Variety Development and Uniform Nurseries

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

Performance measures:

- Change in percent area planted to FHB resistant varieties in affected areas.

Research needs:

- Comprehensive evaluation of advanced lines for all important traits under best management practices (such as tillage, chemical control, biological control, forecasting models…)
- Accurate assessment of economic return to producers and end-users for planting/using FHB resistant varieties.

Outputs:

- Enhanced FHB resistance in varieties with complete package of other important traits (yield, quality, resistance to other diseases etc…).
- Variety performance information for education of producers and end-users.

Resources:

- Multi-location regional nurseries.
- Mechanism for funding large regional projects for multiple years.

Anticipated Impacts:

- Widespread adoption of FHB resistant varieties with competitive agronomic and end-use performance.
- Lower DON levels in wheat and barley.
- More stable supply of high quality wheat and barley for end-users.

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

Performance measures:

Breeding programs should document progress with some of the following metrics when appropriate.

- Percentage of crosses made involving FHB resistant parent (native or exotic resistance).
- Number of crosses (or lines) evaluated in early generation for FHB (Type I or II resistance, other disease measures, DON concentration, FHB marker haplotypes).
- Average performance of breeding lines (advanced, preliminary yield trial entries etc…) compared to appropriate check varieties for FHB and agronomics.
- Number of variety candidates entered into Uniform or Regional Yield Nurseries or industry quality evaluations with enhanced FHB resistance.
- Number of new releases with “native” FHB resistance.
- Number of new releases with “exotic” FHB resistance.
- Number of new releases carrying resistance alleles at mapped FHB QTL.

Variety Development and Uniform Nurseries (cont.)

Research Needs:

- Maintain existing capacity for field testing in mist-irrigated inoculated nurseries.
- Increased capacity for DON testing at breeder and analytical lab level.
- Increased capacity for MAS.
- Database to facilitate sharing of information on population development to facilitate germplasm exchange.
- In uniform nurseries collect additional data for:
  - other important traits.
  - marker haplotypes for known FHB and DON QTL.
- Increased capacity for MAS backcrossing of resistance alleles at specific QTL.
- Increased access to doubled haploid technology.

Outputs:

- More frequent release of FHB resistant varieties with high yield and other desirable attributes that insure widespread adoption by producers and end-users.

Resources:

- Genotyping labs
- Mist-irrigated inoculated nurseries
- DON testing labs
- Backcrossing Center – centralized facility to rapidly backcross resistance alleles from well-validated QTL into elite lines from breeding programs.
- Mechanism for funding large regional projects for multiple years.
- Doubled haploid facility

Anticipated Impacts:

- More varieties with enhanced FHB resistance and complete agronomic/quality/disease resistance package available to producers.

Goal #3: Efficiently introgress effective resistance genes into breeding germplasm.

Performance measures:

- Number of breeding lines with new sources of resistance in their pedigree.

Research Needs:

- Information to determine whether "new" sources of resistance are truly "novel" sources of resistance – marker haplotyping, allelism testing etc…
- Coordination to strategically distribute new sources to different breeding programs for crossing and first generation "pre-breeding".
- Sharing of pre-breeding populations.
- Enhanced phenotyping of mapping populations (more environments in fewer years).

Outputs:

- Improved germplasm with diverse resistance.

Variety Development and Uniform Nurseries (cont.)

Resources:

- Web accessible database to share information on resistant sources, breeding population development, marker haplotypes, etc… data.
- Regional coordination meetings / regional grants to facilitate collaboration.
- Mechanism for funding large regional projects for multiple years.

Anticipated Impacts:

- Breeding germplasm with higher levels of resistance to FHB and lower DON concentrations.
- Enhanced germplasm exchange among breeding programs to more quickly exploit diverse sources of resistance.

CBCC/EEDF Research Areas

<u>Goal #1:</u> Validate integrated management strategies for FHB and DON

Performance Measures: Building a database of disease and mycotoxin responses to specific management strategies alone and in combination.

