

SCAB TALK RE: USWBSI ACTION PLAN POSTED COMMENTS AS OF 3/1/07

New posts since previous version are indicated in **yellow**

Subject: The Initiative's strategy

Post: (1/8/07) - The Initiative has been too near-sighted and afraid to recognize the fact that current breeding efforts even with the best resistance source in hand are unable to control scab epidemics. More basic work is needed to better understand the pathogen-host interaction, particularly at molecular and biochemical level. Only when we know the key steps of this interaction can we draw an effective strategy to deal with this disease.

Reply: (1/29/07) - I agree that breeding can only do so much. I am amazed at how little we know about DON accumulation per se, independently of other factors. I am curious why it has taken 10 years to realize that huge gap in our knowledge. Regardless, breeding can not wait 10 yrs for this issued to [be] fully understood and an action plan formed.

Reply: Unsupported Comments (2/27/07) - Do not take this personally, but I don't believe there is any proof that current breeding efforts

Quote:

are unable to control scab epidemics

- at least for wheat.

How many wheat varieties do growers actually have available (AND USE) that are resistant - very few. So I feel that it is inappropriate, and dangerous, to infer that breeding efforts are failing. Note: I am not a breeder and have little to gain from USWBSI-funding of breeders.

The Sumai3 resistance source has only recently been released in varieties that are well adapted to a few regions and there is strong evidence that the growers who have planted such varieties (e.g. Alsen in ND) did not experience anywhere near the level of disease or economic losses during an epidemic year. Let's face it: most of the wheat growers in the U.S. are STILL growing varieties that are MS at best. There just isn't enough MR material out there to give up on breeding efforts.

Let's be realistic, it has taken a decade just to find out what germplasm is available to use as a resistance source and breeders/geneticists have barely begun to pyramid these sources. I truly believe that in 5-10 years there will be enough varieties available (in all major classes) that are MR for FHB to satisfy grower needs and preferences.

I'm not saying that basic research is unnecessary for this pathosystem; however, it is unlikely that there will be a market for GMO wheat in the next decade and I feel it is hard to justify reducing the funding for breeders and germplasm improvement efforts to work on plant-microbe interactions. Plus, there are alternative sources of funding at the Federal level for the latter type of research, but there is almost no such money for varietal improvement efforts.

Subject: General Comments Regarding Action Plan

Post: (1/23/07) - Strong evidence as to what is needed to accelerate progress in achieving the overall goal of the USWBSI is readily visible when taking into account the commonly cited and overlapping goals of the individual RA's and regions. It is vividly apparent that the best FHB and DON control strategies originating from individual research areas and regions need to be integrated and their cumulative effects validated and applied in production. More immediate sharing of novel resistance sources, adapted germplasm and advanced lines, data, and markers is needed to accelerate overall progress. Identification, mapping and validation of new FHB resistance QTL can be accelerated greatly, by increased collaboration among programs in phenotyping and genotyping of mapping populations as well as joint efforts to rapidly introgress and pyramid new and complementary genes in to viable varieties. Rapid development and availability of selectable and diagnostic markers and their routine application in breeding programs and the regional genotyping centers is critical for rapid success. The Uniform FHB Screening Nurseries contain adapted germplasm that represents a vast and very useful source of both native and exotic FHB resistance; however, effective use of this valuable germplasm could be greatly enhanced by further testing and characterization of unique and highly resistant lines including extensive haplotyping for known QTL, identification of lines having DON levels that are notably and consistently low and by access to more data characterizing these lines for other critical agronomic traits. While identifying and developing superior control strategies is an important goal, accelerated development and application of the best current control strategies is paramount.

Reply: (1/28/07) - I agree with many of Carl's comments. There needs to be an coordinated effort to intergrate or best technologies, and to show the clientele and ourselves that we have made progress. This would encourage growers and millers to start to use the technologies. We are missing that vital last component.

Carl advocates much about markers, but strong phenotypic selection is just as vital, if not more so, to attain adequate FHB resistance. The tagged exotic QTL can only do so much. I heard some one comment that all released lines should have 3BS from Asian sources, yet we STILL DO NOT KNOW MUCH ABOUT THE IMPACT OF 3BS (OR OTHER EXOTIC QTL) ON YIELD AND QUALITY!!! We can not put all our eggs in that basket yet!! There is ample evidence (see Truman) that phenotypic selection can be VERY effective. In fact I would suggest that the initiative would be much further along today (at least in the eastern US soft wheat) had they put all their resources into rapid recurrent selection 10 years ago. We must remeber that FHB PLUS HUGH YIELD what the growers will use. Until that is acheived we will have little impact.

