Minnesota Experiment Station

Bulletin 23.

Wheat.

UNIVERSITY OF MINNESOTA.

Agricultural Experiment Station.

BULLETIN No. 23.

SEPTEMBER, 1892.

WHEAT.

I.—MILLING AND BAKING TESTS. II.—CO-OPERATIVE TESTS WITH SELECTED SEED WHEAT.

III.—THE FRIT FLY—PRELIMINARY REPORT UPON AN INSECT INJURIOUS TO WHEAT.

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WHEAT.

MILLING AND BAKING TESTS.

D. N. HARPER.

Twenty-five bushels of each of the following varieties of wheat were milled:

		Test weight as milled.
1.	Pure Scotch Fife	63.5 lbs.
2.	Pure Blue Stem	59 "
3.	Pure Ladoga	57 "
4.	Scotch Fife	61.25 "
5.	Scotch Fife slightly bleached	60 "
6.	Scotch Fife slightly frosted	58.5 "
7.	Scotch Fife badly frosted	58 "
8.	Scotch Fife badly bleached	57.25 "

All of the wheats were grown upon average Red River valley soil near Hallock. Numbers 4, 5, 6 and 7 were from the same farm and grown from the same seed, any differences were the effects of bleaching or frost. The Ladoga was the poorest appearing wheat, smutty, and in a characteristic shrunken condition. The slightly frosted wheat was of the kind commonly called "brac" frosted, and the badly frosted had green grains, and all were shrunken.

The pure Scotch Fife was not in perfect milling condition, as it was a little too hard, and should have been steamed before milling; it broke flinty and the shorts contained more granules of the heart of the wheat than it should have contained. The Ladoga was in the best condition for milling, the Blue Stem next. No. 4 [Scotch Fife] had been threshed while wet, and had been dried out on the floor of the granary and was not in perfect condition on that account. The bleached and frosted wheats were in good condition except for the characteristics mentioned.

The mill used was a Norman & Nordyke short system, belonging to Russell & Hughs of Hallock. The daily capacity of the mill was fifty barrels. In the mill two reductions are made on the wheat, and four smooth roll reductions on the

middlings. The bolting and purifying system comprises one purifier and aspirator, four scalpers, four interelevator rolls and one bran duster.

The Ladoga milled the most easily, the bran cleaned the best, the middlings purified best and came out in the best form. Pure Scotch Fife came second as to mechanical loss of milling and then the Fife No. 4 and Blue Stem. The bleached wheats milled well but did not finish well. The frosted wheats milled badly, the bran was brittle, pulverized easily and could not be cleaned up well; the middlings were correspondingly dark and hard to reduce and purify.

In milling, the conditions were kept as nearly uniform in all cases as possible, and the yields of the various flours, and other products are strictly comparable. In the following table the number of pounds of flour returned as well as of all other products are given, together with the total number of pounds of wheat run through, exclusive of screenings, and the total number of pounds recovered from the mill.

POUNDS OF WHEAT MILLED AND RETURNED.

No. of Sample.	Kind of Sample.	FLOURS.			OFFALS.			TOTALS.		Per cent. Loss—, Gain +
		Patent.....	Straight..	Four X....	Bran.....	Shorts.....	Germ.....	From mill	Wheat run through...	
1	Pure Scotch Fife...	339	544½	96.5	192	25	121.5	1318½	1341	-1.83
2	Pure Blue Stem....	335½	690.5	67	232	33.5	74	1432½	1460	-1.91
3	Pure Ladoga.....	290.5	504	62	210	26	77½	1170	1249	-6.35
4	Scotch Fife	321	626½	15	263	138	88.5	1452	1457½	-1.39
5	Scotch Fife slightly bleached	317	651	38	226	151	75	1458	1456½	x .10
6	Scotch Fife slightly frosted..	302	559.5	64	252½	220.5	108.5	1507	1437	x4.87
7	Scotch Fife badly frosted....	198	507	131	234	36	139.5	1245.5	1434	-13.2
8	Scotch Fife badly bleached.....	301	628	35	248	125	52	1389	1453½	-4.43

These results when expressed in percentages for the purpose of affording a more uniform basis of comparison, are tabulated below. In the first row of figures opposite each kind of wheat the per cent. of each milled product is given, based upon the amount of all returned from the process; in the second row is given the per cent. returned based upon the amount put into the hopper exclusive of the amount of screenings.

PER CENTAGE AMOUNTS RETURNED.

	KIND OF SAMPLE.	FLOUR.			OFFALS.			TOTALS.		Loss—	Time Required to Mill.
		Patent.	Straight.	Four X.	Bran.	Shorts.	Germ.	Flour.	Offals.		
1	Pure Scotch Fife	25.71 25.28	41.29 40.60	7.34 7.05	14.56 14.32	1.89 1.86	9.21 9.06	74.34 72.93	25.66 25.24	1.83	1 hour and 50 min.
2	Pure Blue Stem	23.42 22.98	48.20 47.29	4.67 4.58	16.20 15.89	2.34 2.29	5.17 5 06	76.29 74.85	23.71 23.24	1.91	2 hours and 10 min.
3	Pure Ladoga	24.83 23.25	43.08 40.35	5.30 4.96	17.95 16.81	2.22 2.08	6.62 6.20	73.21 68.56	26.79 25.09	6.35	2 hours and 45 min.
4	Scotch Fife	22.11 22.02	43.14 42.98	1.05 1.03	18.11 17.04	9.50 9.47	6.09 6.07	66.30 66.03	33.70 32.58	1.39	2 hours and 25 min.
5	Scotch Fife slightly bleached	21.75 21.76	44.62 44.69	2.61 2.61	15.51 15.52	10.36 10.37	5.15 5.15	68.98 69.06	31.02 31.04	gain .10	
6	Scotch Fife slightly frosted	20.04 21.02	37.12 38.94	4.26 4.45	16.75 17.57	14.63 15.34	7.20 7.55	61.42 64.42	38.58 40.46	gain 4.87	4 hours and 20 min.
7	Scotch Fife badly frosted	15.89 13.81	40.71 35.36	10.52 9.13	18.79 16.32	2.89 2.51	11.20 9.73	67.12 58.30	32.88 28.56	13.14	2 hours.
8	Scotch Fife badly bleached	21.67 20.71	45.22 43.21	2.52 2.41	17.85 17.06	9.00 8.60	3.74 3.58	69.41 66.33	30.59 29.24	4.43	

These results when expressed in percentages, taking as a basis the result of the largest amount of flour received in each case as 100, will stand in the following relation to each other for the flours:

	Patent.	Straight.	Four X.	Total.
Pure Scotch Fife	100.	85.66	69.77	97.44
Pure Blue Stem	91.09	100.	44.39	100.00
Pure Ladoga	96.58	89.38	50.38	95.96
Scotch Fife	85.99	89.50	9.98	86.91
Scotch Fife bleached	84.59	92.57	25.76	90.42
Scotch Fife badly bleached	84.29	93.82	23.95	90.98
Scotch Fife badly frosted	61.80	84.56	100.	87.98
Scotch Fife slightly frosted	77.94	77.24	40.49	80.51

The amounts of wheat taken for the tests were nearly the same in all cases, and the lengths of time required for milling as given in the table are comparable.

