U. S. Wheat & Barley Scab Initiative

Fusarium Focus

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Economic Impact of Scab $2.7 Billion From 1998-2000 in U.S.

Fusarium Head Blight (FHB), commonly known as scab, was responsible for an estimated $2.7 billion in economic losses in the United States from 1998 through 2000, according to a new study by North Dakota State University.

The study by ag economists William Nganje, Demcey Johnson, William Wilson, Larry Leistritz, Dean Bangsund, and Napoleon Tiapo was conducted to more precisely quantify losses that have occurred in scab-affected regions of the U.S. Scab is a fungal disease that can make wheat unsuitable for milling, and barley unfit for malting.

Nine states (N.D., S.D., Minn., Mich., Ill., Ohio, Mo., Ind., Ky) are included in the analysis for hard red spring (HRS) wheat, soft red winter (SRW) wheat, and durum. Three of the nine states (N.D., Minn., S.D.) were used for the barley analysis.

Cumulative direct economic losses from FHB in wheat and barley were estimated at $870 million from 1998 through 2000. Direct losses were calculated as the decline in producer revenue due to FHB in affected wheat and barley production areas. Production losses (in bushels) as well as the impact of FHB on net prices (price per bushel) were estimated, taking into account other wheat diseases and yield-reducing causes occurring simultaneously as FHB. Also factored was a higher-than-average rate of acreage abandonment that usually occurs with a FHB outbreak.

Farm price impacts were estimated for both futures and basis (local cash price minus the futures price). The study authors note that the price impact of FHB can be both positive and negative. A production shortfall can put upward pressure on market prices while at

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2001 FHB Forum Dec. 8-10, Cincinnati

The 2001 National FHB Forum will take place on Saturday, Dec. 8 through Monday, Dec.10 at the Holiday Inn Cincinnati-Airport Conference Center in Erlanger, Ky (same location as 2000 Forum). Note that the forum, which will begin at 1 p.m., Saturday, will start one day earlier this year. Previous forums have begun on a Sunday.

The Forum is an integral component of the U.S. Wheat & Barley Scab Initiative. Growers and grower group representatives, millers and other food processors, consumers, and scientists (public and private) are all encouraged to attend. The Forum will be organized into six sessions: Biotechnology, Chemical and Biological Control, Epidemiology and Disease Management, Food Safety, Toxicology and Utilization, Germplasm Introduction and Enhancement, and Variety Development and Uniform Nurseries. Each of the six sessions will be comprised of a poster session, speakers,

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the same time, production in affected areas may be discounted for poor quality.

Direct economic losses were greatest for SRW wheat ($333 million), followed closely by HRS wheat ($330 million). Losses for barley and durum were estimated at $136 million and $70 million, respectively. Losses in 1998 accounted for over 50 percent of the three-year total.

To put the losses in perspective, the three-year combined losses of $870 million would exceed the annual value of all barley and oats production in the U.S. in 1999 and 2000, says Nganje. The total value of barley and oats production in the U.S. was $766 million in 1999 and $797 million in 2000, according to figures from the National Agricultural Statistics Service. Annual losses from FHB represented 4.7% of the total value of all wheat production in the U.S. over the same period.

The combined direct and secondary economic losses for all crops were estimated at $2.7 billion. Two states, North Dakota and Minnesota, account for about 55% of the total dollar losses. Losses in other states were not as large, but substantial losses still occurred in Ohio ($315 million), Illinois ($204 million), South Dakota ($183 million), and over $150 million each in Missouri and Michigan.

During 1998-2000, HRS wheat growers incurred the greatest loss, 57.6%; followed by SRW wheat 23.1%; and durum 20.2%. North Dakota and Minnesota incurred the largest losses for all wheat classes combined, at 76%. North Dakota incurred 70% of the total estimated losses for barley, followed by Minnesota at just over 29%, and South Dakota at less than 1%.

