

USWBSI Barley CP Milestone Matrix

Submitted 10-21-08

RA: Varietal Development and Host Resistance (VDHR)

CP Objective: 1. Screen available *Hordeum* germplasm for novel sources of resistance and initiate pre-breeding.

PI(s)	Months†	Milestones	Progress	Outputs/Linkages
BS,SN,FC	Oct 2008	Preliminary evaluation of 1 st set of 4,000 <i>Hordeum</i> accessions for reaction to FHB in Hangzhou China nursery.	Completed	List of putative resistant sources.
BS,SN,FC	Oct 2008	Second evaluation of putative resistant sources identified in 2007 in replicated FHB trials in multiple locations in MN, ND, and Mexico.	Completed	Refined list of putative sources in time for 2008 Fall crossing block
BS	Oct 2008	Characterize putative sources of resistance with molecular markers and deposit on USWBSI database.	In Progress DaRT submitted Oct 08	Marker haplotypes for confirmed resistant sources. Link to pre-breeding.
FC	Oct 2009	<u>Pre-breeding</u> Develop BC ₂ lines from five putative sources in genetic backgrounds of Pinnacle and Tradition.		<u>1st Introgression Set</u> - 60 BC ₂ families per cross transferred to MN and ND breeding programs
BS,SN,FC	Oct 2009	Preliminary evaluation of 2 nd set of 4,000 <i>Hordeum</i> accessions for reaction to FHB in Hangzhou China nursery.		List of putative resistant sources.
BS,SN,FC	Oct 2009	Second evaluation of putative resistant sources identified in 2007 in replicated FHB trials in multiple locations.		Refined list of putative sources in time for 2009 Fall crossing block
BS	Mar 2010	Characterize newly identified putative sources of resistance with molecular markers.		Marker haplotypes for confirmed resistant sources. Link to pre-breeding.
FC	Oct 2010	<u>Pre-breeding</u> Develop BC ₂ lines from 2nd set of five putative sources in genetic backgrounds of Pinnacle and Tradition.		<u>2nd Introgression Set</u> - 60 BC ₂ families per cross transferred to MN and ND breeding programs

CP Objective: 2) Map novel QTL for resistance to FHB in barley.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
BS	Oct 2008	Initiate new Advanced Backcross (ABC) Mapping population (<i>H. spontaneum</i> PI 466423)	COMPLETE	68 BC ₁ lines
BS	Mar 2009	Complete ABC mapping population (<i>H. spontaneum</i> PI 466423)		BC ₂ S ₁ lines
BS	Oct 2009	Evaluate ABC Pop for FHB		Preliminary QTL from Summer 2009 trials
KS	Mar 2009	Complete association mapping study of DON and FHB from 2006 and 2007 Barley CAP lines with 3,000 SNPs.		DON and FHB QTL locations. Breeder friendly markers. Link to validation study and MAS
KS	Mar 2010	Add 2008 Barley CAP lines to association mapping study		DON and FHB QTL locations. Additional breeder friendly markers. Link to validation study and MAS

CP Objective: 3) Validate and Fine Map FHB resistance QTL

PI(s)	Months	Milestones	Progress	Outputs/Linkages
AK	Jul 2008	Develop first set of isolines with small Clho 4196 insertions in Morex background and associated markers	COMPLETE	Markers, isolines available for MAS 2008 crossing block.
AK	Jul 2008	Develop first set of mutants of Clho 4196 with improved agronomics	COMPLETE	Mutants available for Fall 2008 crossing block;
AK	Mar 2009	Screen additional isolines, markers, and mutants		Markers, isolines and mutants available for Fall 2009 crossing block
AK	Oct 2009	Develop a saturated genetic and physical map of FHB 2H bin 10 QTL;		Tightly linked markers to Fg2Hb10 QTL available for Fall 2009 crossing block
RH	Oct 2009	Validation Fg2Hbin08 from Clho 4196 in two-row and six-row backgrounds		Donor lines and markers for MAS available Fall 2009 crossing block.
KS	Oct 2009	Fine map Fg2Hbin08 from Chevron		Donor NILs and associated markers available for Fall 2009 crossing block.
KS	Oct 2009	Fine map Fg6Hbin6-8 from Chevron		Donor NILs and associated markers available for Fall 2009 crossing block.
KS	Oct 2009	Validation of QTL identified by association mapping		Nils and markers available by Fall 2009 crossing block

CP Objective: 4) Develop new barley varieties with enhanced resistance to FHB and lower

PI(s)	Months	Milestones	Progress	Outputs/Linkages
SN,RH,KS,PS, BC,RDM,LS	Oct 2008	Evaluate best FHB material from Midwest, Canadian, and ICARDA breeding programs in NABSEN.	Evaluation complete; Report in Dec	2008 NABSEN Report- Best FHB/DON lines identified for 2008 Fall crossing block
RH, KS	Mar 2009	Evaluate eight new lines with DON levels at 70% or less of Robust to AMBA pilot testing.		Performance data on eight lines. Select for year 2.
RH, KS	Oct 2009	Complete satisfactory evaluation of 1 st year AMBA plant-scale testing of ND20488 and M122.		Advance to year 2 testing
SN,RH,KS,PS BC,RDM, LS	Oct 2009	Evaluate best FHB material from Midwest, Canadian, and ICARDA breeding programs in NABSEN.		2009 NABSEN Report- Best FHB/DON lines identified for 2008 Fall crossing block
KS, RH	Mar 2010	Complete satisfactory evaluation of 2nd year AMBA plant-scale testing of ND40288 and M122.		First recommended varieties with enhanced scab resistance
KS, RH	Mar 2010	Evaluate eight new lines with DON levels at 70% or less of Robust to AMBA pilot testing.		Performance data on eight lines. Select for year 2.
KS, RH	Mar 2010	Advance two new lines into AMBA Plant Scale Testing		

RA: Gene Discovery and Engineering Resistance (GDER)

CP Objective 5. Identify barley genes differentially regulated in the barley-*Fusarium* interaction.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
GM	Oct 2008	Identify genes that respond to DON in cultivar Morex	Completed	Genes that respond to DON treatment. Genes will be used for haplotype sequencing and mapping.
GM	Dec 2008	Collaborate with KS and BS to identify a diverse set of resistant and susceptible genotypes		Defined set of genotypes with which to do diversity analyses to focus on diverse sources of resistance for pre-breeding and candidate gene association studies.
GM	Mar 2009	Sequence 30 genes that respond to <i>Fg</i> infection in that diverse set genotypes		Genes that respond to infection will be sequenced and variation will be related to disease phenotypes. Genes that are associated with disease phenotypes will be mapped.
GM	Mar 2010	Develop PCR based markers for breeding based on GeneChip experiments		Markers will be developed for genes that are associated with disease phenotypes. Markers will be provided to breeders for MAS to improve FHB resistance.