As to the character of the flour the pure Scotch Fife had the best feel and appearance; the Ladoga the worst, and the others range, after the Scotch Fife, in this order: Blue Stem, No. 4, badly bleached, slightly bleached and frosted. These last have a weak, sticky feel and a greyish caste. The bleached flours are weak and very white. The Ladoga has a very peculiar saffron color, quite different from anything else.

BAKING TESTS.

Bread was baked from each lot of flour, and of the patent and straight flours a great many loaves of each were baked at different times to secure reliable results on the following points: (1) the amount of flour necessary to make the best bread with a definite quantity of yeast liquid, (2) the "strength" of the flour as determined by the dimensions of the loaf made from a definite quantity of flour and yeast mixture, (3) the absorptive and retentive capacity of the flour as determined by the weight of the bread made with a definite quantity of yeast mixture and flour, (4) the quality of the bread as determined by its color and texture. The results are as follows:

I. Amount of flour needed to definite quantity of yeast mixture. The ratios of the weight of flour taken are as follows:

Badly bleached	95.52
Bleached	97.18
Slightly frosted	92.84
Badly frosted	94.74

No. 4	93.68
Pure Blue Stem	94.61
Pure Scotch Fife	93.46
Ladoga	98.62

The above figures are the averages of the ratios obtained in separate tests.

II. The ratios of strength as obtained by the measurement of the dimensions of the loaves are as follows:

Badly bleached	95.89
Slightly bleached	90.45
Slightly frosted	96.77
Badly frosted	95.85
No. 4	93.71
Pure Blue Stem	98.73
Pure Scotch Fife	92.74
Ladoga	88.16

III. The absorptive and retentive capacity of the flours are in the following ratios:

Badly bleached wheat	92.31
Slightly bleached	94.05
Slightly frosted	92.09
Badly frosted	92.21
No. 4 [Scotch Fife]	92.72
Pure Blue Stem	92.55
Pure Scotch Fife	99.27
Ladoga	93.82

IV. Color and texture in following ratios:

Badly bleached	99.
Slightly bleached	95.
Slightly frosted	93.
Badly frosted	91.
No. 4 (Scotch Fife)	98.
Pure Blue Stem	97.
Pure Scotch Fife	100.
Ladoga	50.

The color and texture are matters of individual judgment. To eliminate or reduce this as much as possible I had my assistant weigh out the flours and number them indiscriminately, keeping the names and numbers secret from me. In

every case my judgment arranged the loaves in the order stated while the percentages varied slightly.

The pure Scotch Fife bread was clearly the best in every case as to color, texture, and odor. It was a bright, rich, creamy white. The badly bleached Fife came next but was deficient in the richness of appearance. The Fife (No. 4) was richer looking than the bleached but a little dingy in color. Blue Stem was as rich looking as any and of good texture and had a very slight bluish or greenish tinge. The slightly bleached wheat looked weak and rather dingy. The slightly frosted was greyish and the worse frosted noticeably more so. The Ladoga retained its saffron color but intensified and was of quite a disagreeable appearance.

All these remarks and ratios are drawn directly from the results with patent flours but are equally applicable to results from the straight and red dogs.

In the straight flours the characteristic colors of the Ladoga and Blue Stem were more noticeable than in the patent.

CONCLUSIONS.

The pure Scotch Fife wheat proves to be the best wheat, the Blue Stem wheat next and the Ladoga very poor. Any injury done to wheat by reason of its being threshed while wet, bleached or frosted, injures it for milling and for making good bread, the extent of injury varying.

The Ladoga has been shown to be a failure as to yield, both as to quantity and quality, and the milling and baking tests show it to be equally worthless.

SEED WHEAT.

CO-OPERATIVE TESTS WITH SELECTED SEED.

In bulletin No. 15 of this Station issued in February, 1891, notice was given that the Hon. Chas. A. Pillsbury had kindly placed at the disposal of the Station, for free distribution, some pure scotch fife wheat. The object of this generous gift was to demonstrate the benificial results arising from the careful selection of seed. The wheat was distributed under the following conditions:

"1. It shall be planted on new ground, that which has not grown a crop, or on summer fallowed land, or on land which has just raised a crop of potatos, corn or millet.

2. A record shall be kept of the date when planted, size of plot, time when ripe, and dates when harvested and threshed.

3. A small sample of the crop together with a copy of the record shall be sent to the Station.

4. It shall be seeded at the rate of at least one bushel per acre. The wheat will be distributed in packages not to exceed five bushels, and it is suggested that one bushel be the rate at which it is seeded when a press drill is used, and a bushel and a peck when seeded broadcast.

5. A bushel from the crop shall be sent by each farmer to the State Fair of 1891. Mr. Pillsbury will give a premium of $100, divided in three different prizes, for the best samples submitted there. The expense of transportation to the State Fair will be borne by the Experiment Station and the wheat will then be the property of the Experiment Station. This wheat will be distributed next year.

Those desiring this seed will need to make early application, stating the amount of land under cultivation, whether light or heavy prairie land or timber, and that they will observe the requirements."

Over seven hundred applications were received for seed and

the supply was soon exhausted. All of the railroads in the state generously aided in carrying out this experiment by distributing free of charge the wheat along their lines.

The seed selected for this experiment was pure scotch fife wheat.

Owing to unavoidable delay in procuring this wheat it was impossible to clean it by suction blast as was intended. It was, however, well cleaned through a Champion cleaning mill and cockle machine, and was in good condition for seeding. Its germinating power had been tested and found to be high.

This wheat was perfectly pure scotch fife, having been carefully selected for a number of years. The history of the wheat during this time may be interesting and should prove profitable now. It should suggest to each farmer receiving this seed means to keep it pure and improve it.