When impact is compared by

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Table 1: Total (Direct and Secondary) Economic Impacts from Fusarium Head Blight, All Crops, by State, in the Northern Great Plains and Central United States, 1998-2000

State	1998	1999	2000	Total	By State
ND	425,382	319,440	350,537	1,095,359	40.9
MN	180,635	134,645	59,521	374,801	14.0
OH	215,620	84,269	15,602	315,491	11.8
IL	149,660	53,741	947	204,348	7.6
SD	77,977	77,153	28,299	183,429	6.8
MO	119,474	26,872	12,306	158,652	5.9
MI	101,807	42,337	12,926	157,070	5.9
IN	73,172	24,568	7,983	105,723	3.9
KY	63,695	17,253	4,067	85,015	3.2
Total	1,407,422	780,278	492,188	2,679,888	- - -

Table 2: Total (Direct and Secondary) Economic Impacts for Fusarium Head Blight in All Crops, by Economic Sector and Year, Northern Great Plains and Central United States, 1998-2000

	HRS and SRW Wheat, Durum & Barley			
Economic Sector	1998	1999	2000	Total 1998-2000
Agriculture	42,978	23,825	15,030	81,833
Construction	41,239	22,863	14,423	78,525
Communication & Public Utilities	48,237	26,741	16,868	91,846
Retail Trade	340,482	188,765	119,068	648,315
Finance, Insurance, & Real Estate	76,856	42,610	26,878	146,344
Households	709,769	393,499	248,210	1,351,478
Government	49,380	27,375	17,267	94,022
Other sectors[1]	98,481	54,600	34,444	187,525
Total	1,407,422	780,278	492,188	2,679,888
Total Direct Impacts	457,206	253,475	159,886	870,567
Total Secondary Impacts	950,216	526,803	332,302	1,809,321

[1] Includes sectors such as business, professional, personal, and social services, transportation, and manufacturing.

Table 3: Secondary Employment Losses from Fusarium Head Blight, All Crops, by State in the Northern Great Plains and Central United States, 1998 through 2000

State	1998	1999	2000
	Full-time equivalent jobs		
ND	4,254	3,177	3,476
MN	1,800	1,333	583
OH	2,161	837	149
IL	1,497	531	0
SD	770	761	274
MO	1,193	261	116
MI	1,016	418	124
IN	729	239	75
KY	635	168	34
Total	14,055	7,725	4,831

Economics• *from page 2*

economic sector, household income was hit hardest by FHB, with a $1.4 billion loss from 1998-2000. That was followed by retail trade ($648 million). Finance, insurance, and real estate ($146 million), government ($94 million), communication and public utilities ($92 million) and agriculture ($82 million).

Each dollar of direct economic loss or each dollar of lost producer net revenues would result in an additional $2.08 of lost business activity in state and regional economies. The loss of business activity from 1998-2000 because of FHB would have supported about 26,500 full-time jobs in affected states. Thus, not only are producers affected by FHB through lost revenues, but numerous sectors of the state and regional economies also are affected, says Nganje.

The NDSU study was funded by the U.S. Wheat and Barley Scab Initiative, administered by the USDA's Agricultural Research Service, and launched in 1997 to find research solutions for the grain disease. Tom Anderson, a Barnesville, Minn. farmer and co-chair of the Initiative, points out that the study provides only a snapshot of the economic impact of FHB.

"This problem goes back to the early 1990s, including the widespread Northern Plains epidemic in 1993, the severe epidemic in the East Central U.S. in 1996, and the problem in durum, barley, and soft white wheat production areas this past summer. All told, the full economic impact of scab over the past decade in the U.S. is much greater than the three-year $2.7 billion estimate by NDSU," says Anderson. "Combined with the trend of low market prices and rising production costs, scab has really been an economic blow to affected wheat and barley producers. That's why we need a scab research initiative, to get this grain disease under control."

The full report, "Economic Impacts of Fusarium Head Blight in Wheat and Barley," can be found on the USWBSI Internet web page at www.scabusa.org. ■

Key FHB Forum Deadlines to Note

Nov. 12 -- Deadline for submission of posters and reports for Forum proceedings.

Nov. 16 -- Registration Form due to register at the lower rate.

Nov. 25 -- Last day to reserve hotel at guaranteed availability.

Forum • *from page 1*

and open or panel discussions.

Among this year's guest speakers are Dr. Astrid Mauler Machnik, Bayer Corp., Landwirtschaftszentrum Monheim, Germany, who will speak on "Fungicide Discovery and the Control of FHB." Also, Professor Mariana Ittu, RICIC Fundulea, Romania, who will speak on the "Progress in breeding for scab resistance in Romanian wheat."