CP Objective 6. Evaluate promising transgenes in adapted genetic backgrounds in regional nurseries.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
LD, TA, SN	Nov 2008	Evaluate transgenic Conlon lines for resistance to FHB under field conditions.		FHB resistant transgenic lines identified
TA	Oct 2009	Backcross gastrodianin Golden Promise transgenics into Conlon		Conlon lines expressing gastrodianin
LD, TA, SN, MM	Mar 2010	Evaluate transgenic Conlon and Lacey lines for resistance to FHB under field conditions.		FHB resistant transgenic lines identified

RA: Pathogen Biology and Genetics (PBG)

CP Objective 7. Investigate host genotype x pathogen chemotype/genotype interaction for FHB and DON

PI(s)	Months	Milestones	Progress	Outputs/Linkages
LG, HCK	Mar 2009	Evaluate barley genotypes and pathogen genotypes in field trial for FHB severity and DON		Preliminary information on whether differential host genotype x pathogen genotype interactions exist in the field.
LG, HCK	Mar 2010	Second year evaluation of barley genotypes and pathogen genotypes in field trial for FHB severity and DON		Provide breeders, field pathologists & stakeholders with insights how variable pathogen populations may influence results and decision-making in their work.

RA: FHB Management (MGMT)

CP Objective 8. Elucidate the epidemiology of colonization and survival of *Fusarium graminearum* on host tissue, disease development, and toxin accumulation.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
<i>RDM *</i>	<i>May 2009</i>	<i>Evaluate of treatments that may impact the microbial colonization of residues by Fusarium species</i>		<i>Identification of potential treatments that reduce the inoculum production of Fusarium. Advance to additional testing.</i>

RDM: Ruth Dill-Macky; this research is part of a standalone proposal to the FHB Management Research Area

CP Objective 9. Develop and evaluate chemical/biological management strategies that reduce FHB and/or DON in barley.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
SN	Mar 2010	determine the impact of awns on spatial deposition of fungicides on barley heads		USWBSI Report
SN	Mar 2010	Determine the impact of awn roughness on fungicide deposition and movement		USWBSI Report
SN	Mar 2010	Determine the impact of a range of adjuvants on fungicide deposition		USWBSI Report
SN	Mar 2010	Determine the impact of spike angle on fungicide deposition		USWBSI Report
SN	Mar 2010	Determine the effective distance that a fungicide droplet can inhibit <i>Fusarium graminearum</i> growth		USWBSI Report
SH	Dec 2008	Complete first year of fungicide timing trial		USWBSI Report
SH	Dec 2008	Complete first year of air-assisted application trial		USWBSI Report
SH	Dec 2009	Complete second year of fungicide timing trial		Extension Bulletin / Integrate into BMP trial
SH	Dec 2009	Complete second year of air-assisted application trial		Extension Bulletin /Integrate into BMP trial
MM*	Dec. 2010	<i>Determine the most efficacious fungicide product or product mixture and rate, based on multiple years and location data, for reducing FHB and DON in barley</i>		<i>USWBSI Report, Extension bulletin, Producer meetings</i>

* MM: Marcia McMullen; this work is part of the Uniform Fungicide Trial CP.

CP Objective 10. Develop and promote best management strategies through integrated management.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
JS, SN, SH	Nov 2008	Complete 2008 field study and obtain results from other trials (e.g. breeding, varietal test).		Add results to database.
JS, SN, SH	Dec 2009	Identify top 20 candidate variables using existing data set.		Refine list of candidate variables.
JS, SN, SH	Feb 20'09	Develop candidate models for testing in 2009 using existing data set.		Identify the best model(s). Put on private website for validation.
JS, SN, SH	Nov 2009	Complete 2009 field study and obtain results from other trials (e.g. breeding, varietal tests).		Use results to improve and/or validate model(s).
JS, SN, SH	May 2010	Identify and deploy best model(s) on public websites (e.g. PSU, NDSU, UMN, etc).		Growers will have access to model(s) for use in the integrated management of FHB of barley.
<i>MM, SN, SH*</i>	<i>Dec 2010</i>	<i>Complete the study of the effects of combining multiple strategies (ie crop rotation, variety choice, fungicides) for the management of FHB in barley.</i>		<i>USWBSI Report; demonstrated best management practices; Extension bulletin, producer and commodity meetings</i>

* This is part of the Integrated Management Practices CP

USWBSI Durum Wheat CP Milestone Matrix

Submitted: 10/16/08

RA: Variety Development and Host Resistance (VDHR)

CP Goal #1: Increase acreage planted with varieties exhibiting improved FHB resistance.

Objective 1: Develop varieties that have FHB tolerance/resistance better than Divide.

PI	Months	Milestones	Progress	Output/Linkages
EE, SZ	6	Evaluate the varieties Divide, Alkabo, Grenora, Lebsock, Mountrail, and Pierce for FHB tolerance and DON to provide accurate information to the producers.		Promote the varieties Divide, Alkabo, and Grenora at growers meetings. Divide has some tolerance to FHB. Alkabo, and Grenora have less tolerance than Divide but better than older varieties.
EE	6	Evaluate new developed varieties and experimental lines in the Uniform Regional Durum Nursery for FHB and DON.		Provide the producers with information on the newly developed varieties. The goal is to develop varieties that are better than Divide.
EE	6-12	Initiate crossing and backcrossing of putative sources of resistance with adapted germplasm. In addition make crosses between elite experimental lines/varieties and known sources of resistance in the breeding program.		Introgress sources of resistance into adapted germplasm.
EE	12	Evaluate progenies in greenhouse and field FHB nursery at Prosper, ND. Also use marker assisted selection for known QTL's.		Identify progenies with tolerance/resistance to FHB.
EE	12-24	Second evaluations of selected progenies. Also evaluate existing 800 to 1,200 lines in preliminary, advanced, and uniform regional trials for FHB, DON, and agronomic traits at three locations.		Identify potential experimental lines that are better than Divide, Alkabo, and Grenora for potential release.

CP Goal #2: Increase efficiency of individual breeding programs to develop FHB resistance varieties.

Objective 1: *Fine Mapping of Qfhs.ndsu-3AS in Durum Wheat.*

PI	Months	Milestones	Progress	Output/Linkages
XC (EE, SZ, SK)	6	Development of new molecular markers to further saturate the chromosomal interval harboring <i>Qfhs.ndsu-3AS</i> and the first portion (1,200 individuals) of the large F2 population for fine mapping of the QTL.	Partially completed	- A genetic map of the QTL with higher marker density and more effective markers for MAS in breeding - DNA samples of the first portion of the large F2 population for genotyping and F3 seed for phenotyping (FHB evaluation)
XC (EE, SZ, SK)	12	- Genotyping of the first portion of the F2 population at marker loci near the QTL - Increasing the size of the F2 population and extracting DNA of the additional 800 F2 individuals		- New recombinants within the QTL region for fine mapping - A larger population for increasing resolution of the QTL map
XC (EE, SZ, SK)	18	Genotyping of the additional portion (800 individuals) of the population and development of more molecular markers flanking the QTL, if necessary.		More recombinants within the QTL region and markers more closely linked to the QTL
XC (EE, SZ, SK)	24	Identification of homozygous recombinants in the F3 generation for FHB evaluation and placement of the QTL into a smaller chromosomal interval		Construction of a genetic map with higher resolution for the chromosomal interval containing the QTL and development of better markers for MAS

Objective 2: *Efficiently introgress effective resistance genes into breeding germplasm.*