In 1881 a Red River Valley farmer found a clump of 22 stalks of wheat growing from a single grain, and which matured much earlier than the remaining stalks of wheat in that field. These stalks were pulled when ripe, carefully preserved and threshed by hand. There were obtained 860 grains of wheat, 760 of which were selected for seed and planted in 1882 six inches apart each way on a clean piece of land. These grains yielded 12 pounds of wheat, or at a rate of 40 bushels per acre. In 1883 the seed of 1882 was sown on another piece of clean land in rows 12 inches apart and thick in the rows. The wheat was given thorough cultivation and yielded 17 bushels, or at a rate of 72 bushels per acre. The crop was harvested by itself and garnered in a spare room in the farm house. It was threshed out by hand. In 1884, after cleaning, the wheat was sowed on land which had for the preceding five years been in pasture. This land had been turned down and seeded to timothy because of a rank growth of wild buckwheat. In 1884 the buckwheat appeared again and overran the crop, cutting the yield down to 15 bushels per acre, but the quality was good. The crop was carefully harvested and threshed, keeping the wheat separate from all other lots. Before threshing a half day was spent by two men in cleaning out of the

threshing machine all grains of wheat and weed seeds.

The same care has been observed to keep the wheat pure since that time. It has been grown on new or summer-fallowed land and harvested and threshed separately as long as two kinds of wheat were raised on the same farm. In 1886 it averaged 44 bushels per acre; in 1887 the quality was fine but the winds decreased the yield; in 1888 it escaped the rust and frosts then prevalent; in 1889 and 1890 the quality and yield has been good, the latter averaging in 1890 27½ bushels per acre.

Every two years this seed has been exchanged between two farms 30 miles apart. Although both are prairie farms the beneficial results have been noticeable.

To continue the purity of this wheat and to improve its quality should be the aim of every farmer. This can be done by observing the conditions of the distribution; by seeding on clean ground, harvesting and threshing separately from all other varieties of wheat.

Seed was sent into every county of the state, and owing to the lateness of the following season at which many farmers were compelled to do their threshing on account of the large yield of all grain crops for that year, full reports were not received from many until early in the present year. A few reported loss by a heavy hail storm, while others, especially from the extreme northern portion of the state reported that the wheat crop in general was late on account of heavy spring rains; others reported damage from chinch bugs and late sowing. A large quantity of seed was sent into every wheat growing section of the state, and the season was very favorable for this crop; hence the results are strictly comparable as to yield and weight per bushel and time of maturing, except for the samples damaged by hail, late sowing or chinch bugs as noted. The difference in yield per acre, weight per bushel and time of maturing, color and plumpness are due to the different climatic and soil conditions.

The report of the samples entered for the premium given by Mr. Pillsbury is given first; and then the report on all other samples received up to January 15th, 1892, are tabulated in subsequent pages:

W. F. Cross, Secretary State Fair, Hamline, Minn.:

Dear Sir: The samples of wheat entered for the prizes of the Hon. Charles A. Pillsbury have been adjudged according to the basis of award published in the premium list, and which we quote:

BASIS OF AWARD.

	Points.
Weight per bushel on a scale of	100
Color of grain	100
Plumpness	100
Percentage of glutin	100
Quality of glutin	100

The prizes will be awarded to the five best samples in the order in which they approach the 500 points mark. Of all the samples entered thirteen are much the best and are of nearly equal value, and the result of judging these is given in detail.

First—A. N. Johnson, Hoffman, Grant county.

	Points.
Weight per bushel—62 pounds	100.0
Color	96.5
Plumpness	98.0
Amount of glutin	100.0
Quality	97.5
Total,	492.0

Second—Fred Musner, Millerville, Douglas county.

Weight—62 pounds	100.0
Color	98.0
Plumpness	98.0
Glutin	91.8
Glutin, quality	96.5
Total,	484.3

Third—O. E. Samuelson, Vasa, Goodhue county.

Weight—61 pounds	98.4
Color	100.0
Plumpness	100.0
Glutin	92.0
Glutin, quality	90.0
Total,	480.4

Fourth—Peter Thompson, Cottage Grove, Washington county.

Weight, 61.5 pounds	99.2
Color	96.5
Plumpness	96.5
Glutin	88.7
Glutin, quality	96.5
Total,	477.4

Fifth—E. S. Olsen, Milan, Chippewa county.

Weight, 61 pounds	98.4
Color,	96.5
Plumpness,	97.0
Glutin	91.33
Glutin, quality	92.5
Total,	475.73

Sixth—A. J. Hurley, Lanesboro, Fillmore county.

Weight, 62 pounds	100.
Color	98.
Plumpness	98.
Glutin	83.33
Glutin, quality	95.5
Total	474.83

Seventh—M. H. Smith.

Weight, 61 pounds	98.4
Color	97.
Plumpness	99.
Glutin	77.33
Glutin, quality	99.
Total,	470.73

Eighth—D. L. Wellman, Frazee City, Becker county.

Weight, 61 pounds	98.4
Color	96.5
Plumpness	98.
Glutin	79.3
Glutin, quality	97.5
Total,	469.7

Ninth—L. Kiel.

Weight, 61 pounds	98.4
Color	96.5
Plumpness	98.6
Glutin	81.3
Glutin, quality	91.5
Total,	466.3

Tenth—Theodore Lukens, Lukens, Wadena county.

Weight, 61.5 pounds	99.2
Color	97.0
Plumpness	98.0
Glutin	75.8
Glutin, quality	95.5
Total,	465.5

Eleventh—R. E. Patterson, Pelican Rapids, Otter Tail Co.

Weight, 61.5 pounds	99.2
Color	96.5
Plumpness	98.0
Glutin	73.8
Glutin, quality	98.0
Total,	465.5

Twelfth—J. G. Nelson, Parker's Prairie, Otter Tail county.

Weight, 61 pounds	98.4
Color	96.0
Plumpness	97.5
Glutin	70.2
Glutin, quality	95.5
Total,	457.6

Thirteenth—D. W. Swingh, Appleton, Swift county.

Weight, 62 pounds	100.0
Color	96.5
Plumpness	97.5
Glutin	70.0
Glutin, quality	92.0
Total,	456.0

The prizes are therefore awarded, in the order named, to A. N. Johnson, Fred Meisner, O. E. Samuelson, Peter Thompson and E. S. Olsen. One requirement in sending samples was that all grain submitted should be taken from the machine, and not specially cleaned. As a result all the samples have some weed seeds which, by cleaning, would be removed and the weight per bushel would be thus increased.

But eighty-nine entries were received in time for the fair, and it is quite probable that better samples could have been sent were it not that the fair came too early for the late crop of the year. The major part of the seed was sent into the more northern portions of the state, and at the time the fair was held only a few farmers there had been able to thresh the grain.

D. N. HARPER,
A. C. CLAUSEN,
THOMAS C. HODSON.

Abreviations used in the following tables: pot.—potatoes the previous crop. B't—bright. b. c.—broat cast seeder. subs.—subsoil. B. S.—Blue Stem. Blk.—black.