Research Needs: Identify the best management methods for FHB/DON or Good Farming Practices (GFP) for FHB/DON management - through integrated management studies. Studies to measure integrated effects will include but are not limited to:

- Evaluate the potential disease reductions through combinations of host resistance and fungicides.
- Research documenting the impact of tillage, cropping sequence on disease risk and potential role as part of the integrated management for FHB/DON.
- Develop disease forecasting models that help producers and their advisors evaluate the risk of disease based on environment, cultivar resistance and crop residues.
- Develop economic analyses of responses to integrated management strategies alone and in combination (i.e. fungicide, cultivar, residue management).
- Optimize fungicide application timing and methodology
- Deploy improved FHB/DON forecasting systems and validate the use of the disease forecasting systems in combination with resistant cultivars and chemical control.
- Utilize isolines (developed by breeders) with known response as standards across regions or grain classes.

Outputs:

- Uniform research design to facilitate regional and national interpretations of results.
- Improved or enhanced forecasting systems.
- Document good farming practices (GFP) for FHB/DON management on regional and national basis.

Resources:
Multiple collaborative locations distributed across US. A team approach will be used to reflect overlap across traditional research areas and regional/national scope. Teams will be composed of breeders, pathologists, economists and other scientists from other disciplines as needed.

<u>Anticipated Impact</u>: Producers will make decisions based on regionally validated science-based information.

<u>Goal #2:</u> Enhance communication and end user education/outreach. We recognize that our audience includes, but is not limited to producers, agricultural advisors, research community, and grain processors.

Performance Measures: Implement FHB/DON management methods validated through science-based research

Research Need: Implement best management methods - Good Farming Practices (GFP) for FHB/DON management - through integrated management studies. Studies to measure integrated effects will include but are not limited to:

- Identify sociological and economic influences on FHB/DON behavior.
    - Develop survey tool for multiple audiences - customer need, customer knowledge and source of that knowledge.
    - Survey stakeholder groups to determine current status of FHB management adoption.
    - Conduct limited focus groups in regions/grain class production areas.
    - Assess survey and focus group responses.
    - Conduct a follow-up survey to assess changes in management behavior (3-5 yrs).
- Develop "ScabSmart" outreach materials and platform for exchange of information.
    - Develop Industry-University alliance to interpret Good Farming Practices.
    - Conduct "Train-the-Trainers" workshops to ensure a common message and understanding of what is different in certain circumstances.
    - Conduct region-wide training events for influencers (growers, consultants, and influencers).
    - Partner with CCA organization to deliver on-line training for crop advisors via the Crop Advisors Institute and ICCA magazine. Pre- and Post-testing (learning assessments) would "certify" a crop advisor as a "Certified FHB Manager - 2007". Only the year of testing would be certified.
- Develop economic assessment tools based on discounts/premiums assessed by millers and maltsters, market prices at terminals, and other factors (a model for this tool is available at NDSU in the form of a crop value calculator).

Outputs:

- Survey tools to identify trends in management and adoption of technology.
- Science-based educational materials/training tools with a unified message.
- GFP document for FHB/DON management on regional and national basis.

Resources:
Multiple collaborative locations distributed across US. A team approach will be used to reflect overlap across traditional research areas and regional/national scope. Teams will be composed of industry seedsmen, breeders, pathologists, economists and scientists from other disciplines as needed.

Research Need: Improve communication within the scientific community:

- Establish a separate section for FHB reports in Plant Disease Management Reports.
- Arrange for a Plant Disease feature article series on progress in each RAC (Terry Niblack, University of Illinois is the incoming feature editor).
- Feature speaker at the next Forum to provide a synthesis of progress in managing FHB/DON since the inception of the USWBSI.

Outputs:

- Research reports in refereed journals.
- Communicate a clear message to the scientific community about progress of USWBSI.

Resources: Individual and collaborative reporting of data. A dedicated site established for reporting FHB/DON data.

Anticipated Impact: Increased adoption of practices by producers and decision makers will result in FHB/DON reduction and leading to substantially reduced frequency of unacceptable DON levels in grain loads.

Goal #3: Develop the next generation of management tools for FHB/DON control.