PI	Months	Milestones	Progress	Output/Linkages
EE, SZ	6	Preliminary evaluation of first set of 1000 durum accessions from ICARDA and 50 wild relatives for reaction to FHB in Hangzhou, China, and Prosper, ND nurseries.		List of putative sources of resistance.
EE, SZ	12	Second evaluation in the greenhouse of putative resistance sources		Confirm the resistance of previously identifies putative sources of

PI	Months	Milestones	Progress	Output/Linkages
		identified from previous year.		resistance.
EE	12	Haplotype identified sources of resistance.		Determine if the sources of resistance are novel.
EE, SZ	18-24	Preliminary evaluation of the second set of 1000 durum accessions from ICARDA and other sources for reaction to FHB in Hangzhou, China, and Prosper, ND nurseries.		List of additional putative sources of resistance.
EE	24	Initiate crossing and backcrossing of putative sources of resistance with adapted germplasm. In addition make crosses between elite experimental lines/varieties and known sources of resistance in the breeding program.		Introgress sources of resistance into adapted germplasm.
SK	12	Develop tools needed for effective pedigree based association mapping study of new sources of FHB resistance.	Completed	Several statistical procedures have been evaluated and best option identified.
SK	24	Develop/utilize current advanced breeding lines in association analysis of FHB resistance with marker loci.	Partially completed	Advanced Tunisian derived durum breeding lines have been analyzed.
SX	6-18	Introgression of FHB resistance from <i>T. carthlicum</i> and <i>T. dicoccum</i> to ND durum cultivars.		Develop BC ₁ F ₄ -derived lines, from crossing <i>T. dicoccum</i> and <i>T. carthlicum</i> accessions with the ND durum cultivars.
SX	6-24	Pyramiding of three wild emmer (<i>T. dicoccoides</i>) derived FHB resistance QTL on chromosome arms 3AS, 6BS, and 7AL into the durum variety Divide.		Develop lines with better FHB resistance than Divide.

Objective 3: Develop and map diagnostic markers for effective sources of FHB resistance.

PI	Months	Milestones	Progress	Output/Linkages
SK	18	Identify markers associated with new/novel sources of FHB resistance in advanced breeding lines.	Partially completed	Marker-resistance region linkage data that can be used for validation and utilization.
SK	24	Convert markers identified through association mapping for analysis of breeding lines		Sequence and convert markers identified by high throughput genotyping assays (e.g., DArT) into diagnostic STS
SK	24	Validate markers identified through detailed analysis of advanced breeding lines.		Validate derived STS markers for utility in advanced breeding lines.
SK	24	Validate association analysis results in confirmatory studies.		Identify other derived lines for validation analysis.

RA: Fusarium head blight management (MGMT)

(Marcia McMullen will conduct this research through the MGMT group)

Objective 1: Exam a core set of fungicide treatments across multiple environments to determine efficacy of registered and non-registered products compared to an untreated check.

PI	Months	Milestones	Progress	Output/Linkages
MM	6-24	A greater reduction in FHB severity and DON levels than achieved by current products or application techniques and rates.	Studied 6 fungicide trts in 2008 at 2 locations in ND to determine efficacy.	USWBSI report; ND Crop Production Guide report; Research Extension Center reports; Producer meetings.
MM	6-24	Achieve additional registrations of products that are efficacious.	Received 2 registrations in	ND Dept. of Ag., EPA, ND commodity groups.

PI	Months	Milestones	Progress	Output/Linkages
			2008.	
MM	6-24	Production of outreach material that describes registered products and use of most efficacious materials.	Revision of FHB bulletin w/ new fungicide recs.	Publication – Oct. 12, 2008

Objective 2: Study the effect of timing of infection and duration of wetness on DON accumulation in durum.

PI	Months	Milestones	Progress	Output/Linkages
MM	6-24	Determine infection time and wetness duration that results in the highest levels of DON.	Completed durum greenhouse studies over 2007-2008.	Make fungicide recommendations based on these results.
MM	6-24	Production of outreach material that describes best timing of fungicide application.	Revision of FHB bulletin.	Extension bulletin; producer meetings.

Objective 3: Look at two or more management strategies combined, for reducing FHB and DON.

PI	Months	Milestones	Progress	Output/Linkages
MM	6-24	Demonstrate to producers that integrated strategies are best when reducing FHB and DON, through accumulation of multiple year/location data.	2 years of studies now completed; another year recommended.	USWBSI forum; 3 rd International FHB Symposium, Hungary; grower demonstrations; grower reports.
MM	6-24	Production of outreach material that describes “Scab Smart” management for durum.	Outline of proposal presented; template designed; person hired.	USWBSI forum 2008; presentation of idea and request for feedback

1. Increase acreage planted to varieties exhibiting improved FHB resistance.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
PSB, BB, Bbe	12 to 48	FHB and DON accumulation tolerance of Overland, Camelot, Settler CL, Lyman, and new KS line validated.		Increased acreage of Overland which is released and under significant certified seed production in NE and SD. Based upon this year's results, increase the interest in Camelot and Settler CL in the marketplace.
PSB, SW, BB, AF, JS, YY, JR	12	Level of FHB tolerance in lines in the NE, KS, SD, and ND Winter Wheat Variety Trials for FHB and DON determined and data incorporated into State Variety Trial Reports.		Provide growers with accurate information on all commercial lines in the HWW region so they can select low FHB and DON lines adapted to their farms. Identify promising FHB tolerant experimental lines near release.
PSB, SW, BB, AF, JS, YY, JR	12	45 experimental lines in the Northern Hard Winter Wheat FHB Nursery and about 300 lines in the regional germplasm observation nursery tested for FHB tolerance.		Build the needed FHB and DON database on experimental lines that may eventually be released in HWW.
PSB	6	25 crosses between elite HWW lines to elite native and known FHB QTL soft winter or hard spring wheat lines made		Introgress pyramided FHB QTLs from soft wheat into HWW.
PSB	6 to 12	50 crosses to F1s above using elite HWW lines with native or known FHB QTLs made.		Create 50 populations with two doses of hard wheat quality with pyramided FHB QTLs (note these will be sorted to remove soft types). These populations will be shared within the region.
PSB, AF, Bbe	12	300 single and 3-way crosses between elite HWW experimental lines and HWW lines with native or known FHB QTLs made (75 in NE, 75 in KS, and 150 in SD). Total of this and above items is 375 crosses.		Create 300 populations with hard wheat quality with pyramided FHB QTLs. These populations will be shared within the region.
PSB, SW	12	460 preliminary, advanced and elite lines tested for FHB and DON levels.		Every preliminary, advanced, and elite line will begin to have its FHB and DON level known.
GB, AF, BB, PSB, SW	36	255 BC3-derived lines of Wesley, Trego, and Harding containing FHB1 tested for FHB and agronomic performance. The Wesley BC lines will be sent to Arizona for rapid increase to develop lines that may be used for FHB resistance quickly in the eastern HWW region (mainly eastern SD and NE).		Potentially new FHB cultivars for use in regions with high levels of FHB incidence/severity, but more likely better parents for crossing.
				Potentially new cultivars with a new source of resistance to FHB, thus lessening our reliance on Fhb1.