BLUE EARTH COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded.	Date. Ripe.	Days maturing.	Weight per bushel.	Yield per acre.	Grade.	Notes and Remarks.
350	E. D. Cornish	Vernon	Heavy dark loam	4-28	8-11	105		21		Potatos in 1890.
351	P. McGrath	Good Thunder		4-27	8-17	112		19	1 N	Land not in good condition. Deep b't amber to very slightly starchy.
352	R. L. Houk	" "	Black sandy loam	4-24	8-8	106	62	30	1 H	Potatos in '90. This wheat *much* better than my own.
435	Garry S. Haigh	Mankato	Heavy black loam	4-23	8-8	107		12		Potatos in 1890.

BROWN COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded.	Date. Ripe.	Days maturing.	Weight per bushel.	Yield per acre.	Grade.	Notes and Remarks.
357	Paul Lehman	New Ulm		4-25	8-6	107	60	15	1 N	Weather too dry. Damaged by rust. Deep amber to starchy.

BECKER COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded.	Date. Ripe.	Days maturing.	Weight per bushel.	Yield per acre.	Grade.	Notes and Remarks.
359	D. L. Wellman	Frazee City		4-24	8-12	110	62	37	1 H	L't b't amber inclining to starchy. Good season.
361	J. M. King	Frazee City		5-4	8-17	105	63	28	1 N	Corn and millet in '90. Rust in spots. 50% starchy.
439	John Ruff	Frazee City	Light sandy loam, new	4-4	8-20	118	64	40	1 N	Fifty per cent starchy. Corn and potatos in '90. Season good.

BENTON COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded.	Date. Ripe.	Days maturing.	Weight per bushel.	Yield per acre.	Grade.	Notes and Remarks.
354	A. H. Gates	Rice	Heavy prairie	4-23	8-12	111	63	33	1 N	Nearly all more or less starchy.
355	J. H. O'Keefe	Foley		4-24	8-12	110	63	39	1 H	Corn in '90, clay soil. L't b't amber.

CHIPPEWA COUNTY.

322	N. K. Hogan..	Hogan	Heavy prairie, new land ..	4-24	8-11	109	61		1 H	Due to dry weather only 1/3 of seed sprouted. Deep amber, dirty and shrunken.
328	S. S. Saterlie	Hogan	Blk heavy loam, new land	4-22	8-7	107	62		1 H	Deep amber to very slightly starchy.
323	Hans Larson	Milan	New light soil	4-24	8-9	107	62	22	1 H	Bright amber
324	Ole H. Olson	Milan	Light bottom land	4-28	8-12	106	59		1 H	He thinks this wheat rusts more than B. S. Deep amber. Shrunken.
325	J. H. Klovestad	Milan	New breaking	4-26	8-2	98	61		1 H	B't amber inclining to starchy.
326	E. S. Olson	Milan	Heavy prairie	4-24	8-8	106	62	33	1 H	B't amber.
	John Barnett	Louriston	Black loam, prairie	5-1	8-12	103		24		This wheat is not better than B. S. in his opinion.
	J. A. Hurley	Louriston	Light black prarie	4-6	8-6	122		26	1 H	

CLAY COUNTY.

339	D. O'Donnell	Hawley		5-3	8-21	110		26		Corn in '90. Better than my own S. F. but not better than White Russian.
340	F. W. Cummings...	"					61	20		Light bright amber.

COTTONWOOD COUNTY.

299	M. N. Cadwell	Windom	New land	4-30	8-20	112	63	20	1 H	Light bright amber, some starchy. Too dry when seeded, otherwise would have raised 40 bushels.
303	Adam Burtley	MountainL'ke	Light loam	5-6	8-10	96		7		Damaged by rust very much.
306	F. M. Dyer	Windom	Light loam	4-30	8-15	107	60	15	1 N	Extremely weedy.
307	S. Huntington	Windom	Light loam	4-30	8-17	109	60	15	1 N	Potatos in '90. Seeded too late. Weedy pigeon grass.

CHISAGO COUNTY.

317	J. W. Browning...	Harris	Light sandy prairie	5-1	8-15	106	63	13	1 N	Pot. in '90, very large and starchy.
319	E. M. Brown	North Branch	Sand and clay mixed		8-10		62	22	1 N	Very large and all starchy.

DOUGLASS COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded	Date. Ripe	Days Maturing	Weight per bushel	Yield per acre.	Grade	Notes and Remarks.
288	James Wagner	Millerville	New brush land	4-23	8-15	114	63.2	40	1 N	Large grain; 75% quite starchy. Better than his own.
292	Fred Musner	"	Blk heavy loam, clay subs.	4-24	8-15	113	62.2	34	1 H	Damaged by hail and drouth. Deep amber to very slightly starchy.
289	Wm. Wilkin	"	Heavy loam	5-1	8-22	113	61	35	1 H	Light bright amber, medium, inclining to starchy.
290	P. C. Anderson	Van	Timber cleared in 1889	5-1	8-13	104		40	1 N	Corn in '90; 60% starchy. Weedy pigeon grass.
293	J. S. Reed	Kensington	Heavy loam, clay subs.	4-21	8-18	119	62		1 H	L't b't amber inclining to starchy.
294	J. E. McKinley	Osakis	Timber land, light	4-24	8-10	108	63	18		Corn in '90. Quite starchy.
422	F. von Baumbach.	Alexandria	Sandy loam, gravelly subs	4-18	8-11	115		42	1 H	Season 25% better than last three years.

DAKOTA COUNTY.

285	Wm. McEliot	Lakeville	Rich sandy loam	5-7	8-25	110	60	17.5		Corn in 1890.
286	J. C. Curry	"	Light prairie	5-6	8-14	100	57	16	2 N	Damaged very much from late seeding, very rusty. Amber, shrunken, dirty.
287	L. O. Miller	"	New brush land	4-25	8-7	104	61	25		Corn and potatos in 1890. Seeded too late, very rusty. Light bright amber inclining to starchy.

FREEBORN COUNTY.

268	B. C. Aurud	Albert Lea		5-2	8-15	115	57	16	1 N	Corn in 1890. His own Fife wheat was seeded two weeks earlier, had rust and bleached. Weedy, pigeon grass, &c.

FILLMORE COUNTY.

272	E. N. Larks	Hamilton	Meadow timberland	4-22	8-5	105		8	1 N	Damaged very much by chinch bugs. Corn in '90. Bleached and shrunken, weedy.
273	O. J. Halstad	Hurdal	Heavy, deep black loam	5-6	8-16	102	56	20	1 N	Corn and potatos in 1890. Dirty and Somewhat shrunken.

