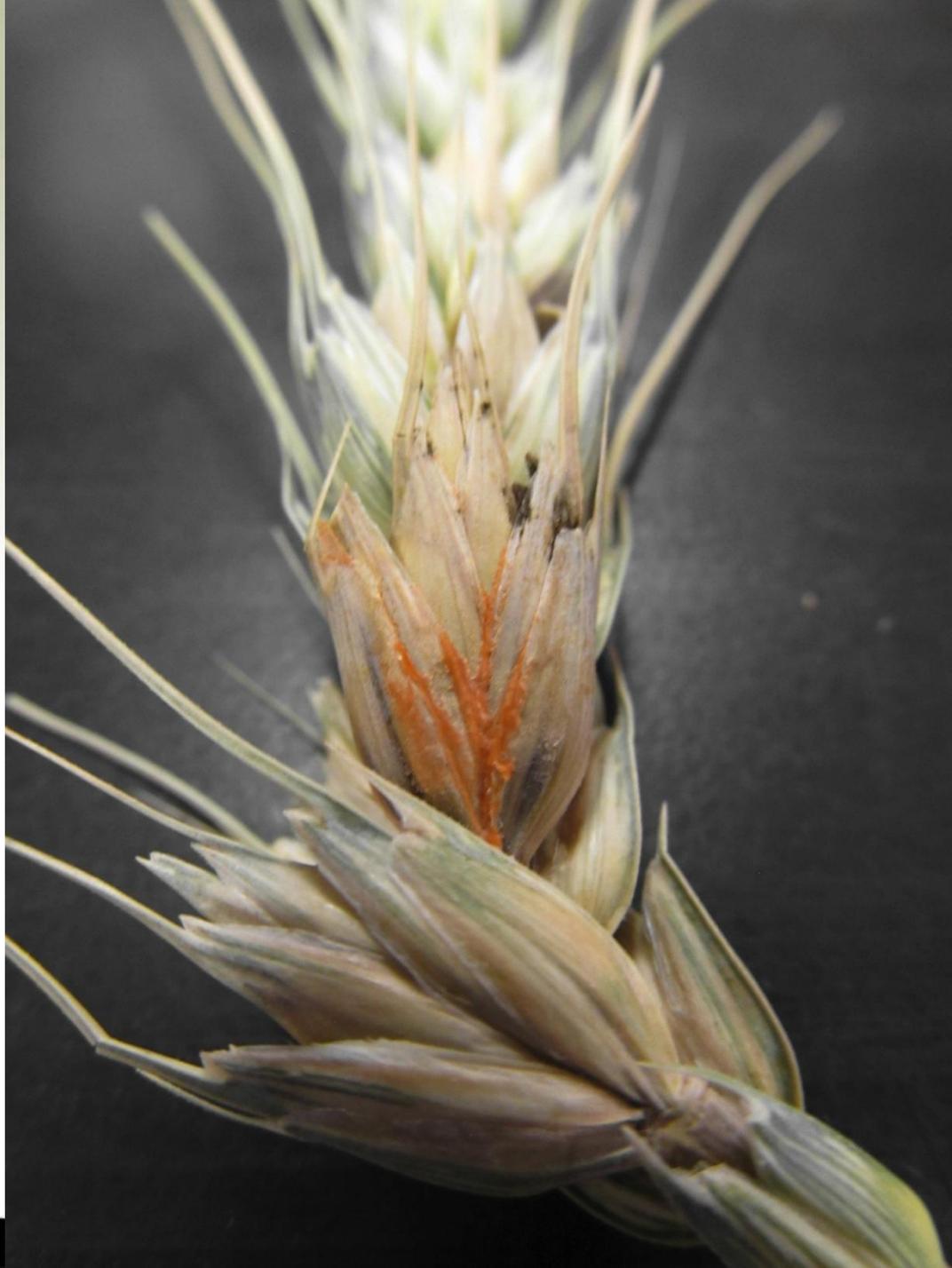
University of Idaho
College of Agricultural and Life Sciences