2. Increase efficiency of individual breeding programs' to develop and release FHB resistant varieties.

PI(s)	Months	Milestones	Progress	Outputs/Linkages
PSB, GB	12	Three-way crosses, BC1, and F2 populations that have the most segregating FHB QTLs identified using MAS		Enriched populations for FHB tolerant lines, thus easier to select resistant types.
PSB,FD	12	Populations segregating for soft kernel types sorted for hard kernels		Enriched populations for hard kernel texture and FHB tolerance.
FD	12	Seed sorted for high protein from 10 populations analyzed to determine if optical sorting for protein content is heritable.		If successful, enriched populations for higher protein content that are FHB tolerant. If unsuccessful, removes a potential time wasting sorting procedure.
SW, FD	24	Optical sorting techniques are developed that reduce subjectivity and increase efficiency.		Remove subjectivity from the FDK assay and lessen human time involved with assay.

3. Develop new breeding technologies and germplasm to further enhance short term and long term improvement of FHB resistance and to efficiently introgress

PI(s)	Months	Milestones	Progress	Outputs/Linkages
BG, PSB, SW, BB, AF, JS, YY, JR	36	New FHB QTLs from alien species (Fhb3) compared to FHB1 in greenhouse and field. Begin crossing this new allele into elite HWW germplasm.		New source of resistance will be passed off to the breeding programs, thus reducing our reliance on Fhb1. Also, any GxE effects will be identified.
GB, AF, BB, PSB, SW	12	Novel FHB QTLs from Chinese wheat lines identified in mapping population.		Identify and quantify new sources of resistance to FHB in wheat.

2008-2010 USWBSI Spring Wheat VDHR CP Milestone Matrix

Submitted: 10/15/08

Sub objective 1. Increase acreage planted to varieties exhibiting improved FHB resistance.

PI(s)	Month	Milestones	Progress	Outputs/Linkages
MN, ND, SD	8	Evaluate the 2008 spring wheat variety trials (~30-50 cultivars per state and pre-released lines) in 6 inoculated FHB nurseries	NOTE to EC: Progress for all milestones in this CP is listed in individual progress reports.	Growers and breeders will know FHB resistance level of cultivars/lines in the nurseries. This informs growers regarding cultivar choice and breeders for release and crossing decisions. Summaries available online at respective MAES/Extension websites and in print in <i>Prairie Grains</i> .
MN, ND, SD	8	Screen the 2008 URN and URSN regional nurseries in 3-4 inoculated FHB nurseries		Breeders will know which lines in the nurseries have resistance to FHB and this can be useful for crossing and cultivar/germplasm release decisions.
MN	8	Characterize 2008 URN and URSN nurseries for presence of <i>Fhb1</i> and 5AS QTL using DNA markers		Breeders will know which lines in the nurseries have these QTL and this can inform crossing decisions.
MN, ND, SD	10	Evaluate ~2,500 preliminary/advanced/elite lines in 1-3 inoculated FHB nurseries		FHB reactions are key to decide which lines to advance for further testing and possible germplasm/cultivar release. Highly resistant lines used as crossing parents.
MN	10	Evaluate FHB reaction of ~300 RILs in the Crookston FHB nursery		Novel sources made available to breeders to increase FHB resistance level.
MN, ND, SD	12	Make ~1,000 crosses among FHB resistant lines/cultivars with good agronomic adaptation and suitable hard red spring wheat quality traits.		New recombinants are generated to combine improved FHB resistance, high grain yield, resistance to other diseases, and suitable grain quality in new breeding lines.
MN, ND	12	Screen ~3,000 breeding lines from 2008 yield trials for presence of <i>Fhb1</i> and 5AS QTL with DNA markers (work done with S. Shao at the USDA genotyping lab., Fargo)		Knowledge of QTL content for crossing and selection decisions.
ND	12	Screen ~10,000 pre-yield trial genotypes for FHB under artificial inoculation conditions in 2008.		Susceptible genotypes discarded; resistant lines are advanced; new sources used for crossing
MN, ND, SD	20	Evaluate the 2009 spring wheat variety trials (~30-50 cultivars per state and pre-released lines) in 6 inoculated FHB nurseries		Growers and breeders will know FHB resistance level of cultivars/lines in the nurseries. This informs growers regarding cultivar choice and breeders for release and crossing decisions.

PI(s)	Month	Milestones	Progress	Outputs/Linkages
				Summaries available online at respective MAES/Extension websites and in print in <i>Prairie Grains</i> .
MN, ND, SD	20	Screen the 2009 URN and URSN regional nurseries in 3-4 inoculated FHB nurseries		Breeders will know which lines in the nurseries have resistance to FHB and this can be useful for crossing and cultivar/germplasm release decisions.
MN	20	Characterize 2009 URN and URSN nurseries for presence of <i>Fhb1</i> and 5AS QTL using DNA markers		Breeders will know which lines in the nurseries have these QTL and this can inform crossing decisions.
MN, ND, SD	22	Evaluate ~2,500 preliminary/advanced/elite lines in 1-3 inoculated FHB nurseries		FHB reactions are key to decide which lines to advance for further testing and possible germplasm/cultivar release. Highly resistant lines used as crossing parents.
MN	22	Evaluate FHB reaction of ~200 RILs in the Crookston FHB nursery		Novel sources will be made available to breeders to increase FHB resistance level.
MN, ND, SD	24	Make ~1,000 crosses among FHB resistant lines/cultivars with good agronomic adaptation and suitable hard red spring wheat quality traits.		New recombinants are generated to combine improved FHB resistance, high grain yield, resistance to other diseases, and suitable grain quality in new breeding lines.
MN, ND	24	Screen ~3,000 breeding lines from 2008 yield trials for presence of <i>Fhb1</i> and 5AS QTL with DNA markers (work done with S. Shao at the USDA genotyping lab., Fargo)		Knowledge of QTL content for crossing and selection decisions.
ND	24	Screen ~10,000 pre-yield trial genotypes for FHB under artificial inoculation conditions in 2009.		Susceptible genotypes discarded; resistant lines are advanced; new sources used for crossing
SD	24	Using MAS, identify and make available for testing at least 50 BC ₁ F ₂ -derived lines from within 3 populations that possess <i>Fhb1</i> .		Potential new resistant cultivars; frequency of <i>Fhb1</i> in parental germplasm increased.

Sub objective 2. Increase efficiency of individual breeding programs' development of FHB resistant varieties.

PI	Month	Milestones	Progress	Outputs/Linkages
Dyer	24	Introgress Sumai 3-based FHB resistance into spring wheat backgrounds adapted for irrigated and sawfly affected production areas of the NWGP and NIR.		F ₃ lines screened in the field for FHB resistance. Extension bulletin on management of FHB and evaluated FHB resistant varieties under irrigated production.
Garvin	9	Complete analysis of 2008 URSN multi-location data		URSN annual report
	21	Complete analysis of 2009 URSN multi-location data		URSN annual report
Halley	6	Evaluation of spring wheat lines in 2008 URSN and subsets submitted from individual projects for resistance to FHB at Langdon, ND.		Best FHB/DON lines identified for 2008 URSN and FHB resistant lines for regional HRSW research projects.
	18	Evaluation of spring wheat lines in 2009 URSN and subsets submitted from individual projects for resistance to FHB at Langdon, ND.		Best FHB/DON lines identified for 2009 URSN and FHB resistant lines for regional HRSW research projects.