Performance Measures: Evaluate the potential of new technologies for the management of FHB/DON.

Research Need:

- Enhance forecasting capabilities:
  - Examine the ability to utilize other sources of weather data and 'ensemble' approaches to forecasting.
  - Develop forecasting tool for DON.
  - Develop and validate forecasting tool for barley.
- Develop control methods that include biological control agents
  - Support discovery and development of biological control agents
  - Develop a better understanding of the ecological relationships associated with biological controls
- Continuous assessment of new control methods for FHB/DON.
- Develop platform for the exchange of information that facilitates more team-building.
- Screen new fungicide compounds across multiple environments as candidates are identified by industry.
- Determine factors influencing DON accumulation in wheat and barley grain
  - Evaluate the potential impact of environment during grain filling growth stages on finial DON levels
  - Determine the role of environment, pathogen population, and cultivar on the accumulation of mycotoxins.
- Develop a repository for negative data with potential explanations for why control was not attained.

Outputs:

- Uniform research designs
- Data interpretations regionally and nationally
- Enhanced and improved forecasting systems
- GFP document for FHB/DON management on regional and national basis.

Resources:
Multiple collaborative locations distributed across US. A team approach will be used to reflect overlap across traditional research areas and regional/national scope. Teams will be composed of breeders, pathologists, economists and other scientists from other disciplines as needed.

Anticipated Impact: Novel methods to integrate in FHB/DON management plans will be identified.

<u>Goal #4:</u> Evaluate and quantify factors influencing DON accumulation in asymptomatic wheat and barley

Performance Measures: Provide information regarding specific factors influencing infection and toxin accumulation that can be used to develop the next generation of scab and DON risk assessment models.

Research needs: Identify host-, weather-, and pathogen-related factors and interactions involving these factors that are associated with DON accumulation in the absence of visual symptoms or when severity symptoms are low. Specific studies will be conducted to evaluate the effects of the following factors on DON accumulation:

- Develop studies to better understand late/secondary infections and the influence of post-flowering weather conditions
    - Determine the importance of post-flowering inoculum density and the associations among inoculum density, weather, FHB, and DON accumulation.
    - Determine the influence of weather (and variety) on infection efficiency (IE) at various growth stages between heading and grain maturity.
        - Determine production of fungal biomass and visual symptoms at time *t* after inoculation (with a fixed inoculum dose) from IE.
        - Use flowering time inoculation studies under a range of temperature and RH conditions to establish infection optima.
        - Assess IE with weather fixed (at *optima*) while varying inoculation time.
        - Evaluate IE with different inoculum doses at optimum inoculation time and under optimum conditions.
        - Evaluate inoculum dose compensation for sub-optimal weather conditions and timing.
    - Determine the influence of weather on temporal variation in fungal biomass of grain following inoculation at different growth stages between heading and grain maturation.

Outputs:

- Uniform experiments conducted using locally-adapted varieties.
- Models describing associations among inoculum density/dose, inoculation timing, temperature, RH, and variety on infection, fungal biomass and DON accumulation in the absence of visual symptoms.
- Improved accuracy of FHB risk assessment models and development DON forecasting models.
- Generate data suitable for the development of process-based FHB and DON risk assessment models.

Resources:
A multi-state collaborative effort involving researchers from all major US wheat and barley-growing regions.

Genetics – Biotech

1. FHB RESISTANCE MAPPING

Goal:
Improve the efficiency of identification and characterization of novel loci for FHB resistance.

Research Need:
PIs need to utilize the best existing molecular markers to demonstrate that any new FHB resistance loci they propose to map is distinct from 3BS in wheat or Chr 2 in barley.

Develop genome-wide marker fingerprints of FHB resistant material to facilitate rapid incorporation of new FHB resistance loci into breeding programs.

Increase the capacity to evaluate segregating populations.

Performance Measures
Initiative should only fund proposals to map new FHB resistance loci that provide preliminary data demonstrating the novelty of the resistance.

Identification of FHB resistance loci from germplasm unrelated to previously identified resistance (3BS wheat) (Chromosome 2H barley).

Increased use of novel FHB resistance loci in breeding programs.