Symptoms and Signs of FHB



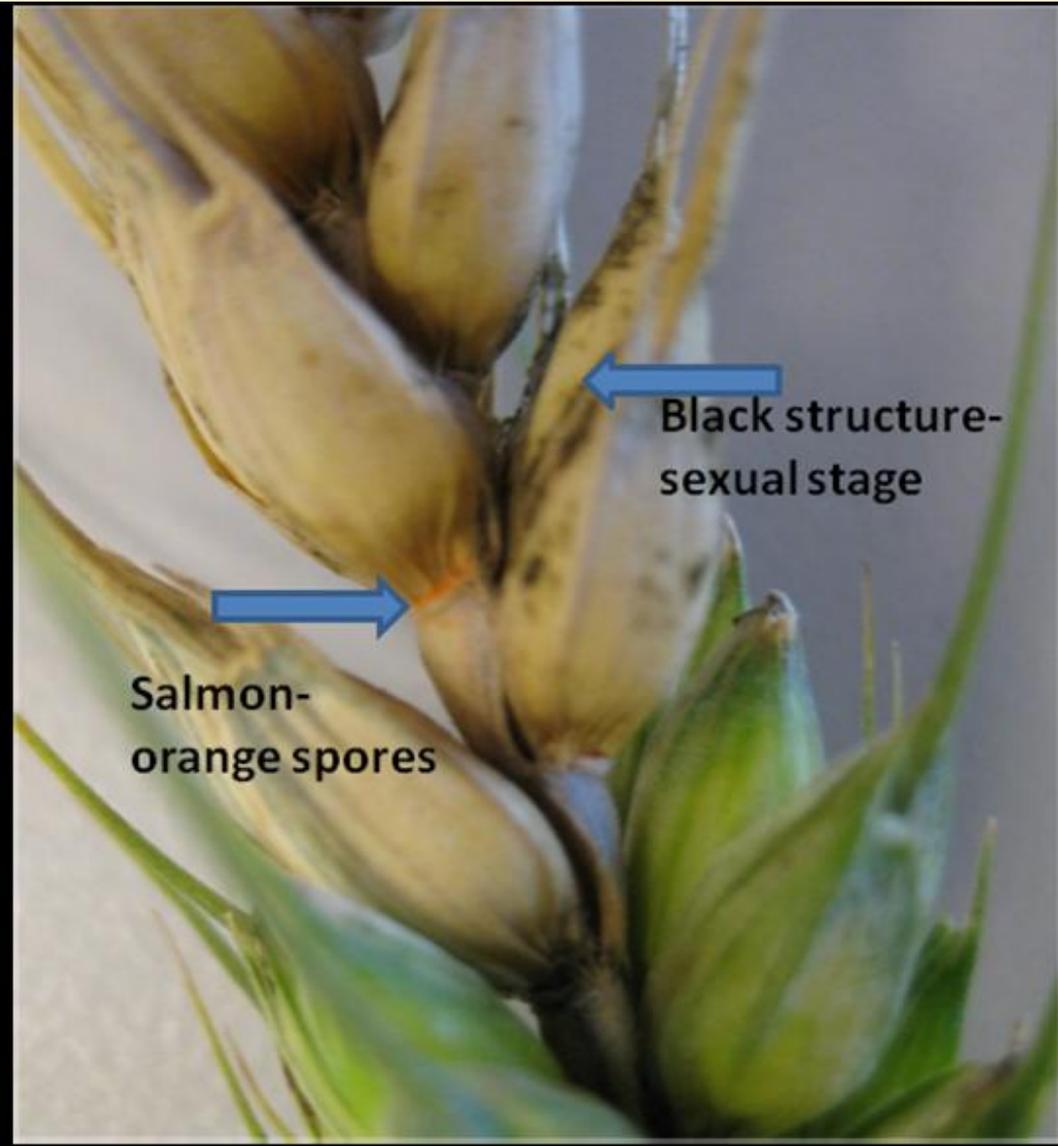






Fusarium Head Blight (FHB) or Scab

Fusarium graminearum



What's Happening in Idaho?

- ❖ Fungus reproduces in **crop** residues and is moved by rain, irrigation or wind to developing wheat or barley
- ❖ Temperatures warm, not hot at flowering of spring cereals
- ❖ Humidity high, and favorable for FHB development under irrigation
- ❖ Susceptible varieties grown
- ❖ Corn grown prior to small grains

What's Happening in Idaho?