Sub objective 3. Increase efficiency of introgression of effective resistance genes into breeding programs.

PI	Month	Milestones	Progress	Outputs/Linkages
Adhikari	6	Test for type I resistance in monosomic wheat lines using attached-leaf bioassay		Identified potential monosomic lines resistant to FHB
	12	Evaluate resistant lines (parents, RCBM) for disease severity and DON		Validate in greenhouse experiments
	24	Evaluate resistant lines by qPCR and molecular markers		FHB resistant sources identified and made available to wheat breeders.
Cai	6	Field evaluations/seed increase of alien introgression lines identified as resistant to FHB in greenhouse screening		Alien introgression lines with potential FHB resistance and favorable agronomic traits
	12	DON testing of field seed and verification of alien introgression line resistance in China		DON levels in alien introgression lines determined; alien introgression lines with confirmed FHB resistance
	18	Cytogenetic and molecular characterization of the resistant alien introgression lines		Alien chromatin composition and haplotypes of resistant lines established
	24	Chromosome manipulation of the resistant lines completed; FHB evaluations at multiple field locations		Spring wheat germplasm with novel FHB resistance and minimal linkage drag

PI	Month	Milestones	Progress	Outputs/Linkages
Duvellier	6	Fusarium International Elite/Preliminary Spring Wheat Nursery organized and increased including materials sent in both 2007 and 2008		1st FIESWN and FIPSWN (70 entries) increased and tested in Mexico and sent to 17 locations
	9	Materials are evaluated in the field		Preliminary information on the entries (field index, DON amount) are made available
	12	Leaf samples are collected in Mexico for DNA extraction and sent to ARS Fargo Lab for marker haplotyping		Haplotype data based on genotyping markers linked to known FHB resistance sources are made available
	24	Evaluate materials for DON		Identify new resistance sources
Mergoum	12	Screen ~ 250 wheat germplasm from CIMMYT and elsewhere to identify new FHB resistance sources/low DON.		Most susceptible genotypes discarded and resistant or moderate resistant entries will be advanced for the 2 nd year testing.
	24	Screen for the second year the selected wheat germplasm from the 2008 screening		Best new sources with FHB resistance/low DON will be made available for breeding programs

Sub objective 4. Develop and map diagnostic markers for effective sources of FHB resistance.

PI	Month	Milestones	Progress	Outputs/Linkages
Anderson	9	Complete FHB evaluation of Wheaton/PI 81791 RIL population		FHB resistance QTLs identified and RILs for crossing chosen.
	9	Cross best RILs from Wheaton/PI 81791 populations with adapted spring wheat lines		FHB resistance QTL from PI 81791 in an improved genetic background made available to other breeding programs
	12	Develop QTL validation materials		QTL-NIL for validation studies in greenhouse and field
	12	Complete marker map of PI 81791/Wheaton		Poster at 2008 FHB Forum
	15	Complete QTL mapping and analysis of PI 81791/Wheaton		Poster at 2009 FHB Forum; manuscript submitted for publication in peer-reviewed journal
	24	Complete QTL validation		Validated FHB resistance QTLs and corresponding markers for breeders to use
Garvin	8	Develop F3 families for FHB evaluations.		Resource needed for FHB mapping.
	8	Identify polymorphic markers in Norm vs. N31 and Apogee vs. A30, for use in QTL mapping		Information on likely locations of FHB resistance QTL introgressed from Freedom
	12	Marker data for Norm x N31 population obtained		Information for map generation.
	18	Marker data for Apogee x A30 population obtained.		Information for map generation.
	24	FHB evaluations completed on populations.		Information for QTL analysis
	24	QTL analysis completed.		Manuscript; markers for new QTL

PI	Month	Milestones	Progress	Outputs/Linkages
Gonzalez	9	Phenotypic screening of the material derived from SD3934. DNA sampling.		Resistance locus from SD3934 introgressed in multiple genetic backgrounds
	18	Genotyping of plant material derived from SD3934. QTL mapping		DNA markers associated with FHB resistance in SD3934
	18	Phenotypic screening of the material derived from Mult757. DNA sampling.		Resistance locus from Mult757 introgressed in multiple genetic backgrounds
	24	Genotyping of plant material derived from Mult757. QTL mapping		DNA markers associated with FHB resistance in SD3934
Zhong	12	Complete two seasons of greenhouse evaluation and one season of field evaluation for FHB and DON		Preliminary QTL(s), FHB resistant DH lines
	18	Additional season of field evaluation completed		Confirmed QTL(s), manuscript submitted for publication
	24	DNA markers closely linked to the QTLs identified		Confirmed QTL(s), more breeder friendly markers, link to validation and MAS

Milestone Matrix of the VDHR-Northern Soft Winter Wheat CP

Variety Development Objectives for Year 1 (5/1/2008-4/30/2009) and Year 2 (5/1/2009-4/30/2010)

1. Create and advance populations that have a high probability of producing new cultivars with improved FHB resistance, yield, quality, resistance to other diseases, and agronomic traits
2. Evaluate the FHB resistance of breeding lines that are candidates for commercial release and cultivars that are released. Disseminate this information to breeders and to growers through Extension activities
3. Conduct research on selection methods, value of QTL, and genotype by fungicide interactions to determine role of current cultivars and candidates for release in best-management practices.
4. Conduct research to identify QTL associated with FHB resistance

Variety Development Milestones

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
All	1a	Complete ~1,700 biparental, 3-way and/or 4-ways crosses to improve FHB resistance in adapted SRWW	Yr1: Complete crosses by 4/2009 Yr2: Complete crosses by 4/2010	Yr1: The 7 projects in this CP have made 1370 crosses and plan to make another 350 crosses that involve at least one parents with FHB resistance in FY08 Yr2:	Generate 1,000s of recombinant lines for future assessments
KY, IL, OH, NY, IN	1b	Initiate or continue to BC FHB QTL into x adapted SRWW genetic backgrounds.	Yr1: Advance ~35 BC populations by 4/2009 Yr2: Advance ~35 BC populations by 4/2010	Yr1: The projects have advanced 188 BC populations involving elite recurrent parents and donors of QTL from primarily from 3BS, 5A, and limited use of 2DL, 3BC, and 4BC. An unspecified number of BC will be initiated in KY. BC2 progeny derived from McCormick were evaluated for resistance. Yr2:	Generate a diverse set of SRWW with known FHB QTLs to disseminate to SRWW breeders and for possible release. Germplasm information compiled into a database.