Demonstrably increased capacity for field evaluation of populations segregating for FHB resistance.

Outputs:
Identification of novel FHB resistance loci transferred to VDUN along with accompanying markers to facilitate deployment.

Resources:
USWBSI funding for characterization of new sources of FHB resistance.
High throughput genotyping facilities.

Anticipated Impact:
US wheat and barley market classes enriched with additional genes that confer resistance to FHB

Genetics – Biotech (cont.)

2. GENE DISCOVERY

Goal: Increased efficiency of identification of candidate genes for resistance against FHB and reduced DON accumulation..

Research Needs:
Rapid identification of wheat and barley genes essential for resistance to FHB and DON.

Rapid identification of genes that confer susceptibility to FHB. If such genes are identified, incorporation of nonexpressing alleles or silencing via transgenic approaches may provide a novel path to FHB resistance.

Rapid identification of transgenes that can be utilized to increase resistance to FHB and/or reduce DON accumulation.

Rapid high capacity assays for discovery and validation of genes with function in FHB and DON resistance.

Performance Measures:
Identification of genes and transgenes that improve FHB resistance and/or reduce DON accumulation.

Outputs:
Genes and transgenes that can be incorporated in new wheat and barley lines with improved FHB resistance or reduced DON accumulation.

Resources:
USWBSI funding of gene discovery.
New high throughput assays for genes functioning in FHB resistance and susceptibility: for example, virus-induced gene silencing and Physcometrella.

Anticipated Impact:
Additional genes available for breeding FHB and DON resistant barley and wheat

Proof of gene efficacy will speed up breeding with native resistance genes and provide options for incorporating resistance transgenes into commercial wheat and barley.

Genetics – Biotech (cont.)

3. PLANT TRANSFORMATION

Goal: Develop effective FHB resistance through transgenic strategies.

Needs:
Establish and support centralized transformation facility(s) for more efficient generation of transgenic plants and seed stocks for Initiative funded research projects. Establishment and optimization of wheat and barley transformation is expensive and requires much time and specialized skills. Support of one or a few transformation facilities would provide a great benefit to research into transgenic solutions for FHB.

Preliminary data for efficacious transgenes must be provided for Initiative support.

The Initiative should support centralized facilities for field testing transgenic wheat and barley.

Development of tools for optimized gene expression in wheat and barley.

Performance Measure
Establishment of a central laboratory for the generation of transgenic plants and T1 seed stocks for Initiative funded research projects.

Incorporation of validated transgenics into VDUN programs.

Resources:
USWBSI funding for research identifying and developing effective transgenic solutions for FHB resistance and reduced DON accumulation.

New website with latest information (positive and negative) from USWBSI-funded research about the efficacy of transgenes for FHB resistance or DON reduction.

This website would also give up-to-date information about the latest tools for effective expression of transgenes in wheat and barley in FHB resistance strategies (organ/tissue specific promoters, introns, 5’ and 3’UTRs etc.)

Anticipated Impact:
Development of transgenic wheat and barley plants with FHB resistance and DON reduction that can be used to complement natural genetic resistance or as a standalone solution.

More efficient use of individual lab time and resources.

PGG Action plan

Goal 1. Characterize genetic variation in FHB pathogen population with regard to aggressiveness toward plants and mycotoxin potential.
Performance measure. Information useable for making decisions on performance of plant varieties toward specific genetic variants of the pathogen.

Research needs. Identify current FHB pathogen populations in the U.S., strains that are likely to travel here, and characterize their threat to plant varieties being developed by USWBSI.

Outputs. Identify and characterize regional variation in genotypes and chemotypes of fungal strains used as inoculum by breeders developing resistant and DON-reduced plant varieties. Make available culture collections reflecting regional differences in pathogen genotypes and chemotypes. Create publications and websites for stakeholders explaining significance of genetic variation to disease resistance and mycotoxin potential in wheat and barley. Develop and continuously update recommendations for breeders on the use of appropriate strains for screening.