We do have good markers and should use them wisely in conjunction with phenotypic selection and in a coordinated fashion. I have not seen much evidence of this developing, but there is much interest in this concept. MAS must be directed at releasing a new variety, not just improving the mean of a population (these are releated, but not identical concepts).

Subject: Funding

Post: (1/2/07) - If the Initiative decides to try regional or commodity based projects, one way to go about this is to have most groups use the current funding as their base request. A good way to add some flexibility to the effort would be to consider having the budget request and then have a section of what would be cut if the budget were reduced 5% or more or increased 5% or more.

Reply: (1/25/07) - I am skeptical of regional funding. It would remove too much of the decision making from the RACs and the executive committee. Many research projects go across regions (this is especially true for epidemiology and control areas). I think the current funding approach is fine.

Reply: (1/28/07) - The initiative should encourage more collaborative projects. The current funding systems seem to encourage people to submit separate proposals for similar topics. I would suggest that if several researchers have similar ideas, that the RAC and EAC inform the groups and encourage them to submit a single proposal on that topic. The proposal should build on the strengths of each. That will build collaborations, increase exchange of ideas, and reduce redundancy.

The initiative still seems to be unable to identify what is the most promising approach to reducing DON and increasing funding for that approach. It is still trying to be all things to all interests. It may be time to let go of some unpromising research areas.

Reply: (1/28/07) - Funding is needed to integrate what we have learned from different research areas. It is apparent that no single technology will reliably produce low DON. It will take a combination of resistance (and NOT just the tagged QTLs), fungicide, and cultural practices. Yet there is not a clear way to fund this. In addition, there is little way to communicate a successful package of technologies, if identified, to the growers.

Subject: Time frame for achieving positive impacts

Post: (1/3/07) - All of the groups had lots of good ideas for lowering mycotoxin levels in grain. Some of the ideas could only have an impact many years in the future, whereas others were more likely to have an impact in short to intermediate term. Although no one wants to be labeled as "shortsighted", it would be helpful to have a time frame in mind, e.g. 3, 5, 10 or 20 years, for accomplishing objectives. It is likely that tangible progress could be made more quickly if a greater percentage of the funding were directed toward projects that had a high probability of reducing mycotoxins in the short to intermediate terms.

Reply: (1/23/07) - Each research group comes from a different perspective. Why not have each group pick their best shot (s) for developing control based on their research findings. Have a panel representing everyone (the steering committee?) go through them and decide on a few to focus on. It is important with this disease to adopt both conventional approaches and a few "outside the box".

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Reply: (1/24/07) - I too would like to have a better grasp on the time frame we are to be considering. My biggest fear is that Congress will not continue to invest in scab research 5 or 10 years from now because of the lack of returns to the producers, processors, and consumers, or because some other disease epidemic will predominate.

Subject: It is time to apply what we have learned so far

Post: (1/8/07) - For the last many years, funding from the Scab initiative was directed in majority towards increasing knowledge in distinct key areas (plant and pathogen genetics, breeding, mapping, etc) and has led to a fair amount of new knowledge. Although there are still many questions that need answering, the discussions during the December Forum also made obvious that there is now a good base of acquired knowledge that is not being applied to its full

potential. There is a strong need for multidisciplinary projects that will better integrate the acquired knowledge from the different disciplines. This could be accomplished by shifting part (not all!) of the funding from knowledge-acquisition projects to knowledge-application projects with specific short to med-term goals towards improving resistance to Fusarium in wheat and barley. Although knowledge-driven projects are more appealing to university scientists (and rightly so based on the promotion system), the knowledge-application projects are the ones that will deliver the goods to the farmers.

Reply: (1/22/07) - I agree completely. The most promising short-term solution for lowering FHB and DON is to combine the current best practices to determine the optimal effect. Although it is likely there are important discoveries to be made about the plant-pathogen interaction, this strategy lacks immediate applicability and initiative funding should be adjusted to favor collaborative studies with practical benefit for the farmers.