FARIBAULT COUNTY.

283	J. G Pace	Blue Earth C'y	Heavy loam	4-25	8-20	117	61	20	1 N	Flax in '90. Uniform deep light amber.

GOODHUE COUNTY.

261	Gust R Ericson	Goodhue	Pasture breakage	5-5	8-14	101	62	37	1 H	Damaged by rust. Deep amber to starchy.
262	O. E. Samuelson	Vasa	Blk. loam, well manured	4-22	8-3	103	64	30	1 H	Deep b't amber uniform, rusty.

GRANT COUNTY.

254	A. H. Johnson	Hoffman	Light pasture land	4-19	8-10	113	65	20	1 H	Weather too dry; drill; deep amber, uniform.
255	L. Anderson	Norcross	Heavy blk. pra., clay subs.	4-21	8-8	109	63	30	1 H	Heavy deep amber, uniform. Broke in '89. Not as much S. F. needed for seed as B. S.
257	Aug. Jensen	Norcross	Medium heavy prairie	4-21	8-9	110	63	25	1 H	Light bright amber inclining to starchy. No rust on this wheat some on B. S
256	S. J. Beebe	Ashby	Prairie 8 years old	4-27	8-10	105		15	1 H	Would have had double the amount if seeded early. Season too dry. Millet in 1890. Rusty.
379	C. M. Parker	Herman	Light prairie, new	4-28	8-17	111		13	1 N	Light weight. Seeded too late otherwise I would have raised 30 bu. to the acre.
380	B. F. Ellsworth	Elbow Lake	Old prairie	5-2	8-15	105				His B. S. better. Potatos in 1890.

HENNEPIN COUNTY.

249	Wm. Dubson	Min't'ka Mills	Black loam, clay subsoil	4-20	8-7	104	67			L't amber, 60 per cent. starchy; too dry.

HOUSTON COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded	Date. Ripe	Days Maturing	Weight per bushel	Yield per acre.	Grade	Notes and Remarks.
251	L. A. Tennison		Sandy loam	4.18	8.31	134	59.2	18.2	1 N	Damaged by chinch bugs, weedy. Pot. in '90. Deep amber to starchy, shrunken.

KANDIYOHI COUNTY.

242	G. Van Vorst	Lintonville	Light sandy, new land	4-23	8-8	107	63		1 N	Press drill; 50 per ct. starchy, b't amber.
245	O. N. Grue	Grue	Sandy loam, clay subsoil	4-22	8-11	111				

KANABEC COUNTY.

247	P. O. Peterson	Grass Lake	L't sandy, timber cleared.	4-28	8-14	108	62	20	1 N	Ninety per cent. very starchy.
248	J. H. Stone	Mora	Clay loam, timber cleared.	5-1	8-18	109	59	18	1 N	Fifty per cent. starchy. Corn in 1890.

KITTSON COUNTY.

224	Donald Morrison,	Northcote		4-29	8-24	117	60	32	2 N	Better than average; damaged by frost.
225	J. G. Lindbloom	Hallock	Heavy prairie	4-27	8-19	114	60			Damaged by rain and rust.
	Alex. Gamble	St. Vincent	New breakage	4-23	8-19	118	63			Damaged by hail; 50 per cent. starchy.

LYON COUNTY.

192	Jos. Kenma	Ghent	Prairie broken in 1890	4-23	8-4	103	64	12	1 H	Uniform b't amber. Late seeding cause of small yield.
193	Wm. Marshall	"		4-23	8-3	102	61	24	1 H	Uniform bright amber.
194	O. Decock	"	Medium heavy prairie	4-23	8-14	113	61	28	1 H	Uniform bright amber, some rust on it. Season good.

LINCOLN COUNTY.

197	M. Fowlds	Lake Stacy		4-28	8-24	118					Destroyed by hail.
200	Jas. Hasford	" "		4-28	8-17	111					Sown too late. No good.

LAC QUI PARLE COUNTY.

220	G. L. Labor	Lac Qui Parle		4-28	8-29	123		21			
386	J. E. Gustafson	Nassau	New land, broken in May	4-20	8-4	106	63	20	1	H	Light bright amber, uniform.
	W. G. Smith	Marietta		4-57	8-8	103		20	1	N	Drilled in.

McLEOD COUNTY.

184	David H. Ellis	Hutchinson	Medium prairie	4-22	8-7	107	66	28	1	H	Corn in '90. Uniform deep b't amber.
187	W. F. Higgins	"	New breakage, prairie land	4-28	8-6	100	62	28.2	1	H	The other wheat averaged 22 bu. bleached.

MOWER COUNTY.

153	Thomas Kough	Taopi,	Light sandy loam	4-22	8-15	115	61	17	1	H	Uniform light bright amber. Potatoes in 1890. No rust on this, some on mine.
155	Wm. A. Brown	"	Black loam	4-22	8-12	112	63		1	H	Bright amber, starchy. Earlier B. S. No crop in '90, no rust. Some on farm.
154	Wm. E. Delany	GrandMe'dow		4-25	8-14	111	61	24	1	N	Potatos in '90, slightly rusty; deep amber. Pigeon grass in it.

MEEKER COUNTY.

185	Peter Dille	Bon'ell's Mills	New black loam	5-24	8-12	109	62	33	1	H	Light bright amber, starchy. B. S. went about 30 bushels. Average yield on farm 20 to 25.
	Louis Burgess	Crow River	Sandy soil	4-26	8-5	101		18			Season dry.

MARSHALL COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded.	Date. Ripe.	Days Maturing.	Weight per bushel.	Yield per acre.	Grade.	Notes and Remarks.
159	John Whalen	Stephen	Black loam, clay subsoil	5-14	9.5	114		46.2		Potatoes in 1890. Seeded ½ bu. lengthwise and then ½ bu. crosswise.
168	J. L. Robertson	Stephen	Seven year old prairie	4-29	8-26	119				Millet in 1890.
170	R. A Whitney	Stephen	Light prairie	4-23	8-25	124		35	1 N	
175	Henry Hoper	Stephen	Heavy prairie	4-29	8-29	122		32	1 N	
380	N. J. Engelbratson	Holt	Light prairie	5-7	8-27	112		30	3 N	Badly frosted.
164	M. A. Beckstrom	Fohldahl	Light sandy, brush cleared	4-27	8-27	122	30		2 N	
165	Otto Haug	Fohldahl	Sandy loam.	4-21	8-27	116				Land too rich, wheat lodged.
	Chas. Tohmer	Argyle		4-26	8-25	121				

OTTERTAIL COUNTY.