- ❖ FHB not an issue under dryland systems

❖ “In the past 5 years we have went from isolated (wheat) samples testing positive, to this year where 98 out of 135 samples in our on-farm sampling program tested positive for traceable amounts of Vom. Overall the crop is within allowable limits but for how long?” - Anon

- ❖ Klasic hard white spring wheat (2013) had 7 PPM DON in a field with no history of corn in the rotation after treatment with Prosaro

What's Happening in Idaho?

- ❖ Reported barley green chop (M69) for dairy cattle too high to feed (2013 in Buhl area)
- ❖ REPORTS of barley being rejected from Idaho production (2013)
- ❖ One barley sample confirmed (PCR) with *F.g.* (2012)
- ❖ Other comments?

Last six years in Idaho – 2007 - 2012

- ❖ Samples tested every year by Dr. Yanhong Dong, St. Paul, Minnesota
- ❖ Spring wheat samples tested positive only for DON in Rupert, Idaho Falls, Aberdeen
- ❖ Winter samples had even lower incidence of DON
- ❖ **NOT ONE SAMPLE TESTED over 0.5 PPM**

2007 Barley DON

no.	ID = Idaho	Location	Spring Barley	Class	DON	3 ADON	15 ADON	NIV
21	IDRupMill	Rupert	Millenium	SB6	nd	nd	nd	nd
22	IDRupStep	Rupert	Steptoe	SB6	0.26	nd	nd	nd
23	IDRupHarr	Rupert	Harrington	SB2	0.11	nd	nd	nd
24	IDRupBar	Rupert	Baronesse	SB2	nd	nd	nd	nd
25	IDAAbdMill	Aberdeen	Millenium	SB6	nd	nd	nd	nd
26	IDAAbdStep	Aberdeen	Steptoe	SB6	nd	nd	nd	nd
27	IDAAbdHarr	Aberdeen	Harrington	SB2	nd	nd	nd	nd
28	IDAAbdBar	Aberdeen	Baronesse	SB2	nd	nd	nd	nd
29	IDIFMill	Idaho Falls	Millenium	SB6	nd	nd	nd	nd
30	IDIFStep	Idaho Falls	Steptoe	SB6	nd	nd	nd	nd
31	IDIFHarr	Idaho Falls	Harrington	SB2	nd	nd	nd	nd
32	IDIFBar	Idaho Falls	Baronesse	SB2	nd	nd	nd	nd
37	IDAshMill	Ashton	Millenium	SB6	nd	nd	nd	nd
38	IDAshStep	Ashton	Steptoe	SB6	nd	nd	nd	nd
39	IDAshHarr	Ashton	Harrington	SB2	nd	nd	nd	nd
40	IDAshBar	Ashton	Baronesse	SB2	nd	nd	nd	nd

2008 Barley DON

no.	ID = Idaho	Location	Spring Barley	Class	DON	3 ADON	15 ADON	NIV
21	IDRupMill	Rupert	Millenium	SB6	nd	nd	nd	nd
22	IDRupStep	Rupert	Steptoe	SB6	0.11	nd	nd	nd
23	IDRupHarr	Rupert	Harrington	SB2	nd	nd	nd	nd
24	IDRupBar	Rupert	Baronesse	SB2	nd	nd	nd	nd
25	IDAAbdMill	Aberdeen	Millenium	SB6	nd	nd	nd	nd
26	IDAAbdStep	Aberdeen	Steptoe	SB6	nd	nd	nd	nd
27	IDAAbdHarr	Aberdeen	Harrington	SB2	nd	nd	nd	nd
28	IDAAbdBar	Aberdeen	Baronesse	SB2	nd	nd	nd	nd
29	IDIFMill	Idaho Falls	Millenium	SB6	nd	nd	nd	nd
30	IDIFStep	Idaho Falls	Steptoe	SB6	nd	nd	nd	nd
31	IDIFHarr	Idaho Falls	Harrington	SB2	nd	nd	nd	nd
32	IDIFBar	Idaho Falls	Baronesse	SB2	nd	nd	nd	nd
37	IDAshMill	Ashton	Millenium	SB6	nd	nd	nd	nd
38	IDAshStep	Ashton	Steptoe	SB6	nd	nd	nd	nd
39	IDAshHarr	Ashton	Harrington	SB2	nd	nd	nd	nd
40	IDAshBar	Ashton	Baronesse	SB2	nd	nd	nd	nd