Reply: (1/28/07) - I absolutely agree. It is imperative to integrate the breeding, epidemiology, and pathology based-technologies to 1) assess where we are (eg have we really made progress?), 2) show the clientele that progress has been made, and 3) get the clientele to utilize the package of technologies. It is very apparent that no single technology will by itself reliably produce grain with low DON. It is time to bring them together. That will take funding proposals that cut across our current boundaries.

Subject: Communication

Post: (1/9/07) - At the forum there seemed to be wide agreement about the need for more communication. What can be done practically to facilitate this? There needs to be recognition/reward for those taking the time to post information/data within the initiative.

Reply: (1/9/07) - I think regional workshops for all researchers - across disciplines might be helpful. The discussion among workers related to specific issues at the forum worked well and yet we have previously focused our workshops by discipline.

Subject: FHB and Fusarium related Publications

Post: (12/21/06) - It would be worthwhile to post the links to publications (better still the PDF files) on FHB and Fusarium on the USWBSI website. Also post protocols.

Reply: (1/25/07) - That is fine, in principle. However, authors typically do not own the copyright on most of their publications (the journal publishers have the copyright). Thus, it would be illegal to post pdf files of published papers, unless the publisher explicitly gave permission.

Subject: Scab screening-Resistance to DON

Post: (12/19/06) - Lack of clear and definitive information as to whether a known association of DON and its role in the wheat-Fusarium host-pathogen system prohibits our ability to logically hypothesize whether breeding for resistance to DON production/accumulation or DON degradation is even biologically possible, i.e, does direct host resistance to DON even exist?

Reply: (12/21/06) - We should not have too much emphasis on DON at the cost of ignoring other aspects of the interaction of this fungus with its host (wheat and barley). We need to continue to learn more about the other toxins produced by the fungus and their role in

pathogenesis and how the host responds to those toxins. These other toxins maybe as critical as DON, eventhough they may not be as abundant as DON.

A better understanding of host interaction with *F. graminearum* and the other FHB pathogens is critical for our long-term efforts to control this disease. By focussing on just the next 3 years we may be compromising our efforts to find a real solution to this problem

Reply: (1/9/07) - I concur with the previous guest. We do know that we have some, although limited, resistance to the fungus and there is also a clear relationship between the fungus and the toxin. I think focusing only on DON might result in us losing ground on obtaining effective resistance to the fungus. We need to balance our efforts - and until we can demonstrate that there is a separate resistance in the plant to the toxin and that this resistance is of value in our efforts to reduce the economic impact of scab - we should not lose sight of the damage the fungus is doing to plant tissues above and beyond contamination with toxins. The problem with breeding for resistance to the toxin is that you actually need fungal infection and DON production for this to be of value - if we can limit the fungal colonization of tissue we will also reduce the toxin and thus the need for host resistance to it.

Reply: (1/28/07) - DON is the most important measure of resistance, but the most difficult as it is the results of all process after infection. It integrates many components of the host/pathogen interaction. Thus like seed yield, it is vital but complex. It is important to note that attempts to find and breed for components of yield are generally ineffective due to difficulty in measuring the components and the compensation between components. Will this happen with components of DON levels?

We must learn mor about how DON accumulates, but independent of other factors that affect overall DON levels, such as major genes for type II resistance. There is virtually no correlation fo DON and FHB Index once FHB index has been reduced by selection. Yet DON levels can be too high in seed from genotypes with low Index.

Subject: Does resistance to DON itself exist?

Post: (1/23/07) - In the "Nuts and Bolts" breakout session of the FHB Forum, the following statement was included in the report: "There is evidence that plants can degrade DON, which would be related to resistance to DON". In order to successfully breed for resistance to DON itself, it is imperative that this hypothesis be validated and better understood. Is host resistance directly impeding DON production or degradation of DON feasible to achieve from a biological standpoint?" We know that the host can interact directly with *Fusarium* to reduce initial infection and spread, but does the host and its resistance mechanism directly affect DON? Many studies to date have stated that resistance affects DON levels, but a majority if not all of these studies have simultaneously been working with known QTL conferring type I or type II resistance which themselves indirectly lower DON content by reducing the amount of *Fusarium* present. I feel this needs to be resolved before we can move on with a realistic strategy for reducing DON.