Goal 2. Characterize plant-fungal interactions in plant lines being developed by USWBSI.
Performance measure. Information of how plant infection occurs and DON accumulates in plants over time and how these processes vary between resistant and susceptible varieties.

Research needs. Studies on pathogen infection, movement, and DON accumulation during grain maturation and when resistance is expressed.

Outputs. Detailed histology of infection and accumulation of DON over time in different cultivars. Understanding of the biology of DON accumulation of asymptomatic wheat and the role of DON as a pathogenicity factor in barley. Development of standardized techniques for screening, sampling and testing varieties based on knowledge of pathogen biology.

Goal 3. Develop new strategies for reducing impact of FHB disease and mycotoxin contamination in barley and wheat.
Performance measure. Strategies for disease and mycotoxin management based on knowledge of pathogen fitness, biology, genome and genetics are developed.

Research need. Discovery of genes for pathogenesis, trichothecene reduction, novel antifungal compounds, etc. Development of molecular approaches to modulate pathogen genes for disease control and mycotoxin reduction. Develop new strategies to reduce sporulation on potential inoculum sources of the pathogen (e.g., residues of corn).

Outputs. Identify genes potentially useful to reduce disease or mycotoxin contamination when introduced into transgenic plants. Develop web-based resources for access to information on mutants created and their phenotypes. Determine patterns of pathogen gene expression and protein accumulation vital to disease and trichothecene accumulation. Develop new strategies for pathogen gene silencing.

Food Safety Toxicology and Utilization- Diagnostic Services

Goal 1.1: Provide analytical support for DON/trichothecene quantitiation for initiative stakeholders.

Performance measure 1.1.1: Increase awareness about optimal sampling, grinding and test protocols for mycotoxin analysis.
Research Needs: Lack of awareness about optimal sampling and grinding protocols for grain industry, milling industry and initiative researchers. This may result in incorrect data and inhibit effort to reduce DON
Outputs

- Short term
  - Session/meeting devoted to sampling /analytical methods. Present at next initiative meeting
  - Protocols will be included in USWBI web page within the year
  - Links to protocols will be provided to initiative users
- Long term- Recommended methods will be updated/modified taking into account FGIS- and EU-recommended protocols

Resources: Diagnostic lab directors
Anticipated Impact: Clarify stakeholder concerns over test accuracy and repeatability of data. Implementation of standardized sampling and grinding protocols can improve comparability/quality of data.

Performance measure 1.1.2: Increase capacity for the analysis of DON and other tricothecenes
Research Needs: Initiative members need increased test capacity and turnaround time to make progress since the future focus will be less DON. The extent of need is unknown.
Outputs:

- Diagnostic labs
  - Survey of initiative users for anticipated needs, and continued evaluation of new technology.
  - Request to EC for expanded capacity (existing labs or new lab, if needed), and increased capabilities on- line within 12- 16 months.
- Facilitate on-site rapid testing
  - Workshop(s)/continuing education devoted to sampling /analytical methods at initiative meeting(s) perhaps including kit manufacturers
  - Suggested rapid assay protocols (e.g. FGIS) will be included in USWBI web page. Links to protocols will be provided to initiative users.
  - Solicit bulk discounts for initiative users
  - Continued evaluation of new technologies

Resources: Diagnostic lab directors.

Anticipated Impact: Increased testing will enable breeders to achieve goals of DON reduction sooner.

Food Safety Toxicology and Utilization- Diagnostic Services (cont.)

Performance measure 1.1.3: Diagnostic labs will include measurement of ADONs, other trichothecenes and glycosidic forms in selected surveillance samples.
Research Needs: There is concern about change in *Fusarium* genotypes and masked (glycosidic) trichothecene forms but there are limited data on occurrence individual toxins other than DON. FDA survey data is very limited.
Outputs: Multiyear year survey data on occurrence of different trichothecenes and relative ratios of these analytes
Resources: Diagnostic lab directors.
Anticipated Impact: This data will assist discussion of "shifts" in observed mycotoxin profiles.

Goal 1.2: Provide requisite information on DON/trichothecene safety issues to producers, millers, researchers, risk assessors, and regulators.

