A Guide - Determining Yield Losses from the BYD in Wheat and Barley

Juliet M. Marshall and Arash Rashed, University of Idaho

1) Symptoms in barley – we are seeing extensive yellowing of leaves that are consistently and uniformly distributed throughout the affected fields. Reddening may be present but more often we are seeing extensive yellowing of the upper portions of leaves. NOTE the yellowing does not always include the whole leaf, but often just the upper portion of the leaf. Dwarfing may or may not be obvious with the symptoms.

2) Symptoms in wheat are similar, but more frequently we also see the reddening of leaves. There are entire fields that look only yellow from a distance, but up close you may see leaves with reddening.

How do we determine the extent of yield loss? This is a very difficult question. Much of the previous research relies on data from the mid-west where incidence is about 10 – 40% of the plants in the field. It is unusual to have as widespread damage where 85-99% of the plants in the field are showing symptoms.

Also remember that visual symptoms alone may UNDERESTIMATE the actual incidence in the field.

Based on our experience from the 2013-2015 southern Idaho epidemics and from published research, we are providing the following suggestions:

In many fields, 20-30% yield loss will be common. Documented yield losses vary! We saw yield losses greater than 50% in 2013-2014. In 2015, losses varied a great deal, with some growers reporting 85 bushels/A instead of their expected 140 bu – about 55 bu/A decrease. Test weights were also low.

Published reports indicate that for every 1% increase in incidence, there will be a decrease of 0.25 bu/A. (Australian paper: McKirdy, S.J., R.A.C. Jones, and Nutter, F.W., Jr.). (Incidence is simply the presence of the disease – any plant showing symptoms. This does not consider severity of the disease on those affected plants.)

Data from Kansas State University determined that over seven years, the following equation applied: Yield = -0.659X + 134.9

Where x is the incidence (percentage of tillers showing symptoms).

X = incidence If X =	then yield equals	Percent yield	Percent yield loss
0	135	1.00	0.00
1	134	0.99	0.01
5	132	0.97	0.03
10	128	0.95	0.05
15	125	0.93	0.07
20	122	0.90	0.10
25	118	0.88	0.12
30	115	0.85	0.15
35	112	0.83	0.17
40	109	0.80	0.20
45	105	0.78	0.22
50	102	0.76	0.24
55	99	0.73	0.27
60	95	0.71	0.29
65	92	0.68	0.32
70	89	0.66	0.34
75	85	0.63	0.37
80	82	0.61	0.39
85	79	0.58	0.42
90	76	0.56	0.44
95	72	0.54	0.46
100	69	0.51	0.49

Things to consider in Idaho:

- This table was not developed for Idaho conditions. In 2013, yield losses exceeded 70% in heavily damaged fields. IN 2015, losses were a lot less, with extensive May rains helping to combat losses.

- BYD will decrease yield, test weight, plumps. Therefore, winter barley for malt, even with low percentages of infection (less than 30%), may not have great malt quality!

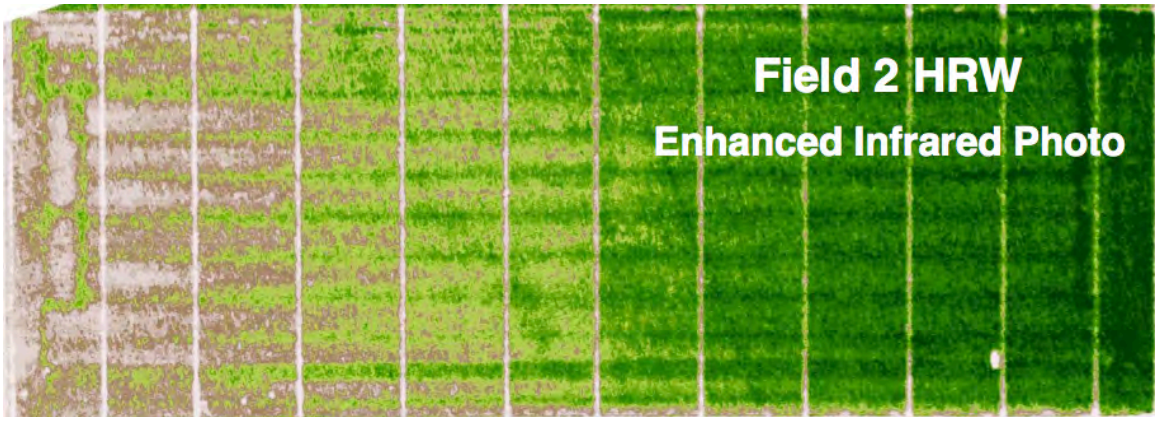
- The ability to mitigate damage depends on nitrogen and water. Right now, March rains will be very helpful in reducing damage and plant stress, especially until irrigation is available.