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
IL, MO, OH	1c	Establish and advance recurrent selection populations based primarily on SRWW FHB resistance	Yr1: Complete 2 rounds of crossing by 4/2009 Yr2: Complete 2 rounds of crossing by 4/2010	Yr1: OH will initiate their crossing this winter while MO will continue inbreeding in their populations. Yr2:	Generate many novel combinations of resistance genes for selection. Populations will be made available to all breeders.
IN	1d	Introgress <i>Qfhs.pur-7EL</i> into a SRWW. Complete 2 nd and collect field.	Yr1: Complete 2 nd BC by 5/2008 Yr2: Collect field data by 6/2009	Yr1: IN phenotyped spring wheat lines and winter wheat lines that have and that do not have <i>Qfhs.pur-7EL</i> , determined by marker genotyping: disease severity averaged 8.3, 3.9, 2.0 in susceptible, <i>Fhb1</i> , and <i>Fhb1+Qfhs.pur-7EL</i> lines. Yr2:	Create germplasm with novel FHB resistance gene and evaluate its effectiveness. Germplasm will be made available to all breeders.
All	1e	Advance multiple populations through early generations	Yr1: Yr2:	Yr1: All projects reported advancing multiple populations. Not all reported number but at least 2,568 populations were advanced by 5 projects. Yr2:	Identify increase seed of desirable recombinant lines
KY, IL, NY, OH	1f	Use marker-assisted selection in ~50 early generation populations, including enrichment of F1 from BC of 3-way crosses	Yr1: Isolate DNA and obtain marker data by 4/2009 Yr2: Isolate DNA and obtain marker data by 4/2010	Yr1: MAS is being executed in ~85 F2 – F4 populations and/or F1 populations from 3-way crosses. 2147 F4 lines were obtained from enriched F1 populations Yr2:	Frequency of FHB resistance QTL will be increased via MAS. Germplasm information compiled into a database and germplasm made available to breeders
All	2a	Evaluate a total of ~3,700 new breeding lines	Yr1: Obtain data by 7/2008. Process data	Yr1: The PIs evaluated at least 6,414 new breeding lines and at least 1,201	Identify new recombinant lines with

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
		generated within the 7 programs for FHB resistance. Continue evaluating lines that are advanced within each program each year. Note, this is not cooperative, multi-state testing.	and select by 9/2008 Yr2: Obtain data by 7/2009. Process data and select by 9/2009	more advanced breeding lines (Unreported numbers were omitted from all counts). That is a total of at least 7,615 lines evaluated for FHB resistance. Yr2:	enhance FHB resistance and agronomic potential. Germplasm information compiled into to database
All + USDA SWQL	2b	Assess FHB resistance of 60 lines in the multi-state NUWWSN in 7+ environments. Evaluate other traits such as quality, and resistance to other diseases as they occur.	Yr1: Obtain data and send to coordinator by 8/2008 Yr2: Obtain data and send to coordinator by 8/209	Yr1: All listed cooperators provided data. DON data will arrive shortly. Quality data was distributed in late September. Yr2:	Assess FHB of line for potential release. Germplasm information compiled into to database and germplasm made available to all breeders
KY, IL, IN, MI, MO, OH + USDA SWQL	2c	Assess FHB resistance of 60 lines in the multi-state PNUWWSN in 6+ environments. Evaluate other traits such as quality, and resistance to other diseases as they occur.	Yr1: Obtain data and send to coordinator by 8/2008 Yr2: Obtain data and send to coordinator by 8/209	Yr1: All listed cooperators provided data. DON and quality data will arrive shortly. Yr2:	Assess FHB of lines for potential release. Germplasm information compiled into a database and germplasm made available to all breeders
KY, IL, IN, MI	2d	Assess FHB resistance of 50 entries in the multi-state Five-State (IL, IN), Uniform Eastern (IL, IN,), Uniform Southern	Yr1: Obtain data and send to cooperators by 8/2008 Yr2: Obtain data and send to cooperators	Yr1: All listed tests were evaluated in June of 2008 and data distributed to test coordinators. Yr2:	Assess FHB of lines for potential release. Germplasm information compiled into a database and

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
		(IN), Mason Dixon (KY), SUWWSN (KY, IL) and UE White Wheat (MI) trials of advanced breeding lines	by 8/209		germplasm made available to all breeders
KY, IL, IN, MI, MO, OH	2e	Assess FHB resistance of cultivars entered in the State Evaluation Trials of commercially available cultivars. Disseminate information to growers via Extension.	Yr1: Collect data and disseminate by 8/2008 Yr2: Collect data and disseminate by 8/2009	Yr1: Completed by all listed projects. All results were distributed through multiple extension service outreach mechanisms. Yr2:	Assess FHB of lines for commercially available cultivars. Data will be compiled into a database that will be used in various Extension outreach material (reports, websites, presentations, etc).
OH	2f	Coordinate the P+NUWWSNs of 120 SRWW genotypes and checks. Disseminate preliminary and final reports in a timely fashion	Yr1: Preliminary report by 8/08, Final report by 11/08. Yr2: Preliminary report by 8/09, Final report by 11/09	Yr1: Data was obtained from 11 collaborators for the NUWWSN and 8 collaborators for the PNUWWSN. A preliminary report was prepared and sent to all collaborators by early August. We received seed of 60 entries for the 2008-09 NUWWSN and entries for the PNUWWSN. This seed was treated and distributed to 15 collaborators Yr2:	PDF sent to all breeders, summarized in Forum proceedings, posted on USWBSI website, placed in database
All	2g	Increase seed of breeding lines with improved FHB resistance for potential commercial release. Report increases to CP	Yr1: Harvest increase and report by 8/2008 Yr2: : Harvest increase and report by 8/2009	Yr1: Increased seed of 20 lines with at least acceptable FHB resistance: IL04-7874, IL04-7942, IL04-10741, IL04-17762 IL04-8445, IL04-9942, IL04-10118, IL04-11003, E6003 ,E6001R	Facilitate commercial production of FHB resistant cultivars and disseminate information to seed

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
		coordinator		,E6002, P011007A1-14-2, P92226E2-5-3-17-27, OH04-264-58, OH05-200-74, OH05-152-68, OH02-101-1, OH05-72-6, KY00C-2567-01, KY00C-2109-01 Yr2:	companies, Extension services, milling industry, and growers
KY, IL	3a	Conduct cultivar by fungicide trial and disseminate data to growers in terms of best-management practices	Yr1: Collect data by 8/2008 Yr2: Collect data by 8/2009	Yr1: <u>KY grew 30 entries in a cultivar x fungicide trial in scab nurseries at Lexington and Princeton KY.</u> IL grew 12 entries in a cultivar x fungicide trail in the scab nursery at Urbana. Control, Folicur and Prosaro treatments were included. Yr2:	Determine role of current cultivars in BMP to minimize DON. Data will be compiled into a database that will be used in various Extension outreach material (reports, websites, presentations, etc).
IN	3b	Assess FHB resistance of isolines with different combinations of QTL from chromosomes 3BS, 7EL, 1B, 3A	Yr1: Increase seed and conduct GH evaluations by 4/2009 Yr2: Collect field data by 6/2009	Yr1: IN phenotyped spring wheat lines and winter wheat lines with and without the <i>Qfhs.pur-7EL</i> , as determined by marker genotyping: disease severity averaged 8.3%, 3.9%, and 2.0% in susceptible, <i>Fhb1</i> , and <i>Fhb1+Qfhs.pur-7EL</i> lines. Yr2:	Results will suggest best combinations of QTL. Information will be presented at forum and published for use by all breeders
NY	3c	Evaluate phenotypic and marker-assisted selection for FHB	Yr1: Yr2:	Yr1: Completed evaluation of single plant selection and single row selection for FHB resistance to generate heritability estimates and refined	