2009 Barley DON

no.	ID = Idaho	Location	Spring	Class	DON	3 ADON	15		
							ADON	NIV	ZEA
21	IDRupMill	Rupert	Millenium	SB6	0.19	nd	nd	nd	nd
22	IDRupStep	Rupert	Steptoe	SB6	0.06	nd	nd	nd	nd
23	IDRupHarr	Rupert	Harrington	SB2	nd	nd	nd	nd	nd
24	IDRupBar	Rupert	Baronesse	SB2	nd	nd	nd	nd	nd
25	IDAAbdMill	Aberdeen	Millenium	SB6	nd	nd	nd	nd	nd
26	IDAAbdStep	Aberdeen	Steptoe	SB6	0.12	nd	nd	nd	nd
27	IDAAbdHarr	Aberdeen	Harrington	SB2	nd	nd	nd	nd	nd
28	IDAAbdBar	Aberdeen	Baronesse	SB2	nd	nd	nd	nd	nd
29	IDIFMill	Idaho Falls	Millenium	SB6	nd	nd	nd	nd	nd
30	IDIFStep	Idaho Falls	Steptoe	SB6	nd	nd	nd	nd	nd
31	IDIFHarr	Idaho Falls	Harrington	SB2	nd	nd	nd	nd	nd
32	IDIFBar	Idaho Falls	Baronesse	SB2	nd	nd	nd	nd	nd
37	IDAshMill	Ashton	Millenium	SB6	nd	nd	nd	nd	nd
38	IDAshStep	Ashton	Steptoe	SB6	nd	nd	nd	nd	nd
39	IDAshHarr	Ashton	Harrington	SB2	nd	nd	nd	nd	nd
40	IDAshBar	Ashton	Baronesse	SB2	nd	nd	nd	nd	nd
			Winter						
53	IDRupCha	Rupert	Charles	WBA	0.09	nd	nd	nd	nd

2010 Barley DON

no.	ID = Idaho	Location	Spring Barley	Class	DON (ppm)	3 ADON (ppm)	15 ADON (ppm)	NIV (ppm)	ZEA (ppm)
21	IDRupMill	Rupert	Millenium	SB6	nd	nd	nd	nd	nd
22	IDRupStep	Rupert	Steptoe	SB6	nd	nd	nd	nd	nd
23	IDRupHarr	Rupert	Harrington	SB2	nd	nd	nd	nd	nd
24	IDRupBar	Rupert	Baronesse	SB2	nd	nd	nd	nd	nd
25	IDAbdMill	Aberdeen	Millenium	SB6	nd	nd	nd	nd	nd
26	IDAbdStep	Aberdeen	Steptoe	SB6	nd	nd	nd	nd	nd
27	IDAbdHarr	Aberdeen	Harrington	SB2	nd	nd	nd	nd	nd
28	IDAbdBar	Aberdeen	Baronesse	SB2	nd	nd	nd	nd	nd
29	IDIFMill	Idaho Falls	Millenium	SB6	nd	nd	nd	nd	nd
30	IDIFStep	Idaho Falls	Steptoe	SB6	0.08	nd	nd	nd	nd
31	IDIFHarr	Idaho Falls	Harrington	SB2	nd	nd	nd	nd	nd
32	IDIFBar	Idaho Falls	Baronesse	SB2	nd	nd	nd	nd	nd
37	IDAshMill	Ashton	Millenium	SB6	nd	nd	nd	nd	nd
38	IDAshStep	Ashton	Steptoe	SB6	nd	nd	nd	nd	nd
39	IDAshHarr	Ashton	Harrington	SB2	nd	nd	nd	nd	nd
40	IDAshBar	Ashton	Baronesse	SB2	nd	nd	nd	nd	nd
			Winter						
53	IDRupCha	Rupert	Charles	WBA	nd	nd	nd	nd	nd