Reply: (1/28/07) - I absolutely agree. Most mapping populations that are segregating for major QTL for type II (and/or I if that exists) are way too small to identify a QTL associated with just DON metabolism. I find it hard to believe that we know so little about DON accumulation per se after all these years!

Subject: Suggested additional goal for EEDF area

Post: (1/24/07) -

Goal: Evaluate and quantify factors influencing DON accumulation in asymptomatic wheat

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:

- Late/secondary infections and post-flowering weather conditions
 - Post-flowering inoculum density and the associations among inoculum density, weather, FHB, and DON accumulation.
 - Influence of weather (and variety) on infection efficiency (IE) at various growth stages between heading and grain maturity.
 - IE measured in terms of fungal biomass and visual symptoms at time t after inoculation (with a fixed inoculum dose).
 - Inoculate at flowering under a range of temperature and RH conditions to establish optima.
 - Hold weather fix (at *optima*) and vary inoculation time.
 - Evaluate different inoculum dose at optimum inoculation time and under optimum conditions.
 - Evaluate whether inoculum dose compensate for sub-optimal weather conditions and timing.
 - 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-growing regions.

Reply: (1/25/07) - This suggested additional Goal reflects the wishes of several researchers in EEDF. There is a long history of collaboration in EEDF, as evidenced by the disease

forecasting system and other accomplishments. Many epidemiology researchers (myself included) feel that this listed goal is a logical next step.

Reply: What is asymptomatic wheat? (2/27/07) - First, what you propose was already a research priority of the EEDF for FY07 and will likely remain:

Quote:

Research addressing factors associated with high levels of mycotoxin in asymptomatic grain.

Second, the experiment you proposed is so complicated and artificial that I suspect you would find highly variable (read: non-conclusive results). One thing I've learned from working with this pathosystem is to KISS (keep it simple stupid) <- nothing personal, just a saying. The fungus rarely cooperates completely.

Third, I am unaware of any compelling evidence supporting this idea of "asymptomatic grain". It is something that I have never personally experienced, i.e. grain with high DON always had medium/high FDK counts. It my personal opinion that this phenomenon is due, at least in part, to the class of wheat where this is most commonly noted. That is, quantifying FDKs in soft red and white wheats is substantially more difficult than in hard wheats. I would like to see results from a study documenting where grain with a low FDK count (few-none) had > 2ppm DON. If this has already been published, please excuse my ignorance and supply a reference.

Subject: VDUN proposed goals

Post: (1/29/07) - The VDUN document looks good. I suspect there will need to be some refinement on the performance measures such as "change in % of area planted to FHB resistant varieties in affected areas." The haplotype information on the uniform nurseries is critical and should be included in the reports. It would also be helpful to get haplotypes going back a couple of years.

FORUM (format and timing)

Subject: Planning meeting

Post: (1/3/07) - The recent FHB Forum was a large departure from the usual meeting format. Initially, I was skeptical about the usefulness of such a format; however, I was pleasantly surprised at how informative the meetings were. Re-focusing on our goals was a useful exercise. Kudos to the planning staff. Finally, in my experience, the DON testing services have been accurate and reasonably timely in their production of data. As a result of the Forum, however, it seems that their workload will increase substantially. Hopefully, funding levels, accuracy, and turnaround times will still allow for researchers to make selections in a timely manner.

Reply: (1/23/07) - I thought the forum format was great. The only thing that might have helped would have been to mix the groups more. I attended as many sessions as I could outside of my domain and found that communication between groups greatly needs improving. I don't think we come close to using each others findings and this is a serious problem.

Subject: Weekend Meeting

Post: (1/11/07) - I have always disliked the weekend start time for the Scab forum and just curious what others think. Originally, I believe part of the idea was to get cheaper "Saturday night stay" airfares, but these days, weekend travel is often more expensive. Work obligations cut into family time plenty during the week, do we really need to take away a weekend from them as well?

Reply: (1/23/07) - I agree completely. I think weekend meetings, especially between Thanksgiving and Christmas are not appropriate.

Reply: (1/23/07) - I second the motion that we should not start the meetings on the weekend.

Subject: Prosario, New fungicide from Bayer

Post: (1/15/07) - I recently came across a nice promotional brochure from new buyer's fungicide "Prosaro" (active ingredient is prothioconazole).

Do you guys in the Chemical Control area have a good feel for it?

Is it a good option, or better ask, is it the best option we have so far?