Performance Measure 1.2.1: Conduct research on adverse effects of consuming DON and related trichothecenes that allow extrapolation from animals to humans and inform regulators thus enabling science-based risk assessment. Key considerations are groups at high risk and biomarkers of exposure/toxicity.
Research Needs: EU has established DON regulatory standards that are much lower than U.S. and there is pressure on CODEX to follow suit. There is new concern about change in Fusarium genotypes and mycotoxin profiles.
Outputs:

- Publication of research/reviews in high impact journals that inform international risk assessors and regulation.
- Participation in national/international research meetings/ forums/committees that inform risk assessors
- Develop preliminary data for NIH-funded human epidemiology studies

Resources: Food safety researchers
Anticipated impact: Risk assessors and regulators will use data to make sound scientifically valid decisions that ensure public health but minimize economic effects to wheat and barley industries.

Performance measure 1.2.2*:* Summarize known toxicology information on DON, /trichothecenes, their risks and rationale for regulations.
Research Needs: There is lack of easily comprehensible information on DON and its risks. This creates confusion among producers, millers and initative scientists.
Outputs:
-Web pages with questions and answers about DON safety
-Initiative-originated reviews/position paper(s)
Resources: Scab Web support facility, food safety researchers
Anticipated Impact: Improved understanding/communication of the importance of the problem among the producers, millers, researchers and government.

Food Safety Toxicology and Utilization- Diagnostic Services (cont.)

Performance plan measure 1.2.3*:* Conduct research on inhalation risks of DON and related trichothecenes, exposure and and risk management

Research needs: Inhalation of DON and other trichothecenes poses unknown hazard to farmers, grain handlers, millers and researchers. Inhalation is more effective than ingestion in delivering these toxins. Effects could involve increased infection, inflammation and asthma.

Outputs:

- New data/publications on effects of trichothecene/contaminated grain dust inhalation on toxicity markers
- New data /publications on occupational exposure to DON in grain dust
- Provide information about "at-risk" occupations and mitigation strategies
- Develop preliminary data for NIH-funded human epidemiology studies

Resources: Environmental and occupational safety workers

Anticipated Impact: Ensure safety of wheat and barley industry workers.

Results from Barley Discussion Group at Forum

The session was started out by people in the room talking about what research they were FHB doing. One thing that was evident was there was good collaboration between the public barley improvement programs (breeder, pathologist, and cereal chemist), the Busch Agricultural Resources, Inc. (BARI) program, and the malting and brewing industries. This part of the session was particularly helpful for those who don't work on barley full time.

Items noted as needs by the group included:

Collaborative testing of FHB-tolerant breeding lines in a trial with Prosaro and other fungicides if warranted. Les Wright of BARI indicated that he would try to obtain monies from his company to help support this project.

Corby Kistler offered to provide different chemotypes of the pathogen to researchers wanting to test if barley lines respond differently to the different chemotypes.

The group was very supportive of preparing a mini-CAP type grant that would include barley improvement, chemical and cultural control of FHB, DON testing, etc.

A statement was made by industry about the need to demonstrate the value of the forecasting system for barley. I interpret that this was not a negative comment, but rather people want to know if it works so they can use it and if it doesnt then research in that area can cease. I sensed some frustration with the time it is taking to resolve this issue, so it should be a priority.

It was acknowledged that most mid-west breeding programs had some lines with good resistance which were due to be commercial-scale tested in the near future, but with the lack of resistance available in barley, comments were made that there needs to be as many lines as possible in the pipeline. I interpreted that to mean that both gene discovery, pre-breeding and breeding should be a priority.

An industry representative suggested the need for research on the effect on the brewing process of fungicides being used in the field, in particular the effect on yeast. Similarly it was also suggested that transgenic barley with antifungal genes should also be tested for its impact on the brewing process. An integrated approach was suggested with agronomy, pathology, residue chemistry and brewing chemistry being involved.