126	Jonathan Irish	Pelican Rapids	Timber land	4-22	8-20	120			1 H	Corn and pot. in '90, well pleased with this wheat.
128	J. M. Johnson	Pelican Rapids	Timber cleared, old land	5-5	8-25	112			1 H	Wheat in 1890.
392	R. E. Patterson	Pelican Rapids	Timber cleared	4-22	8-23	123	65		1 H	Potatoes in '90. Light amber, starchy.
427	M. F. Jacobs	Pelican Rapids	Bkg. sandy loam, clay subs	4-24	8-21	119		30		Seeder; no rust on this, some on oats.
127	Hugh Kelly	Perham	Meadow, heavy loam	4-28	8-15	109	64	39	1 N	Wheat in '90; 2nd crop, very starchy.
426	J. G. Nelson	Parker's Prair		4-20	8-10	112	63	34	1 H	Oats in '90. Drill No rust on this, some on oats.
428	F. N. Gillmore	Fergus Falls	Heavy clay subsoil	4-28	8-16	110			1 H	Barley in '90; best wheat raised for 6 yrs.
123	Ole Hanson	Leaf Mount'n	Tim. cleared, blk.clay loam	4-30	8-13	105		31		Broadcast seeder.
124	Geo. W. Chaffer	Maine	Clay loam, brush land	5-5	8-10	97	63	37	1 H	Dark amber, starchy. Best crop for 11 years.
125	J. H. Clark	Maine	Brush land, sandy loam	5-5	8-11	98	63	35	1 H	Bright amber, inclining to starchy.
131	John Moore	Maine	Brush land	4-23	8-10	109	64	28	1 N	Wheat in '90, slightly starchy. Looked like frost, due to heat.
132	T. L. Perry & Son	Maine	New brush land	5-0	8-21	112		30	1 N	Corn in '90.

MORRISON COUNTY.

140	Lorenzo Bernhart	Graceville	Brush cleared in '89, sandy loam.	4-10	8-8	120		15		Wheat in 1890.

MURRAY COUNTY.

146	H. G. Day	Slayton	Blk. loam, 3 yrs. old	4-22	8-8	108	63		1	N	A little rust on account of late seeding. Seventy-five per cent. starchy.
150	H. E. Erickson	Hadley	Light loam, clay subsoil	4-23	8-18	117			1	N	Late seeding great draw back.
389	Steven Laible	Iona	New light soil	4-23	8-14	113	62	15	1	H	Season too dry. Deep amber, nearly uniform.
390	Fred D. Hart	Iona	Light soil	4-25	8-16	113	61	17	1	H	Deep amber, starchy. Rust on it and whole farm.

POLK COUNTY.

96	A. St. Michael	Huot	Timber clearing, clay soil	4-21	8-21	122			1	H	
97	Antoine Ray	Huot	Timber clearing, clay soil	4-21	8-22	122			1	N	Damaged by frost.
98	D. B. Ferguson	Mallory	Heavy prairie	5-2	8-17	107		25	1	N	Millet in 1890. Damaged by rust.
393	Wm. Flemming	Mallory	Garden land, black loam	4-25	8-6	103		30			Some rust.
99	Peter Martell	Gentilly	Blk. heavy loam—prairie	5-14	8-31	109					No rust on this, other grain rusted badly.
107	Chr. Hagen	Fosston	L't timb. clear. clay subs	4-29	8-11	104	63	35			Rust on this wheat, little on his own, much on oats.
108	J. F. Uteck	Fosston	Brush breakage	4-21	8-20	121	62	26	1	N	
109	I. S. Erickson	Fosston	Dark loam, clay subsoil	4-28	8-27	121					Rust on this; none on oats.
111	Lyman Clarke	St. Hilaire	Light prairie	4-24	8-24	124					Damaged by frost.
87	J. K. Pederson	Carman	Heavy prairie	5-2	8-25	115					Potatos in 1890.
88	W. N. Gonfray	Maple Bay	New brush land	5-5	8-24	111					
398	P. W. Horton	Maple Bay	Light new prairie	4-27	8-11	106		20	1	H	His B. S. only went 16.2 to the acre.
94	Chas. Rejembal	Crookston	Old pasture land	4-23	8-19	118	62	28	1	H	Amber, inclining to starchy, slightly shrunken.
103	Fabien Rejembal	Crookston	Blk. sandy loam, new bkg.	4-22	8-25	125	61	33	1	N	Deep amber, shrunken.
104	L. Davis	Crookston	Heavy prairie, low	4-27	8-31	126	59.2	25	R		Musty and starchy. Rejected.
106	J. P. Bullaw	Crookston	New heavy prairie	4-23	8-17	116		23	1	H	
112	Hugh Galbraith	Crookston	Prairie land	4-26	8-20	116	62		1	H	Deep amber, uniform.
397	L. H. Judson			4-27	8-24	119					Shoe drill, not better than his own.

POPE COUNTY.

85	Olans Peterson	Langhei	New land, clay subsoil	4-27	8-8	103	65	15	1	H	Corn in 1890.

REDWOOD COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded	Date. Ripe	Days Maturing	Weight per bushel	Yield per acre.	Grade	Notes and Remarks.
73	W. C. Mann	N. Redwood	L't sandy loam, new bkg.	4-21	8-6	107		20		Corn in 1890. Press drill.
75	A. D. Stewart	N. Redwood		4-27						Seeded too late. Crop no good.
77	F. M. Shumacher,	N. Redwood	Sandy loam, bottom land	4-30	8-10	102	62	28	1 H	Corn in '90. Shoe drill, amber deep, uniform.
76	J. W. Marion	Lamberton	Timothy sod	4-27	8-22	117		20		

RICE COUNTY.

59	C. O. Persons	Lester	Rich timb. land, clay subs.	4-20	8-11	113	63	14	1 N	Pot. in '90, l't amber, somewhat starchy
60	C. L. Clover	Dundas	Timber land, heavy	4-23	8-7	106	61	14	1 H	His own went 20 bushels to the acre.
61	N. Becker	Faribault	Low timber land	4-29	8-7	100	62	30	1 H	Bright amber, uniform.
436	Daniel Dillen	Faribault	Low timber land	4-30	8-10	102	61	24	1 H	Deep amber, uniform, somewhat shrunk.
40	Jas. McCaln	Hazelwood	Low timber land	4-22	8-5	105	62	14.2	1 N	Damaged by chinch bugs, oats in '90, b't amber, slightly starchy.

RENVILLE COUNTY.