Advanced registration for the forum is required. Cost is $90 for registrations received before Nov 16, and $120 after. Conference registration covers Saturday reception/dinner; Sunday breakfast, lunch and dinner; Monday breakfast; refreshment breaks and conference materials including one copy of the Forum proceedings.

Participants are responsible for their own travel arrangements. A block of rooms has been reserved at the Holiday Inn Cincinnati Airport for forum participants. To reserve a room at the Holiday Inn for the forum rate of $70.00+tax/night for a single or a double, call the Holiday Inn directly at (859) 371-2233, and indicate that you are with the National FHB Forum. Reservations must be made by Nov. 25, after which rooms held for the forum will be released and sold on a first-come, first-served basis.

The Holiday Inn Cincinnati Airport is located in the city of Erlanger, Ky at I-275 Exit 2 (Mineola Pike), west of I-75/I-71. The hotel is located right at the end of the exit ramp. The Greater Cincinnati Airport is located about 2 miles from the Holiday Inn Cincinnati Airport. The hotel provides a shuttle service from the airport to the hotel every 30 minutes on the hour and half-hour. You may also schedule a pick-up by phoning the hotel directly using their direct line located in the baggage claim area in the airport.

Questions regarding the 2001 National FHB Forum may be directed to the Networking and Facilitation Office at (517) 355-2236 or scabusa@msu.edu. Participants may register for the forum online at www.scabusa.org, where the forum agenda, hotel and travel information, poster and paper submission requirements, and online proceedings ordering information are posted. ■

Canadian Studies Look To Improve Understanding of FHB

Apart from moisture and warm temperatures at flowering time, little is known about the factors that affect the incidence of Fusarium. Thus, Canadian researchers in several new studies are examining the impact of the proximity of wheat heads to infected stubble, and of production practices such as fertilizer use, tillage and rotation. One study will investigate the infection process itself.

The proximity of wheat heads to infected stubble may have a significant impact, says Dilantha Fernando, plant pathologist at the University of Manitoba. "A research study has shown that the taller varieties do not have as much infection as the shorter varieties. This leads us to believe that the Fusarium inoculum is mainly coming from spores that are being ejected from the stubble that's left behind. These spores may be ejected in such a way that it's harder for them to get up to the heads of taller varieties, whereas the shorter varieties might be more open for infection."

If this is the case, using a cover crop such as medic may help protect wheat from infection, he says. A study by Fernando, Anita Brûlé-Babel and Martin Entz will use spore traps to compare wheat grown with and without the cover crop medic, to see if there's a difference in the number of Fusarium spores moving around under each system. "This study will give us a good feel for whether cover crops have any benefit," says Fernando. "Our hope is the cover crop will reduce the availability of spores that would otherwise infect the wheat heads."

Fertilizers such as nitrogen may prove another key factor, he says. "Many scientists have noted that certain fertilizers, especially nitrogen, might increase the infection and also make susceptible plants even more susceptible. So in the same experiment, we'll also be comparing the effects of low and high nitrogen availability."

Other experiments will examine the effects of tillage and rotation, with Fernando working in collaboration with Jeannie Gilbert of the Cereal Research Center and Debbie McLaren of the Brandon Research Center. "We're looking at no till and conventional till at two main plots, and at sub plots we are using different crops in rotation," says Fernando. "This will give us a closer look at whether these cropping practices have any impact on the incidence and survival of the pathogen."

A third study will examine how Fusarium spreads. "We're interested in really nailing down the infection process," he says. "We're going to use some novel techniques to track the pathogen, beginning from the time the spores land on the heads."

Researchers are interested in finding answers to two main questions, he says. One is whether the pathogen infection occurs before or after toxins are produced and injected into the cells. Another is how the Fusarium-produced toxins travel through cells.

"We have noticed over the years there are some varieties which will not show any symptoms, but you will still see a lot of the toxin accumulation in some of these cells," he says. "This study may help explain why."

A fourth study will look for fast and reliable screening techniques to investigate resistance to Fusarium in the field and greenhouse.