Feedback from NAMA on first draft of USWBSI's Action Plan

TO: Dave Van Sanford, Co-Chairman, US Wheat and Barley Scab Initiative

FROM: Jane DeMarchi, Director of Government Relations, North American Millers' Association (NAMA)

RE: Strategic Plan

DATE: 3/7/07

We applaud your efforts to engage in a strategic planning process to emphasize measurable goals for the USWBSI. NAMA's objective, as you know, is to reduce DON levels in wheat. We feel it is imperative that the USWBSI view communication as a core function for achieving reduced DON levels. A staff and a plan are needed to influence the growers to use resistant varieties and other strategies. Maintaining support and government funding for USWBSI will be nearly impossible without practical application of your research. The USWBSI must make a concerted effort to fund the development and dissemination of information. The adoption of your tools by wheat farmers and the subsequent reduction in DON levels in wheat will be the measurement of your success.

NAMA members have agreed to have more sustained involvement on all levels with the USWBSI. As you develop the structure of a reinvented Initiative we will work with you to determine how our involvement can be utilized so that our input has an impact.

Many of the bullets below are taken from the strategic goals identified from within the USWBSI community and indicate areas where NAMA is supportive of your efforts.

The Variety Development and Uniform Nursery research area is very much in sync with NAMA's objectives.

- Cooperative evaluation of advanced lines for all important traits under best management practices.
- Increase acreage of FHB resistant varieties with a complete package of other important traits (yield, quality, resistance to other diseases etc…).
- Create a database to facilitate sharing of information on population development to facilitate germplasm exchange
- Develop Information to determine whether "new" sources of resistance are truly "novel" sources of resistance
- Share pre-breeding populations

We view that a key shortcoming of the initiative has been weak mechanisms to validate and circulate information on best management practices. Identify the best management methods for FHB/DON or Good Farming Practices (GFP) for FHB/DON management. (Use existing information to start.).

- Use these in a "ScabSmart" outreach platform that includes materials and multiple outreach tools.
- Coordinate more closely with fungicide producers and other input providers to "bundle" messages.
- Develop economic assessment tools based on discounts/premiums. Develop economic analyses of responses to integrated management strategies alone and in combination (i.e. fungicide, cultivar, residue management).

- Conduct region-wide training and on-line training for influencers, growers, consultants and crop advisors.
- Determine status of FHB management adoption by growers. (Possibly through focus groups) Repeat on a routine basis to measure impact of communication programs.
- Conduct "Train-the-Trainers" workshops for extension specialists to ensure a common message and understanding of what is needed in different circumstances.
- Develop disease-forecasting models that help producers and their advisors evaluate the risk of disease based on environment, cultivar resistance and crop residues.

Lack of communication within the scientific community also appears to be contributing to the lack of progress by the USWBSI.

- Develop platforms for the exchange of information to facilitate more team building.
- Create new website resources to disseminate information useful to the research community, so that redundant research is minimized.
- Develop a repository for negative data with potential explanations for why control was not attained.

More information supporting the US standards in the face of more stringent EU regulations is needed.

- Provide understandable summary information of existing research on DON/trichothecene safety issues for producers, millers, researchers, risk assessors, and regulators. This will help regulators make sound scientifically valid decisions that ensure public health but minimize economic effects to wheat and barley industries.

The following points that we support come from several research areas:

- More understanding of the relationship between the plant, the fungus and DON is needed. (What causes the fungus to produce DON in wheat?)

- Evaluate and quantify factors influencing DON accumulation in asymptomatic wheat.

- We don’t have any specific comments on the genetic research. We support this type of research funding by USWBSI but recognize that it is an expensive drain on resources and may not be the best allocation for funding.

<u>NAMA does not support the following objective in the strategic plan</u>

- NAMA feels that OSHA regulations sufficiently address risks from the inhalation from grain dust. We do not support research on inhalation risks of DON and related trichothecenes.
- NAMA is satisfied with the recommendations for sampling, grinding and test protocols currently being used by industry. No additional work is needed there. If additional work needs to be done in this area within the research community we will not object.
- NAMA does not support the use of USWBSI funds to determine occurrence of individual toxins other than DON.
- NAMA would suggest that a literature review of global research would be a possible first step prior to funding animal studies on adverse effects of consuming DON and related trichothecenes.