

## **Economic Impact of USWBSI's Impact on Reducing FHB<sup>1</sup> (August 2017)**

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### **Executive Summary**

Deoxynivalenol (DON) is a mycotoxin associated with Fusarium Head Blight (FHB) and has resulted in major economic losses to the wheat and barley supply chains. The purpose of this study was to estimate the economic impacts of the US Wheat and Barley Scab Initiative (USWBSI) research in reducing FHB on cereal producers, traders, handlers and processors.

DON has evolved to be a problem since at least 1993. It has impacted the entire supply chain including inputs, farm production practices, marketing and handling, in addition to processing and distribution. It has increased risk and cost throughout the marketing system, reduced yields and has contributed to the declining acreage planted to wheat which has ensued since the early 1990's and before.

A suite of tools has been developed to treat DON. Of importance has been the increased use of fungicide, and development of and planting of more resistant varieties. Fungicide use quickly became adopted in about the mid-2000's and now is used on 70-80% of wheat and barley area planted. Concurrent has been the adoption of more resistant varieties in most producing states affected by DON.

The impacts of FHB on growers is to increase the risk of DON being excessive, reducing yield and increasing discounts for excessive DON. Taken together, mitigation strategies have the impact of increasing returns, and reducing risks. The strategies result in greater returns and lower risks than otherwise. Without these technologies, growers would need to be compensated in the area of: HRS \$130/acre; SRW \$49/acre; HRW \$28/acre and Malting Barley \$29/acre to grow wheat and barley.

Impacts of DON on end-user's operations and costs are important, and are probably irreversible. Part of the impact of DON is due to the premiums (costs) in the market, and/or costs related to testing, segregation, storage, cleaning, and the unexpected increased distance needed for procurement which adds shipping costs.

**Costs Accrued by Wheat and Barley due to DON:** The most important costs accrued by the wheat and barley industries (shown below) are the value of yield forgone and the risk premium paid to induce adoption of DON reducing technologies. These were followed by the costs of fungicide, added shipping costs, testing and segregation and discounts.

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The report is under review and forthcoming and available from the authors (William.wilson@ndsu.edu)

## Summary of Costs of DON to Wheat and Barley Industries, 2015/16 (\$)

	Wheat Total	Malting Barley	Total
<b>Value of Yield forgone</b>	1,176,000,000	293,000,000	1,469,000,000
<b>Costs accrued by Growers (Market)</b>			
Fungicide	197,128,500	13,891,050	211,019,550
Risk premium implied	2,743,870,000	81,156,500	2,825,026,500
Discounts to growers	23,900,000	na	23,900,000
<b>Testing costs by Elevators</b>	21,403,369	2,452,500	23,855,869
<b>Testing costs and discounts for trading firms</b>			
Testing costs Traders (exporters--inbound)	776,634	1,603	778,237
Testing at export loading	4,531,032	75,783	4,606,815
Discounts		nil	
<b>Added Costs Accrued at Flour Mills and Malt Pl</b>			
Discounts	7,635,996	1,101,600	8,737,596
Testing	11,425,793	3,798,225	15,224,018
Segregation	4,963,500	10,729,125	15,692,625
Added trucking costs	15,463,643	9,753,750	25,217,393

**Implications for the wheat and barley Industries:** The incidence of DON has improved, though the problem persists and has implications for the supply chain. Importantly, the impact of DON increases risk and cost for the supply chain, and varies through time, and geographically, and thus impacting firms differently. The most important direct costs are those related to increased use of fungicide, testing and increased draw areas. While reliance on fungicide is notable, it is risky due to growing consumer resistance to excessive chemical use in agriculture.

There are also indirect costs of reduced production due to DON. The industry accrues indirect costs of having to pay implicit risk premiums to induce planting and use of DON reducing technologies. Without these technologies, the cost to the industry would increase substantially. In addition, there is an important cost accrued by the industry due to the reduced production because of DON.

**Value of yield forgone:** One impact of DON is that it results in reduced yields versus what would otherwise be achieved in normal growing conditions. The value of lost production varies by year and state. These values were: HRS \$186 million; Durum \$7 million; HRW\$ 415 million; SRW \$569 million; and Barley \$294 million.

### SCAB Initiative:

Important implications regarding the Scab Initiative can be deduced from results in this study. One is that the DON problem has improved. However, it has not been eliminated and remains a temporally and spatially risky problem. Second, while there are several risk mitigation tools, and all prospectively have impacts of reducing DON,

two are important. One is fungicide use, which has increased from virtually nil in the 1990s' to being applied on up to 70-80% of the cereals acreage planted. This has a high cost, and is not perfect. Indeed, there are some places and times where fungicide is applied multiple times in one growing season. Third is the development and adoption of resistant varieties. There are also other breeding technologies that are emerging which may go a long way towards reducing the impacts of DON. Finally, perceptions of both traders and processors recognize these same conclusions.

***Declining Losses for Growers:*** The average production and revenue losses for the base period (1993-1996) was higher than all proceeding years with the Scab Initiative (1997-2014). The variability of revenue losses was also lower, indicating a positive impact from the initiative, with few exceptions. These results are consistent with improved varieties and management practices.

***Savings from the Scab Initiative:*** The combined savings from hard wheats (hard red spring and hard red winter), soft red wheat, durum, and barley were estimated at \$9.69 billion from 1997 through 2014. The direct economic gains over the period were greatest for SRW wheat (\$6.1 billion), followed by hard wheats (\$3.16 billion). Savings for barley and durum were estimated at \$45 million and \$395 million, respectively. Combined gains with the four crops were greatest in 2000 (\$880 million) and were lowest in 2008 (\$297 million). The net present value of these savings from 1993-2014 was \$5.9 billion.

Gains from all crops were summed by state. Indiana, with economic gains from FHB reduction in soft red wheat incurred the greatest impact (\$4.4 billion) of all states from 1997 through 2014. Other states with considerable economic gains over the period included North Dakota (\$1.1 billion), Kansas (\$1 billion), Minnesota (\$721 million), and Washington (\$634 million).

***Returns on Investment:*** This study estimated the return on investment to the research expenditures of the SCAB initiative which has spent \$76 million over its life, including in-kind contributions of \$12.76 million. The NPV of net savings from reduced production loss ranged from \$5.3 to \$5.4 billion over the period 1993-2014 for both wheat and barley. Or, during the study period, a \$76 million investment resulted in \$5.4 billion in savings, i.e., for every \$1 invested there were \$71 in benefits! This is significant and compares very favorably to other studies on agriculture research.

Several measures of return on investment to the funding of the SCAB Initiative were derived. The results showed an IRR (internal rate of return) using conventional methodologies and assumptions was 38% in recent years. Comparably, the MIRR (modified internal rate of return) was 15% and the AROI (aggregate return on investment) was 34%. By comparison to other studies on agriculture research (Fuglie and Heisey (2007) these are very favorable returns.

***Direct and Indirect Benefits:*** The value of the USWBSI goes beyond production to other sectors in the economy (agribusiness industry, input supplies, trade, etc.). Total direct and secondary economic gains from FHB reduction in HRS wheat, barley, durum, and SRW wheat from 1997 to 2014 were estimated at \$21.6 billion.