The new studies will piggyback on a major study to screen wheat lines for genetic resistance at the university's new Fusarium disease nursery in Carman, Man. The nursery is supported directly by farmers through the wheat check-off fund administered by the Western Grains Research Foundation. The additional studies are supported by matching funds from Manitoba's Agri-Food Research and Development Initiative.■

Biotech Researchers Conduct Lab Exchange

Wheat and barley scientists received a better understanding of their colleagues' gene transformation research as it applies to FHB, by conducting a lab exchange, so to speak, last summer and this fall. On May 7 and 8, gene transformation researchers from MN, ND, and WI met with scientists and students at Manhattan, KS and Lincoln, NE for laboratory tours and discussions on transformation. Then on Sept. 24 and 25, researchers from KS, NE, and ND met in St. Paul and Madison for transformation research tours and discussions. Summaries of both the southern and northern plains transformation lab visits and workshops are posted on the Internet at www.scabusa.org.■

FHB Reports From Areas of the U.S. in 2001

Negligible FHB in Nebraska

In general, we were very dry in the area that is most likely to have scab. However, our Crop Improvement Association found three samples out of 499 tested for germination that were sufficiently infested with scab to warrant noting. I have not heard from the Crop Improvement Association, but expect the samples came from southeast/southcentral Nebraska near Kansas where we had more rain than in most of the rest of the wheat-growing area. I also expect them to be varieties that are known to be more susceptible. I did see a few infected heads in southeast NE, but they did not appear to be enough to cause major crop damage. – *Stephen Baenziger, University of Nebraska*

Some Wheat with DON Rejected in Kentucky

We had June-like temperatures in May when the crop was flowering and almost all of May was very dry. Thus, too hot and dry and no disease in most of the state. There were some "hit or miss" situations in late May that did get some rain and thus, head blight. But overall, the Fusarium head blight situation in Kentucky was very light. An interesting twist was that we did have some areas of the state where loads of wheat were rejected at the elevator due to excessive vomitoxin, but without any head blight being a problem in the field. Apparently, this situation was the result of delayed crop harvest due to rain and lodging. The deterioration in wheat prior to harvest was evidenced by significant declines in test weight. – *Don Hershman, University of Kentucky*

Late Freeze, Not FHB, Problem in North Carolina

Weather was very dry in North Carolina from head emergence to end of grain fill. We had no disease to speak of, even the perennial favorites: powdery mildew and leaf rust. Our major production constraint was a devastating late spring freeze on April 19. It essentially wiped out wheat in the southeastern part of the state. This freeze plus the dry weather resulted in a 35% drop in wheat production in North Carolina from last year. Yield per

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Barley Samples Being Analyzed for DON

The Department of Cereal and Food Sciences at North Dakota State University is completing the 23rd annual Midwestern Barley Crop Quality Survey. Approximately 300 barley samples are to be collected in North Dakota and western Minnesota during the 2001 harvest. Samples are analyzed for test weight, protein, kernel plumpness, kernel color, and deoxynivalenol (DON). At this writing, 189 samples have been analyzed for DON.

All samples to be collected from Minnesota have been analyzed, and the results indicated that barley from the two western crop reporting districts, on average, displayed levels below 0.5 ppm. This average is slightly lower than that observed for the 2000 crop. No samples with DON in excess of 2.5 ppm were found in either district.

Only 60% of barley samples to be collected in North Dakota have been analyzed. As environmental conditions, FHB severity, and DON levels can change for early to late harvested grain, these preliminary results must be viewed with some care. DON levels appear to be quite variable across the state, and in some cases within specific regions. In general the lowest DON levels have been observed in the southcentral southeast and eastcentral districts. While DON levels averaged 0.6 ppm in these districts, samples with levels as high as 8.1 ppm were detected. The highest levels of DON were observed in the northeast, northcentral and northwest districts of North Dakota, with average levels of 3.3, 5.5 and 8.7 ppm respectively. The 2000 statewide average for barley in North Dakota was 2.2 ppm. Funding for barley sample collection was provided by the American Malting Barley Association, while funding for DON analysis was through the USWBSI. – *Paul Schwarz, NDSU*

MSU Looking for Ways to Refine, Simplify DON Testing and Analysis

The incidence of FHB in soft white wheat was high this year in Michigan, with variable DON levels. Pat Hart, Michigan State University plant pathologist, says that DON levels don't appear to be as bad as in 1996, and not as bad in the western part of the state as last year. However, DON levels of 1 to 4 ppm were common. Some mills rejected wheat with DON levels below 2 ppm.