2011 Barley DON

ID =

no.	Idaho	Location	Spring Barley Class	DON	3 ADON	15 ADON	NIV	
21	IDRupMill	Rupert	Millenium	SB6	0.06	nd	nd	nd
22	IDRupStep	Rupert	Steptoe	SB6	nd	nd	nd	nd
23	IDRupHarr	Rupert	Harrington	SB2	nd	nd	nd	nd
24	IDRupBar	Rupert	Baronesse	SB2	nd	nd	nd	nd
25	IDAbdMill	Aberdeen	Millenium	SB6	nd	nd	nd	nd
26	IDAbdStep	Aberdeen	Steptoe	SB6	nd	nd	nd	nd
27	IDAbdHarr	Aberdeen	Harrington	SB2	nd	nd	nd	nd
28	IDAbdBar	Aberdeen	Baronesse	SB2	nd	nd	nd	nd
29	IDIFMill	Idaho Falls	Millenium	SB6	nd	nd	nd	nd
30	IDIFStep	Idaho Falls	Steptoe	SB6	nd	nd	nd	nd
31	IDIFHarr	Idaho Falls	Harrington	SB2	nd	nd	nd	nd
32	IDIFBar	Idaho Falls	Baronesse	SB2	nd	nd	nd	nd
37	IDAshMill	Ashton	Millenium	SB6	nd	nd	nd	nd
38	IDAshStep	Ashton	Steptoe	SB6	nd	nd	nd	nd
39	IDAshHarr	Ashton	Harrington	SB2	nd	nd	nd	nd
40	IDAshBar	Ashton	Baronesse	SB2	0.07	nd	nd	nd
Winter								
53	IDRupCha	Rupert	Charles	WBA	nd	nd		

2012 Barley DON

no.	ID = Idaho	Location	Spring Barley	Class	DON	3 ADON	15 ADON	NIV
21	IDRupMill	Rupert	Millenium	SB6	0.06	nd	nd	nd
22	IDRupStep	Rupert	Steptoe	SB6	nd	nd	nd	nd
23	IDRupHarr	Rupert	Harrington	SB2	nd	nd	nd	nd
24	IDRupBar	Rupert	Baronesse	SB2	nd	nd	nd	nd
25	IDAAbdMill	Aberdeen	Millenium	SB6	nd	nd	nd	nd
26	IDAAbdStep	Aberdeen	Steptoe	SB6	nd	nd	nd	nd
27	IDAAbdHarr	Aberdeen	Harrington	SB2	nd	nd	nd	nd
28	IDAAbdBar	Aberdeen	Baronesse	SB2	nd	nd	nd	nd
29	IDIFMill	Idaho Falls	Millenium	SB6	nd	nd	nd	nd
30	IDIFStep	Idaho Falls	Steptoe	SB6	nd	nd	nd	nd
31	IDIFHarr	Idaho Falls	Harrington	SB2	nd	nd	nd	nd
32	IDIFBar	Idaho Falls	Baronesse	SB2	nd	nd	nd	nd
37	IDAshMill	Ashton	Millenium	SB6	nd	nd	nd	nd
38	IDAshStep	Ashton	Steptoe	SB6	nd	nd	nd	nd
39	IDAshHarr	Ashton	Harrington	SB2	nd	nd	nd	nd
40	IDAshBar	Ashton	Baronesse	SB2	0.07	nd	nd	nd
			Winter					
53	IDRupCha	Rupert	Charles	WBA	nd	nd	nd	nd

Integrated practices are the only way to reduce disease impacts

Control Options



FHB Control - Fungicides

- ❖ ***FUNGICIDE SPRAYS MAY REDUCE INFECTION AT HEADING BUT MAY NOT REDUCE DON PRODUCTION***
- ❖ Do not use strobilurin fungicides to control or reduce the disease – DON toxins will not be reduced
- ❖ **LABELED TRIAZOLE FUNGICIDES:
PROLINE, CARAMBA, PROSARO**
All rated good

Fungicides for FHB Control - NCERA-184

Class	Active ingredient	Product	Rate/A (fl. oz)	Stripe rust	Head scab	Harvest Restriction
Triazole	Metconazole 8.6%	Caramba 0.75 SL	10.0 - 17.0	E	G	30 days
	Propiconazole 41.8%	Tilt 3.6 EC	4	VG	P	Feekes 10.5
	Prothioconazole 41%	Proline 480 SC	5.0 - 5.7	-	G	30 days
	Tebuconazole 38.7%	Folicur 3.6 F	4	E	F	30 days
	Prothioconazole 19% Tebuconazole 19%	Prosaro 421 SC	6.5 - 8.2	E	G	30 days

Efficacy categories: NL=Not Labeled and Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent.