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
				selection methods. Yr2:	
MO, NY	3d	Haplotype most resistant material to assess putative QTL for FHB resistance in	Yr1: Collect marker data by 4/2009 Yr2: Collect marker data by 4/2010	Yr1: MO - New sources of resistance described in full report will be haplotyped following verification of resistance this winter. To date, we have haplotyped approximately 125 sources.. NY has haplotyped its entries in the Uniform Soft Red and the Uniform Soft White Nurseries. We have haplotyped our primary breeding lines for 3BS and 5A. Yr2:	Haplotype will infer which crosses might be best for pyramiding QTL. Data will be placed in a database.
MO,K Y, IN, OH	4a	Identify QTL in the Truman/MO94-317 population: phenotype and genotype	Yr1: Collect phenotype data from 4 states by 8/2008. Generate map by 4/2009 Yr2: Collect phenotype data from 4 states by 8/2009. Collate with 2009 data and analyze by 11/2009	Yr1: The population of 250 RILs+parents was evaluated for FHB resistance in MO (2 reps), KY, IN, and OH during the 2007-08 season. This will be repeated in 2008-09. We collected data on incidence, severity, index, and DON (forthcoming). A post-doctoral fellow, partially funded by the USWBSI, will be hired this fall to begin genotyping. Yr2:	Results will quantify the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a data base.
OH,MI	4b	Identify QTL in the CIMMYT/OH685 population: phenotype and genotype key regions	Yr1: Collect phenotype data from 3 locations by 7/2008. Generate marker data from key regions by 8/2008.	Yr1: OSU and MSU phenotyped 170 RILs from the cross for a total of three environments. The RILS were genotyped with SSRs 2DL, 2DS, 3BS, 5AS, and 4BC and data were analyzed. A large effect QTL was found. A QTL	Results will be used to infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
			Analyze data by 9/2008 Yr2: Pending	affecting both IND and SEV was found on 2DL in a region that is quite likely homologous to the 2DL QTL reported in the literature. Other markers were non-significant. Yr2:	at the forum, published, and placed in a database.
IL, OH	4c	Identify QTL in the IL97-1828/Clark population: phenotype and genotype	Yr1: Collect phenotype data from IL by 8/2009. Generate map by 4/2009 Yr2: Collect phenotype data from IL and OH by 8/2010. Collate with 2009 data and analyze by 11/2010	Yr1: Seed was increased and planted in IL in the Fall of 2008 Yr2:	Results will be used to infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a database.
NY	4d	Identify QTL in the NY9017-8080/Caledonia population: phenotype and genotype	Yr1: Collect phenotype data from by 8/2008. Generate map by 4/2009 Yr2: Collect phenotype data from by 8/2009. Collate with 2009 data and analyze by 11/2009	Yr1: The NY8080 x Caledonia RIL population was phenotyped for FHB resistance in 2008 and will be repeated in 2009. Genotyping will be completed in 2009 Yr2:	Results will be used to infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a database.
IN	4e	Identify QTL in the Xing 117/P9762 and Xing117/P9774 populations: phenotype	Yr1: Collect phenotype data from by 8/2008. Generate map by 4/2009	Yr1: Point inoculated RILs from the Xing117/P9762 and Xing117/P9774 populations. Will carry out an additional test in the greenhouse in fall 08. Marker	Results will be used to infer the value of QTL for FHB resistance and may be used in MAS.

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
		and genotype	Yr2: Collect phenotype data from by 8/2009. Collate with 2009 data and analyze by 11/2009	screening on parent lines is in progress. Yr2:	Information on putative QTL will be presented at the forum, published, and placed in a database.
MO, VA	4f	Identify QTL in the Ernie/MO94-317 population: Collect type I data	Yr1: Collect Type I data. Coanalyze with past genotype data to identify QTL by 12/2008 Yr2: None	Yr1: We have phenotyped 5 reps from four environments. In addition, greenhouse preliminary type II analyses were conducted in the spring of 2007. In 2007/08, we completed the first replicated type II experiment. Currently 3 additional replications for a second experiment assessing type II resistance are being vernalized and analyses will be conducted in the fall of 2008. Map will not be ready until September of 2009. Yr2:	Results will be used to infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a database.
MO	4g	Generate 3 populations for DH lines for future mapping	Yr1: Generate lines and confirm DH nature by ??? Yr2:	Yr1: No progress reported Yr2:	Results will be used to infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a database.

Milestone Matrix of the VDHR-Southern Soft Winter Wheat CP

Variety Development Objectives for Year 1 (5/1/2008-4/30/2009) and Year 2 (5/1/2009-4/30/2010)

1. Create and advance populations that have a high probability of producing new cultivars with improved FHB resistance, yield, end-use quality, resistance to other diseases, and overall agronomic superiority.
2. Evaluate the FHB resistance of breeding lines that are candidates for commercial release and cultivars that are released.
Disseminate this information to breeders and to growers through Extension activities.
3. Conduct research on selection methods, value of QTL.
4. Conduct research to identify QTL associated with FHB resistance.

Variety Development Milestones

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
All	1a	Complete biparental, 3-way and 4-ways crosses to improve FHB resistance in adapted SRWW	Yr1: Complete crosses by 4/2009 Yr2: Complete crosses by 4/2010	Yr1: 1721 completed Yr2:	Generate 1,000s of recombinant lines for future assessments
All	1b	Initiate or continue to BC FHB QTL ((LDN 3A), (Frontana 3A, 5A, 7A), 2B, 2D, <i>Fhb1</i> , 3BSc, 4B, 5A) into adapted SRWW genetic backgrounds.	Yr1: Advance BC populations by 4/2009 Yr2: Advance ~35 BC populations by 4/2010	Yr1:7 populations in BC ₂ F ₂ , BC ₂ F ₄ , BC ₃ F ₃ , generations developed Yr2:	Generate a diverse set of SRWW with known FHB QTLs to disseminate to SRWW breeders and for possible release. Germplasm information compiled into to database.
All	1c	Advance multiple populations through early generations	Yr1: Yr2:	Yr1: 2,648 populations between F ₁ and F ₇ being worked Yr2:	Identify & increase seed of desirable recombinant lines
MD, VA, NC, GA,	1d	Use marker-assisted selection in early generation populations,	Yr1: Isolate DNA and obtain marker data by 4/2009	Yr1:49 early generation populations	Frequency of FHB resistance QTL will