Hart says MSU continues to look at ways to refine and simplify DON sampling and testing methods, including ways to accelerate sampling at the country elevator, or even conduct infield sampling prior to harvest.

This past summer, Hart came up with an unusual but effective way to prepare a sub-sample of grain for DON analysis: a coffee grinder. Bought used from a gourmet coffee house for about $400 (it would be about $600-$700 new), Hart has found that the coffee grinder can grind a representative sample of wheat for DON analysis faster than industry sampling equipment that costs over $2,000.■

In their research to find better ways to sample grain for DON analysis, MSU researchers have found that a professional grade coffee grinder (at right, bought used for $400) can be as effective at preparing a grain sample for DON analysis as industry sampling equipment (left) that can cost more than five times as much. More cost-effective testing methods would benefit country elevators and may lead to infield DON sampling in the future.

FHB Reports • *from page 5*

acre was off an average of 28%. We all just want to "fast forward" to next season. – *Paul Murphy, North Carolina State University*

Significant FHB in Northeast MO

In Missouri, we had significant levels in the northeastern part of the state and a less severe outbreak in the northwest. Dry conditions throughout the remainder of the state resulted in no scab.—*Anne McKendry, University of Missouri*

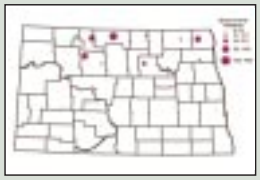
Only a Trace of FHB in KS

We had only a trace of scab here in Kansas this year. It was cooler than normal after heading over most of the state. Moisture was fairly normal.—*Bob Bowden, Kansas State University*

FHB JOTTINGS

FHB Forecasting System Finishes Another Successful Season

This past growing season, the North Dakota State University Small Grains Disease Forecasting System delivered timely information to producers in the region about the potential for development of FHB and other small grain diseases. The graphic below shows low spore counts (small purple circles)



between July 11-16 in dry parts of the state, and high counts (large diameter circles) in areas where scab severity was later shown to be the worst.

Growers who sprayed an effective fungicide based on spore counts and their own intuition about the weather generally received an economic return, according to Len Francl, NDSU plant pathologist who manages the forecasting system. Multiple approaches to scab management — resistance, timely fungicide application, and cultural practices — provide growers with the tools they need to cope with this recurrent but unpredictable disease, he says. The forecasting system, on the web at www.ag.ndsu.nodak.edu/cropdisease, is now inactive for the season but does include a summary of 2001 forecast activity.■

2001 Sees FHB Common, Severe in Some Parts of ND

FHB was common and severe in parts of North Dakota in 2001. IPM field scouts, working for the NDSU Extension Service, evaluated approximately 1,500 wheat, durum, and barley fields in 2001 for presence of diseases and insects. Of the 386 fields surveyed past kernel watery ripe stage (Zadok's 71) for presence and severity of scab, 69% of the spring wheat, 71% of the durum, and 37% of the barley fields had visual symptoms of scab infection.

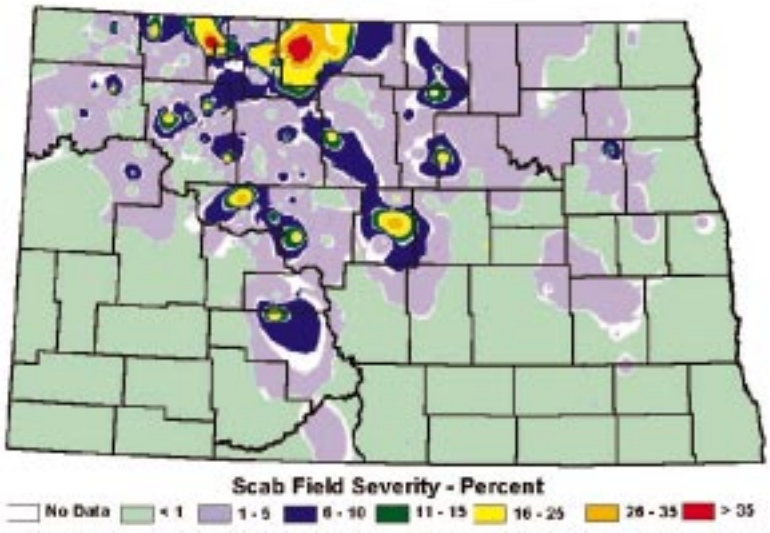
For spring wheat and durum, the greatest concentration of infected fields and highest scab field severities (incidence x head severity) were observed in portions of the central part of the state, and in the northcentral and northwest regions, areas of high durum production *(see graphic)*. Individual field severities ranged from <1% up to 80%, with the highest severities on durum wheat. Continued wet weather, heavy dews, and cloudy days for several weeks extending over the flowering periods of July 11 to July 27 contributed to the severe infections in these regions. Early harvest reports from severely impacted fields indicate low yields, low test weights, high percent damage, and low market grade.

