Wheat Stem Sawfly and Harvest Loss

By
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THE presence of wheat stem sawfly[1] in wheat or other susceptible crop is seldom recognized until after the damage is done because the larva, or grub, responsible for the injury feeds inside the stem where it remains hidden from view. Not until these weakened stems begin to topple over prematurely is sawfly injury suspected. Evidence of sawfly activity is most readily seen by opening the stems. The infested stem contains a quantity of fine, powdery material left by the larva in its feeding.

In late summer, when the grain is ripening, most of the larvae will have reached the base of the plants. Here they remain until late spring to emerge as adults. They are slender, wasp-like insects. There is but one generation per year. During the latter part of June the adult thrusts her eggs into the upper portion of the stems through a "sawlike" appendage at the tip of her abdomen. Where these insects are numerous, more than one egg may be deposited in a stem, but only one of the resulting larvae develops. Normally there is but one larva to be found in a stem. The larva is somewhat wrinkled, pale yellow with brown head and at maturity is about one-half inch in length. The young larva works its way downwards in the stem, feeding as it goes. As the grain approaches the ripening stage in August the larva reaches the base of the stem. Here it cuts a shallow groove around the inside of the stem at the ground level, plugs the space for a short ways below with its powdery castings, and then retires into the base of the stem to hibernate and complete its development the following spring. This groove weakens the stem so that it readily breaks over in the wind, thus providing an exit for the insect when it changes to the adult stage.

The wheat stem sawfly is a native pest, having lived on wild grasses until the introduction of wheat and other small grains enlarged its range of host plants. Its occurrence on flax, first observed in 1942 in Saskatchewan by Farstad,[2] is of slight consequence but of great significance. Farstad suggests that the value of flax in ridding fields of the pest far outweighs the damage it does to this crop. The insect cannot complete its development in the flax plant, and, being unable to escape to a more suitable host plant, dies before reaching maturity. In 1944 a slight amount of sawfly damage occurred in flax in North Dakota, but in all instances observed the larvae died before reaching the base of the plant.

The wheat stem sawfly is limited in its distribution almost entirely to northwestern North Dakota and adjoining areas of eastern Montana and prairie provinces of Canada. While present to some extent every

[1] *Cephus cinctus* Norton
[2] Farstad, C. W. Wheat Stem Sawfly in flax. Scientific Agriculture Ottawa, Canada. 24: (8) 383 (Apr. 1944)

year, it is only the occasional year that outstanding damage is recorded. Records indicate that sawfly damage in North Dakota was most severe during the years 1916, 1923 and 1929. Of late the sawfly has been on the increase and in 1943 and 1944 caused extensive damage. High winds and delay in harvesting add to the damage, especially in heavily infested fields. The damage has been sometimes confused with hail injury. Rain prior to harvesting is also responsible for loss by causing the infested stems to collapse.

Where wheat follows wheat or other susceptible crop in the rotation the infestation will be more extensive throughout the field, especially so, if the crop has been seeded into the stubble (stubbled in) or if there has been no other seedbed preparation than shallow tillage at seeding time. Fall plowing of at least five inches depth either destroys the larvae, or delays their development so late the following year that they are not a menace to a crop. Clean summerfallow also rids the field of this pest and aids in safeguarding wheat or other susceptible crop to follow. For years it has been known that the burning of stubble in fall or spring is not effective.

In areas where "strip cropping" is necessary to prevent soil drifting, the problem of sawfly control is increased. This is especially the case where the strips of stubble remain undisturbed until after the insects have emerged in late spring. A study of these fields in the Minot area where the strips were about 10 rods in width showed an average of 48 percent of the wheat stems at the margins containing sawfly larvae; at the center or about 5 rods in from the margins 29 percent of the stems contained sawfly larvae.

Shallow cultivation in the fall, or early spring, which exposes the stubble to the surface is said to destroy many of the sawfly larvae but more evidence on this point is needed to determine its effectiveness in comparison with fall plowing. Resistant crops such as sweet clover, flax, corn, potatoes and oats are especially recommended for growing on infested fields. Late sown spring wheat is less subject to sawfly damage than the early sown fields.

A high degree of field protection has been obtained in some areas by the use of "trap strips." The method was developed in Western Canada where it has extensive application. It consists of a marginal strip of early sown wheat which completely surrounds the field to be protected. The strip need only be a drill width, and should be sown at least a week to ten days in advance of the remainder of the field. Effectiveness of the trap will be improved if a strip of bare ground of similar width intervene between the early seeded outer strip and the later sown crop. The purpose of the trap is to attract the egglaying adults and hinder their invasion of the main crop.