- There **are** differences in varieties for susceptibility, but there isn't any real resistance in our currently grown varieties. We are performing product testing of insecticidal seed treatments and foliar sprays in a winter wheat test in Buhl. We will publish the results in the fall 2016.

- Insecticidal seed treatments do help to reduce BYD. With long falls, seed treatments will not last long enough to protect earlier planted cereals. In this instance, fields planted late with emergence from October 7 – 10 show no symptoms of infection.

2013 BYDV – approximate yield of a hard red winter wheat with gradations of infection:
Picture provided by Mike Erickson, McGregor Company

50 bu/A ➔➔ 150 to 175



Recommendations for *severely* affected fields:
Destroy severely affected crops (dead plants do not harbor the virus). Treat infected grain by spraying with Roundup or other burn down chemicals. Plow or disc down the crop four to five days after applying Roundup. Wait at least two to three weeks after spraying before planting a spring crop. If you replant with spring grain, be aware that replanting quickly can result in an increase in additional soilborne disease problems (like crown rots, take-all, Pythium seedling damping off, Rhizoctonia, etc) in newly planted wheat or barley unless you give enough time for the winter grain to decompose.

Leaving infected crops in place (including infected strips for crop adjustment purposes) can result in a disease reservoir that will serve as a source of the virus for newly planted spring crops. This is termed a "green bridge"

where overlapping generations of crops result in transfer of diseases to the newer crop. Such practices will maintain BYD as an issue in future cropping cycles.

ADDITIONAL NOTES from 2015-2016 season:

Early planted winter wheat and winter barley, even with full rates of insecticidal seed treatments, are showing symptoms of virus infection, as confirmed by ELIZA testing from the University of Idaho's Entomology Program and Western Labs in Parma, ID.

Late fall planted seed treated with insecticide have significantly reduced symptom development, and in many cases, late planted fields are not symptomatic.

References:

Marshall and Rashed. 2014. Barley Yellow Dwarf Virus in Idaho Cereal Crops. CIS 1210. University of Idaho. http://www.cals.uidaho.edu/edcomm/pdf/CIS/CIS1210.pdf

Baltenberger, D. E., Ohm, H. W., and Foster, J. E. 1987. Reactions of oats, barley, and wheat to infection with barley yellow dwarf virus isolates. Crop Sci. 27:195-198

Gaunce, G.M. 2011. Master's Thesis. Quantifying yield losses due to barley yellow dwarf on winter wheat in Kansas using disease phenotypic data. Kansas State University. Department of Plant Pathology.

McKirdy, S.J., R.A.C. Jones, and Nutter, F.W., Jr. 2002. Quantification of yield losses caused by Barley yellow dwarf virus in wheat and oats. Plant Dis. 86:769-773.)

University of Idaho Research trials currently being funded by the Idaho Wheat Commission and the Idaho Barley Commission:

TITLE: The importance of corn and grassy weeds in BYDV spread. Mahnaz Rashidi, Arash Rashed, Pam Hutchinson, Nilsa Bosque-Perez, Juliet Marshall

TITLE: Barley Yellow Dwarf Virus Effects on Wheat Water and Nitrogen Use Efficiency. Xi Liang, Juliet Marshall, Arash Rashed, Christopher Rogers

TITLE: Barley Yellow Dwarf Virus Effects on Barley Water and Nitrogen Use Efficiency. Xi Liang, Christopher Rogers, Arash Rashed, Juliet Marshall