For the barley fields surveyed, observed scab field severities were relatively low, ranging from 0-2.3%, with the highest levels found in Renville and Ward counties in the northcentral portion of the state. Barley fields in much of the state were planted early and developed rapidly during the hot temperatures of July, resulting in maturation ahead of the wet weather that favored scab infections in spring wheat and durum. ■

– Marcia McMullen, NDSU extension plant pathologist

Field Severity of Scab Infections - All wheat

North Dakota IPM Survey - 2001
(Fields surveyed after kernel watery ripe)



Graphic depicts estimated field severity values (incidence x head severity) based on 2001 NDSU field survey data. Individual fields within an estimated range may vary. Graphic prepared by Dr. Phil Glogoza, NDSU Extension Entomologist

FHB Minor in New York

There were only minor occurrences of FHB and vomitoxin contamination in New York soft winter wheat in 2001. While moisture was present during wheat flowering, conditions were very dry from stem elongation through spike emergence, likely inhibiting regional inoculum production.— *Gary Bergstrom, Cornell University*

Some FHB in MN

Although excessive moisture did result in late and prevented planting, particularly in extreme northwest MN, small grain diseases were generally limited this year in western Minnesota. Dry weather in June generally limited the development of FHB. However, FHB could be found in many fields, although severity was low in most cases. FHB progressively became more severe in later planted fields. – *Jochum Wiersma, University of Minnesota*

FHB Reports • *from page 7*

Moderately Severe FHB in Canada

Fusarium levels this year in Manitoba would be classified as moderately severe, not as bad as in 1993 and 1994 but similar in parts of the province, to a 1996 or 97 outbreak, according to Andy Tekauz, head of the cereal diseases section of the Cereal Research Center, Winnipeg. Clear trends emerged from field surveys this season. Crops that were planted in early May before the weather turned wet and halted seeding escaped largely unharmed. While there were some infections, Tekauz characterized these as quite low based on field observations. Later seeded crops bore the brunt of the infections. In the later part of the season, which coincided with the flowering and heading period for later season crops, the risk levels quickly exploded as temperature and humidity climbed. – *Excerpted from a report by Gord Gilmour, Manitoba Co-operator*

Minimal FHB in Virginia

Scab was observed in Virginia in 2001 but the incidence and severity was low. We did notice moderate scab infection in our no-till state variety trial planted into corn stubble at Warsaw, VA. Also, there was a report of a producer who had irrigated his wheat and sustained significant damage from scab. – *Carl Griffey, Virginia Tech*

U.S. Wheat and Barley Scab Initiative Fusarium Focus

This newsletter is made possible by the U.S. Wheat and Barley Scab Initiative administered by the USDA-ARS. For more information about the Initiative, or to submit news items for consideration in this quarterly publication, contact Sue Canty, U.S. Wheat & Barley Scab Initiative, Networking & Facilitation Office, 380 Plant & Soil Sciences Building, East Lansing, MI 48824-1325 Phone: (517) 355-2236 FAX: (517) 353-3955 E-mail: scabusa@msu.edu. This newsletter contains an update on only a sampling of research funded by the USWBSI. For more information on scab research in the U.S., and projects funded by the USWBSI, see the Initiative's website, www.scabusa.org. *Fusarium Focus* is compiled by Prairie Ag Communications, 2607 Wheat Drive, Red Lake Falls, MN 56750.

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