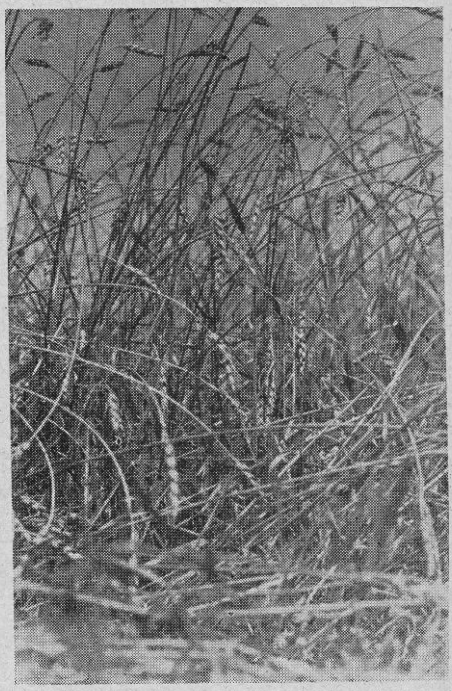

Figure 1—Stems weakened by wheat stem sawfly readily break over in the wind and some heads are lost. Photo taken in a field near Minot in August 1944.

The question is occasionally asked **"What does wheat stem sawfly damage represent in bushels of grain lost per acre?"** Obviously it is impossible to give one answer that will fit all situations. The loss will be influenced by the degrees of infestation, the type of weather prior to harvesting, the kind of harvesting machinery used, and possibly other factors. In 1944 infestations were observed ranging from less than one percent of stems affected to above 75 percent. High winds and delay in harvesting add to the damage, especially in heavily infested fields. For this reason it is standard recommendation to harvest the fields as soon as they are ripened enough to avoid abnormal shrinkage of the grain. Reference to Table 1 showing harvesting dates and corresponding grain losses, together with consideration of the data on maximum daily wind velocity, in Table 2, support this recommendation.

More grain is believed to be lost following straight combining than by the use of the binder for the reason that the binder is more readily lowered to retrieve the heads of infested stems which are broken, but not fallen beyond recovery. The damage due to sawfly is seldom uniform over the field. Ordinarily the edges of the field bordering native grassland show the heaviest infestation. To determine the loss caused by wheat stem sawfly, fallen heads were collected from square yard areas at the edge, and at well distributed points up to 200 yards into infested and non-infested fields of wheat which had been "straight" combined. The difference in loss represented by this sampling indicates the net loss of grain caused by sawfly under a limited set of conditions. Unfortu-

NORTH DAKOTA
WHEAT STEM SAWFLY INFESTATION DURING 1944

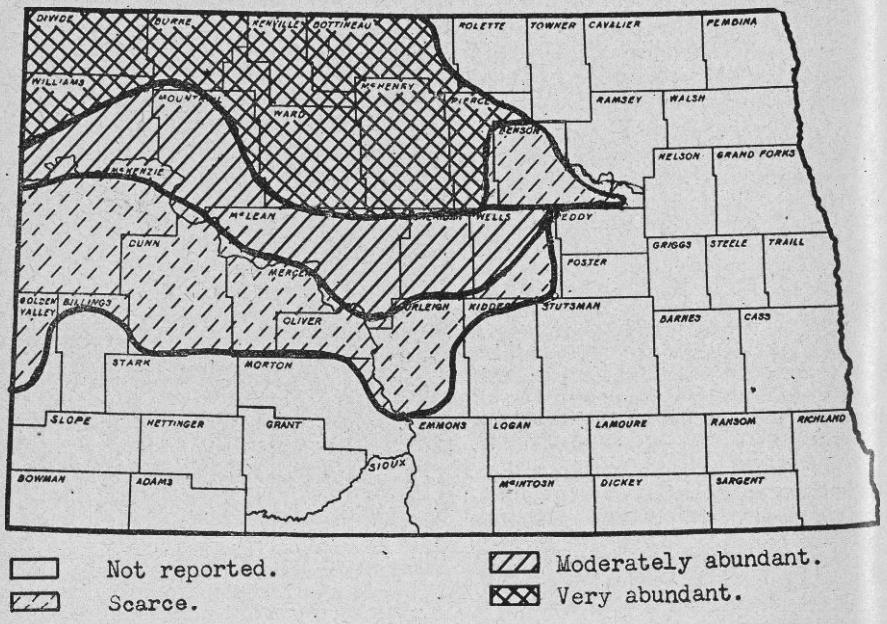

Figure 2—Wheat Stem Sawfly infestation during 1944 in North Dakota

nately time and facilities did not permit the collection of data under a wider range of situations which might have considered the loss following "swath" combining and the binder.