63	H. H. Olson	Sacred Heart	Heavy, low prairie	4-23	8-11	110	62	20	1 H	Corn in '90, bright amber.
64	C. H. Hopkins	Fairfax	New bkg. sandy loam land	4-20	8-31	133				
67	James Drake	Fairfax	New land	4-20	8-5	107			1 H	Corn in '90. Broadcast seeder, b't amber.
68	Alf. Johnson	Olivia	Light soil, one year old	4-23	8-8	107				Seeded too late, otherwise very good.
69	B. C. McEwen	Buffalo Lake	Heavy prairie, loam.	4-27	8.13	108	61	25	1 H	Choice; very much pleased with it. Flax in '90, b't amber, some starchy.
399	S. C. Dike	Norfolk	black loam, clay subsoil	4-23	8-27	126	62	25	1 H	Bright amber with caps.
400	I. S. Sheppard	Lakeside	Deep, old land	4-25	8-9	106	61	12	1 H	Bright amber, some starchy.

SCOTT COUNTY.

404	A. R. Snow	Prior's Lake	New land, light loam	4-22			59	25	2 N	Corn in '90, musty, 75 per cent. starchy.

SWIFT COUNTY.

32	Wilcox & Liggett.	Benson	Loam, clay subs, prairie...	4-23	8-7	106	65				Drill, bright amber, uniform.
34	N. W. Simon	Benson	Med. l't prairie, new land	4-21	8-12	113	62			1 H	Seeder.
35	J. M. Simon	Benson	" " " " "	4-27	8-12	107	63	16		1 H	Damaged by rust, l't amber, little starchy.
38	W. F. Wilcox	Benson	Sandy loam, clay subsoil..	4-18	8-10	114	63	24		1 H	Corn in '90, new bkge. l't amber, starchy.
409	Ed. Layland	Benson	Heavy blk. loam new pra.	4-27	8-9	104					Potatos in 1890.
36	Ole E. Hegstad	Hegbert	New land, clay subsoil	5-6	8-22	108				1 H	Flax in 1890, press drill, poor on account of late seeding.
37	J. M. Ellingson	Halloway					65			1 H	Deep amber, some starchy.
45	D. W. Swingle	Appleton	Old light soil	4-24	8-6	104	60	28			Raised wheat for three years.

STEARNS COUNTY.

407	Wm. Shuffins	Sauk Centre	Sandy prairie, 1 yr. old	4-23	8-15	114		21			Press drill.
437	R. A. McCoy	Kimball	Heavy blk. loam, tim.land				62	24		1 N	Light amber, starchy.

SHERBURNE COUNTY.

406	James Glipp	Lake Fremont	Sandy loam	4-28	8-7	101		15			
438	Chas. Bridge	Lake Fremont	New land		8-12		61	30		1 N	Fifty per cent. starchy. Good wheat for this country.

STEELE COUNTY.

49	J. S. Cory	Medford	Light prairie	4-24	8-7	105				1 N	Damaged by rust and blight.

TODD COUNTY.

377	O. L. Graves	Nebo	Heavy loam, brush prarie	5-1	8-18	109	61	24		1 N	Deep b't amber to starchy. Shrunken. A little rust.

TRAVERSE COUNTY.

29	Byron Wilcox	Wheaton	Heavy prairie	5-1	8-27	118		10			Injured by frost.

WABASHA COUNTY.

No.	Name of Person.	Town.	Kind of Soil.	Date. Seeded	Date. Ripe	Days Maturing	Weight per bushel	Yield per acre.	Grade	Notes and Remarks.
25	O. E. Boughton	Mazeppa	Clay loam, prairie	4-29	8-10	103	61	19	1 H	Seeded 14 days late, drill, ⅓ better than my own.
27	James Hayes	Millville	Heavy grub land	5-4	8-16	104	61	15	1 H	Deep amber, some grains shrunken, corn in '90, considerable rust on it.
28	J. E. Chasrey	Wabasha	Clay, black, sandy	4-27	8-6	101	64	48	1 N	75 per cent. starchy, straw stiffer, stands wind better.
39	F. H. Floguson	Elgin		4-23			61		1 N	Corn in '89, somewhat shrunken, broadcast, deep amber.

WASHINGTON COUNTY.

434	Peter Thompson	Cottage Grove	Black loam	4-30	8-17	109	62		1 H	Uniform bright amber, ripened ten days earlier than B. S.

WADENA COUNTY.

24	Theo. Lukins	Verndale	Old prairie land	4-27	8-14	109	63	17	1 N	Millet in '90, uniform bright amber, seeded too late.
410	C. A. Alton	Lukins	Brush prairie	5-12	8-24	104	60	22	2 N	
411	Peter Aunt	Wadena					62		2 N	90 per cent. starchy

WILKIN COUNTY.

12	A. W. Morris	Tenney	New land, heavy prairie	4-24	8-10	108	63.5	18	1 H	Broadcast seeder, season too dry, amber, large grain,
13	Jos. Fredericks	Kent		4-22	8-17	117	62	34.3	1 H	Dark amber, large grain, better than B. S.
14	J. B. Rodenmacher	Kent		4-22	8-9	109	63		1 H	
15	J. R. Harris	Kent	New land	5-13	8-6	90	64	21.5	1 H	Drill, amber, large grain.

WINONA COUNTY.

8	Gouston Melcher..	Mt: Vernon					64		1	N	Potatoes in '90, broadc. seeder, starchy.
10	S. Garden	Homer.....	Oak clearing.....	4-28	8-7	101	60	10	2	N	Very starchy, potatos in '90.

WRIGHT COUNTY.

3	W. F. Shattuck....	Clearwater	Black loam, river bottom	4-22	8-8	108	61		1	N	Broadcast seeder, 25 per cent slightly starchy.
424	W. T. Brannan.....	Clearwater	Light, sandy prairie.....	4-24	8-7	106	58	11	1	H	Amber, somewhat shrunken, corn in '90, damaged by drouth.
4	Aaron Reinmuth..	Howard Lake	New breakage	4-26	8-15	111					Cleared of oak, corn in '90.
5	F. T. Prohe	Howard Lake	New breakage	4-29	8-24	117	63	35	1	N	Very little starchy, oak clearing, corn '90.
413	Wm. Fleming	.....	.....				63		1	N	Corn in '89 and '90, 50 per cent. starchy.
6	H. A. Niles.....	Hasty	New land, light sandy	4.25	8-13	108	64	18	1	N	75 per cent. starchy.
7	Levi Drew.....	Hasty	Timber land	4-22	8-9	109	61	18	1	H	Corn and potatos in '90.

SUMMARY OF RESULTS.