Fungicides for FHB Control

- TIMING of application is CRITICAL
- ★ Prosaro - BCS - For wheat, apply at Feekes 10.51 (beginning of flowering) and for barley, apply at Feekes 10.5 (all ears out of sheath)
- ★ Caramba – BASF – (suppression only) beginning of flowering (Feekes 10.5.1)
- Proline – BCS – initial flowering (Prosaro is the preferred product)

FHB Control – Crop Rotation

- ❖ Crop rotation – avoid grain after corn, if possible, or grain after grain. Plant legumes?

From the Barley Compendium, APS Press –

“Because spores of the fungus can be airborne for some distance, if possible barley should not be planted in proximity to corn or fields containing abundant residues of corn, wheat, or barley crops.”

FHB Control – Production Practices

- ❖ Avoid minimum tillage where scab has been a problem in the past – infected debris is an excellent source of inoculum
- ❖ Increase seeding rate to decrease tillering and increase uniformity of heading
- ❖ Control volunteer and weedy grasses
- ❖ Reduce lodging
- ❖ Can we modify irrigation practices?
- ❖ After harvest, destroy residue of affected crops

FHB Control – Production Practices

- ❖ Do not replant grain in affected fields (prevent seedling infections in subsequent grain crops)
- ❖ Do not replant diseased seeds (may result in seedling blight)
- ❖ Use seed treatments to reduce carryover from infected seed
- ❖ Plant several different varieties – spread out risk

FHB Reduction - Harvesting

- IF you have FHB in the field, increase the fan speed at harvest to blow out FHB infected kernels

Control / Reduction

- ❖ Utilize multiple control tactics
- ❖ Use healthy seed with seed treatments
- ❖ Practice Crop Rotation
- ❖ Fungicide use at flowering, especially following corn
- ❖ Select resistant varieties
- ❖ Set higher fan speed on combine in affected fields

BMP

Crop Rotations
Soil testing
Appropriate Fertilizer
Variety Selection
Certified Seed
Seed Bed Preparation
Seed Treatments
Starter Fertilizer
Irrigation Management
Scouting

**Remember –
Appropriate
use of BMPs
will reduce
disease
pressure**

US Wheat and Barley Scab Initiative


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WHAT'S Hot!

On-line Article: [Scab Initiative's Support Key to HRS Wheat Variety Development](#) *(Posted: 1-6-14)*

[2013 National Fusarium Head Blight Forum](#) *Proceedings and Presentations now available*

[Mycotoxin Sampling Tool](#) *Posted: 12/20/13*

Best viewed in Mozilla Firefox or Google Chrome internet browsers

[Mycotoxins in Canada: A Perspective for 2013](#) *Posted: 12/20/13*

On-line Article: [FHB in 2013: From Benign to Serious](#) *Posted: 11/11/13*

Attention Growers: Important Tools for FHB

- [Scab Smart](#)
- [Sign up for FHB Alerts](#)
- [FHB Risk Assessment Tool](#)
- [FHB Prediction Center \(Wheat\)](#)
- [Links to Regional FHB Management Sites](#)
- [Grain Sampling for DON analysis](#)
- [Best Methods for Applying Fungicide to Grain Heads Using Air-assist Sprayers](#)

[Plant Scientists Fight Hunger Through Genetics](#) *Read article and watch video!*

[USWBSI's Action Plan](#)

[DON Testing Information including Sample Submission Instructions.](#) *Updated for 2013*

[FHB Bibliography Database](#) *Maintained by USDA-ARS-CDL*

[US Wheat, Barley and Durum Variety Scab Resistance Data](#) *Interactive Map*

[Protocols, Tips and Tricks](#)

Future Strategies

- 1) Promote appropriate BMP's – grower education
- 2) Variety Development
- 3) Cooperative Screening Nurseries
- 4) Investing in transgenic / basic research