All fields used in the work had been in small grain crops in 1943, and remained in stubble until the spring of 1944 when cultivated preparatory to seeding the wheat. The field histories were obtained from the farm operators. Sawfly incidence was determined from stubble collections obtained while making the collections of fallen heads. The wheat was removed from each collection, weighed and the average of the weighings for each field used in computing loss on the acreage basis. The information is presented in the following table:

Reference to Table 1 shows the harvest loss of grain in the sawfly infested fields to be nearly 7 times greater than for the non-infested fields. The difference in loss per acre for the two areas may be attributed largely to wheat stem sawfly which weakened the stems and caused the heads to fall on the ground prior to or during harvesting. Infested stems are not well anchored to the ground, hence the heads, because of their weight, tend to tip lower at the slightest opportunity. While the harvesting machinery is a contributing factor, wind is probably the greatest agency in knocking these heads down.

On the basis of the official estimate of wheat acreage for 1944 and the indicated loss caused by wheat stem sawfly in the area where the pest was "very abundant" the loss of wheat in North Dakota approximated 2,781,240 bushels. To this might be added the loss sustained in the areas designated, on the map, "moderately abundant" and "scarce," if figures on the per acre loss in these latter mentioned areas were known.

Table 1. SHOWING HARVEST LOSS OF GRAIN IN INFESTED AND NON-INFESTED WHEAT FIELDS.

Field Designation	Area	Date Harvested	Grain Lost Per Acre	Percent Sawfly Infestation	
				In the 25 yard margin of the the field	200 yards inside of field
A	Minot	8/17/44	1.65 Bu.	36	9
B	Minot	8/10/44	1.71 Bu.	48	21
C	Minot	8/10/44	1.26 Bu.	35	6
D	Minot	8/24/44	2.53 Bu.	29	15
E	Minot	8/24/44	1.89 Bu.	31	8
Average for Infested Fields			1.80 Bu.	36	12
F	Jamestown	8/17/44	.34 Bu.	0	0
G	Jamestown	8/14/44	.20 Bu.	0	0
H	Jamestown	8/14/44	.31 Bu.	0	0
I	Jamestown	8/14/44	.29 Bu.	0	0
J	Jamestown	8/7 /44	.17 Bu.	0	0
Average for Non-Infested Fields			0.26 Bu.	0	0

Table 2. MAXIMUM DAILY WIND VELOCITY

August '1944	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Jamestown	12	47	28	29	14	17	24	32	25	20	30	25	18	12	13
Minot	18	20	30	21	10	27	40	20	29	27	30	23	16	11	14
August 1944 16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Jamestown 10	9	28	24	15	14	15	8	17	23	22	21	12	15	32	35
Minot 25	12	22	28	23	27	10	10	27	25	23	17	12	25	34	34

(U.S. Weather Bureau—Courtesy of F. J. Bavendick, State Meteorologist)

Sawfly damaged stems are most subject to being blown over during August. On most days the wind reached velocities sufficient to cause increasing numbers of the sawfly weakened stems to break over.

Occasionally the question is asked, **"do infested stems yield less than non-infested stems?"** In an effort to secure an answer a comparison was made of the weight of wheat obtained from 300 heads of infested stems and 300 heads of non-infested stems. The heads were collected in lots of 100 each from a field near Rugby on August 30, 1944. The field showed 36 percent wheat stem sawfly infestation at the margin. The grain was removed from the heads, weighed, and the data tabulated as follows:

The slight difference in weight of wheat from infested and non infested stems, as shown by table 3, indicates that sawfly damage causes no significant reduction in yield of the individual heads. The chief loss, as previously indicated is due to the heads of infested stems dropping to the ground.

Special appreciation is expressed to Dr. F. Gray Butcher, Extension Entomologist who conducted the survey upon which the 1944 distribution map of wheat stem sawfly is based, and to Mr. Stanley Saugstad, formerly Assistant Entomologist of the North Dakota Agricultural Experiment Station, for valuable assistance in the investigation of this problem in the Minot area, where he is now engaged in farming.

Table 3. WEIGHT OF WHEAT FROM INFESTED AND NON-INFESTED STEMS

Number of Wheat Heads	Weight of Wheat from Infested Stems	Number of Wheat Heads	Weight of Wheat from Non-Infested Stems
100	40.340 grams	100	40.970 grams
100	40.170 grams	100	40.035 grams
100	40.645 grams	100	40.615 grams
300	121.155 grams	300	121.620 grams

Dr. D. F. Eveleth, Chairman of the Department of Veterinary Science of the North Dakota Agricultural College and Experiment Station, has been named a member of the Committee on Parasite Diseases for the United States Livestock Sanitary Association. Dr. Eveleth has given much attention to the problem of internal parasites of sheep.

Dr. J. A. Munro, Station Entomologist and Professor of Entomology was honored by the Ohio State Beekeepers Association at their winter meeting in Columbus, Ohio, January 30 to Feb. 1, 1945, by being presented with a gold key in recognition of his contributions to the science and art of beekeeping. E. R. Root, the veteran apiculturist of Ohio and James I. Hambleton, apiculturist in the U. S. Department of Agriculture were similarly honored. Dr. Munro's friends and colleagues in North Dakota congratulate him on this splendid recognition.