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
LA		including enrichment of F1 from BC and 3-way crosses	Yr2: Isolate DNA and obtain marker data by 4/2010	underwent MAS Yr2:	be increased via MAS. Germplasm information compiled into to database and germplasm made available to breeders
NC	1e	Use double haploid technology to develop FHB resistant lines.	Yr1: Yr2:	Yr1: Initial attempt resulted in 38 DH lines (22 with <i>Fhb1</i>). Second set of four F ₁ hybrid populations undergoing pollination and embryo rescue Yr2:	Speed the development of FHB resistant cultivars and breeding lines
All	2a	Evaluate new breeding lines generated within programs for FHB resistance. Continue evaluating lines that are advanced within each program each year. Note, this is not cooperative, multi-state testing.	Yr1: Obtain data by 7/2008. Process data and select by 9/2008 Yr2: Obtain data by 7/2009. Process data and select by 9/2009	Yr1:933 new breeding lines evaluated. Yr2:	Identify new recombinant lines with enhance FHB resistance and agronomic potential. Germplasm information compiled into to database
VA USDA SWQL	2b	Assess FHB resistance of lines in the multi-state NUWWSN. Evaluate other agronomic traits and resistance to other diseases as they occur.	Yr1: Obtain data and send to coordinator by 8/2008 Yr2: Obtain data and send to coordinator by 8/209	Yr1:Evaluated at Blacksburg and Warsaw, VA Yr2:	Assess FHB of lines for potential release. Germplasm information compiled into to database and germplasm made

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
					available to all breeders
VA	2c	Assess FHB resistance of 60 lines in the multi-state PNUWWSN. Evaluate other agronomic traits and resistance to other diseases as they occur.	Yr1: Obtain data and send to coordinator by 8/2008 Yr2: Obtain data and send to coordinator by 8/209	Yr1: Evaluated in Blacksburg and Warsaw, VA Yr2:	Assess FHB of lines for potential release. Germplasm information compiled into to database and germplasm made available to all breeders
ALL USAD Qual. Lab	2d	Assess FHB resistance of lines in the multi-state SUWWSN. Evaluate other traits such as quality, and resistance to other diseases as they occur.	Yr1: Obtain data and send to cooperators by 8/2008 Yr2: Obtain data and send to cooperators by 8/209	Yr1: Evaluated at nine misted locations in six states in region. In addition, evaluated in IL, KY, Romania and Hungary. Quality testing by USDA Yr2:	Assess FHB of lines for potential release. Germplasm information compiled into a database and germplasm made available to all breeders
All	2e	Assess FHB resistance of cultivars entered in the State Evaluation Trials of commercially available cultivars. Disseminate information to growers via Extension.	Yr1: Collect data and disseminate by 8/2008 Yr2: Collect data and disseminate by 8/2009	Yr1: Between 20 'most important' to all 91 entries tested in misted or natural inoculation environments. Data reported on Web Yr2:	Assess FHB of lines for commercially available cultivars. Data will be compiled into a database that will be used in various Extension outreach media (reports, websites, presentations, etc).
NC	2f	Coordinate the SUWWSNs of approximately 55 SRWW genotypes	Yr1: Preliminary report by 8/08, Final report by 11/08.	Yr1: Done. Yr2:	Excel sent to all breeders,

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
		and checks. Disseminate preliminary and final reports in a timely fashion	Yr2: Preliminary report by 8/09, Final report by 11/09		summarized in Forum proceedings, posted on USWBSI website, placed in database
All	2g	Increase seed of breeding lines with improved FHB resistance for potential commercial release. Report increases to CP coordinator	Yr1: Harvest increase and report by 8/2008 Yr2: : Harvest increase and report by 8/2009	Yr1:9 lines in increase Yr2:	Facilitate commercial production of FHB resistant cultivars and disseminate information to seed companies, Extension services, milling industry, and growers
VA	2h	Release of cultivars with improved FHB resistance. Report releases to CP coordinator.	Yr1: Release by 8/2008 Yr2: Release by 8/2009	Yr1: SS 5205 (VA01W-205)	Provide the wheat community with wheat cultivars with improved FHB resistance
VA	2i	Assess FHB resistance in winter barley lines and germplasm	Yr1: Obtain data by 8/2008 Yr2: Obtain data by 8/2009	Yr1: Sixty four winter barley entries and 60 winter barley germplasm lines evaluated at Blacksburg, VA.	Assess FHB of lines for potential release. Germplasm information compiled into to database and germplasm made available to all breeders
VA, LA	3a	Conduct cultivar by fungicide trial and disseminate data to growers in terms of best-management practices	Yr1: Collect data by 8/2008 Yr2: Collect data by 8/2009	Yr1:Evaluations at two locations in VA and two locations in LA. Yr2:	Determine role of current cultivars in BMP to minimize DON. Data will be compiled into a

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
					database that will be used in various Extension outreach media (reports, websites, presentations, etc).
VA, NC	3b	Assess FHB resistance of isolines with different combinations of QTL from chromosomes 2BS, 3BS, 3BSc, 4B and 5A (VA) and LDN (3A)	Yr1: Seed increase (NC) and first set of evaluations (VA) by 08/2008. Yr2: Collect field data by 6/2009	Yr1:Completed Yr2:	Results will suggest best combinations of QTL. Information will be presented at forum and published for use by all breeders
VA, LA, NC, MD, AR.	3d	Haplotype most resistant material to assess putative QTL for FHB resistance.	Yr1: Collect marker data by 4/2009 Yr2: Collect marker data by 4/2010	Yr1: Advanced breeding lines evaluated to determine appropriate parents for crosses	Haplotype will infer which crosses might be best for pyramiding QTL. Data will be placed in a database.
AR	3e	Conduct research on selection methods using DON and NIV chemotypes of the pathogen to improve quantification of Type I resistance, late blighting resistance, tolerance and identification of presence of <i>Fhb1</i> .	Yr1: Report progress 8/2008 Yr2: Report Progress 9/2009	Yr1: Student dissertation research in progress	New selection techniques can speed the release of new FHB resistant cultivars.
VA (MO and KY)	4a	Identify FHB-QTL in the Becker/Massey population:	Yr1: Collect phenotype data from 3 states by 8/2008. Generate map by 4/2009 Yr2: Collect phenotype data from 3 states by 8/2009. Collate with 2009 data and analyze by 11/2009	Yr1:Phenotypic and Genotypic data collected Yr2:	Results will infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at

State(s)	#	Description	Target Date	Progress	Outputs/Linkages
					the forum, published, and placed in a data base.
VA (MO)	4b	Identify QTL in the Ernie/MO94-316 population:	Yr1: Collect Type I, II, III, and IV data. Coanalyze with past genotype data to identify QTL, Add additional markers by 12/2008 Yr2: None	Yr1: Completed Year 1 goals Yr2:	Results will infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a data base.
VA, GA, USDA-NC, USDA-OH	4c	Identification, confirmation, and selection for resistance to FHB, stripe rust, and improved milling and baking quality in an elite breeding population (VA, GA, USDA-NC, USDA-OH):	Yr1: Collect FHB Type I, II, III, and IV data, Stripe rust reactions and quality analysis by 2/2008 Yr2:	Yr1. Completed Year 1 goals	
NC	4d	Generate populations for future mapping	Yr1: Generate lines and confirm by 8/2008 Yr2: Generate lines and confirm by 8/2009	Yr1: F ₄ seed of 200 SSD lines produced in NC-Neuse x AGS 2000 population Yr2:	Results will infer the value of QTL for FHB resistance and may be used in MAS. Information on putative QTL will be presented at the forum, published, and placed in a data base.