	Number.	Per cent.
Total reports tabulated	169	
Total number reporting rust	14	
Total number injured by frost	4	
Total number with reports on weight per bushel	119	
Total number weighing 64 pounds or over per bushel	16	15
Total number weighing 63 pounds per bushel	26	24
Total number weighing 62 pounds per bushel	24	22
Total number weighing 61 pounds per bushel	23	21
Total number weighing 60 pounds per bushel	9	8.2
Total number weighing 59 pounds or less per bushel	11	11
Total number yielding 40 bushels per acre and over	6	5
Total number yielding from 35 to 40 bushels per acre	10	12
Total number yielding from 30 to 35 bushels per acre	19	16
Total number yielding from 25 to 30 bushels per acre	17	10
Total number yielding from 20 to 25 bushels per acre	27	
Total number yielding from 17 to 20 bushels per acre	13	
Total number yielding under 17 bushels per acre	26	

Shortest time for maturing, 90 days; longest, 118 days.

Average yield per acre, 24.1 bushels.

Average weight per bushel, 62 pounds.

Average of days maturing, 106.

In conclusion little remains to be said that is not already recorded in the tables or summary.

The use of good seed wheat, of uniform sized grains, free from foreign matters or other varieties of wheat, when not hampered by rust, dry weather, frost, or insects, results in uniformity in the time of maturing of the crop, a large average yield per acre, and a high average weight per bushel.

PRELIMINARY REPORT UPON AN INSECT INJURIOUS TO WHEAT.

OTTO LUGGER.

This report, though very incomplete in all details, is made at this time to warn farmers against an insect not observed before in Minnesota, and to enable them to prevent more serious losses in 1893. As soon as the life-history of this insect has been studied more thoroughly it will be given in a future bulletin.

During the early part of September a number of letters were received from different parts of the Red River Valley, both from the Minnesota and North Dakota side, in which the writers complained about an insect of some kind that had reduced the wheat crop very materially by partially cutting off the culm (stem) just above a joint from three to four inches above the ground. This took place at a time when the head was filling. The culm above the injured joint wilted, gradually turned yellow, and soon after broke down entirely by bending over at the infested spot. Some of the writers discovered that the injury was caused by an insect of some kind, while many others, less observant, claimed that the injury was due to hail, to a blistering hot sun, or to some other cause. Two gentlemen specially interested in this insect, and fearing greater trouble for next year, invited the entomologist of this station to make an investigation and to suggest remedies. The farm of Mr. Chas. T. Ohmer, of Argyle, Marshall county, was visited first. In one of his fields, from which the crop had been harvested and removed, very many heads of wheat were found upon the ground. The supporting culms had been broken down before harvest, and were consequently not cut by the reaper. These heads were all partly filled with berries more or less badly shrunken, and the culms were still adhering to the roots. The break-

age of the culms had taken place most frequently above a node or joint about three inches from the ground. Just below this breakage, and immediately above the joint, the culprits were found. In most cases but one puparium, but in a few cases two, three, and even more puparia could be found. A puparium is the hardened skin of the larva or worm, made strong by a deposit of horny material. These puparia are glossy chestnut-brown, shading to a yellowish-brown towards the smaller end; faint indication of sutures or segments are visible. All these seed-like objects contained at that time the larvæ or worms which are of a white color. No pupæ could be detected during the investigation, nor can they be found at this date (Sept. 28). Larvæ could not, as a matter of course, exist in such dry culms. These puparia are very similar to those of the Hessian fly, or to the "flax seed stage" of that insect, and this resemblance had given color to the belief of some that this injurious insect had found a home in the valley. It seems, therefore, most likely that the insect investigated hibernates in this stage, and that the puparia are really well protected in this condition, and in the position assumed inside the culm. They are inserted in the material of the upper part of the node, inaccessible by any moisture from the outside, as the culm above does not break off entirely but simply bends in a more or less acute angle a short distance over the puparia, and thus prevents the entrance of moisture. Yet the culm is sufficiently fractured to permit a free exit of the future fly in spring.

A number of other places were visited in the adjoining counties of Polk and Kittson, and it was found that similar conditions prevailed in many fields. In fact the numerous inquiries among farmers plainly indicated that this insect has caused more or less damage over a large area, and that remedies should be applied wherever necessary.

It is not always easy or even possible to explain why any one insect should suddenly appear in such numbers over a large area. It is only by a very careful and long continued investigation that we may sometimes arrive at a true explanation. Here it is readily found in the fact that owing to the wet autumn of 1891, and the equally wet spring of 1892, not

much more than one half of the usual acreage of wheat was plowed, and in many places the shocks of grain had to be left upon the fields. Many inquiries also plainly indicated that small patches of wheat had been noticed in 1891 which showed bleached heads long before harvest, and no doubt these white culms harbored the insect unknown to anyone. Since the culms infested with these puparia were left upon the fields the resulting winged insects were not destroyed, but they issued during the spring of 1892 and greatly extended their domain. The very causes that killed off the armies of young migratory locusts, *i. e.* excessive moisture, protected this new pest.

From all appearances this insect is one of the Frit flies, but which one, remains to be seen by breeding it to maturity. The name Frit fly was given this insect from the fact that Swedish farmers call the worthless grain resulting from injuries caused by such flies "frits."

From the rather few facts we at present possess in regard to this insect in Minnesota one very important conclusion may be reached. As the insects hibernate in the culms of wheat in stubble fields, and very likely remain in that condition until spring, simple remedies are evident and can readily be applied. All that is necessary to kill the great majority of these insects is to destroy the stubble at this time of the year, or as soon as possible. Two methods are feasible: burning the stubble, or plowing it under. Burning can be practiced in some few cases but in many fields there is not sufficient material to do it thoroughly. Plowing therefore, is our best remedy, and no field should be left unplowed that contains such insects, or is suspected of containing them. A very superficial inspection of the fields will show the whereabouts of these insects, if the owner has not already detected the broken culms or heads. By splitting with a knife the joint just below the broken culm the dark puparium will be readily seen. If not the discolored interior of the culm above will indicate its presence, and closer inspection will reveal the culprit. All such fields that contain infested straw should be plowed, and this as soon as possible to make sure; the rest of the fields can be plowed later. In doing

this now we will be sure of one thing: the insects although well protected against moisture will come in lasting contact with the moist soil, the broken tube above will be filled with earth, and the fly can not escape next spring to carry destruction near and far.

The damage caused by this insect in 1892 is by no means a small one. In many places fully one fourth of the entire crop of wheat has been destroyed, and in a great many more the losses amount to at least one tenth. As many places are badly infested the total amount is quite large, and if no steps are taken to prevent it, a repetition may become ruinously large in 1893.