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Loose Smut of Wheat, Spelt and Barley

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Loose smut disease is common throughout Michigan wherever wheat or barley is grown. It is highly visible when the grain heads are protruding from the boot in early summer. Annual losses from this disease however, can now be reduced to insignificance by a new and comparatively safe seed treatment.

Ionia and Genesee, the most commonly grown white winter wheat varieties, are among the most susceptible. The red winter wheat cultivars Abe and Arthur contain considerable genetic resistance. The most severe infestation was seen in spelt where homegrown seed was sown.

LOSSES

Loss in yield is almost directly proportional to the percentage of infection by the causal fungus. If 5% of the heads are infected, yield will be reduced by about 5%.



Two heads of spelt infected by loose smut fungus. Van Buren County, 1968.



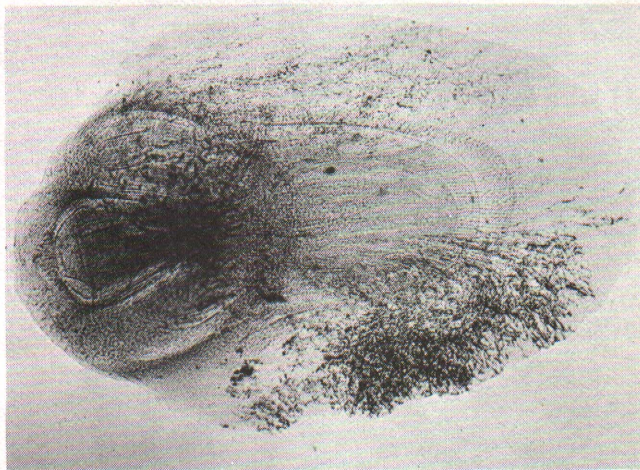
Right: Normal healthy head of wheat.
Left: Infected head with black mass of fungus spores.

A 1974 loose smut survey of 230 seed wheat fields revealed an overall incidence of 0.31%. One field of Ionia contained 2.36% infected heads.

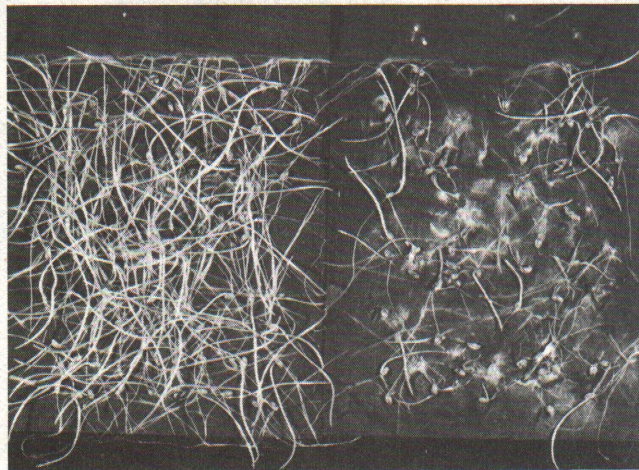
A survey of 14 commercial fields disclosed 0.59% loose smut with a high of 3.52% where certified seed was used and 4.37% where two seed years from certified was planted.

A grower can estimate his own loss per acre by determining the percentage of heads with loose smut multiplied by a factor (0.8 if less than 5% loose smut and 1.0 if 5% or more) multiplied by the yield per acre in bushels times the current selling price of wheat. For example: 5% loose smut x 1.0 x 60 bu/A x \$4.50 = \$13.50 loss per acre. In seed fields, the loss is continued into the next crop because some of the harvested grain will contain the loose smut fungus.

A 1½% average statewide infected heads in a normal year translates into loss as follows: 1.5% x 0.8 (factor) x 40 bu/A x 910,000 acres harvested in 1974 x \$4.50/bu estimated price equals a loss of \$1,965,600.00. This is all due to 1.5% loose smut during the summer resulting from planting infected seed without adequate seed treatment.



Excised embryo of barley seed showing dormant dark mycelial threads of loose smut fungus.



Seed treatment of wheat. Left: Treated with maneb fungicide. Right: Not treated. Note mold growth of seed-borne fungus, *Fusarium graminearum*.

CAUSE

Loose smut of wheat and spelt is caused by the fungus *Ustilago tritici* and loose smut of barley by the closely related fungus *Ustilago nuda*.

The fungus lives in the embryo of the infected kernel. As the seed germinates and the young plant grows, the fungus grows inside the wheat or barley plant until it reaches the seed head at flowering time. The grain head becomes completely filled with the black spores of the fungus. These spores are released and carried by wind currents to adjacent clean flowering heads where the fungus germinates and enters the embryo of the forming seed. This infected seed appears normal but when dissected, the mycelium of the fungus inside is visible under the microscope as fine black threads. If this seed is planted, the disease cycle of the fungus is repeated.

APPEARANCE

The smutted heads are readily recognizable by the mass of black spores. Upon wind dispersal of the spores only the bare rachis (stem) remains and these are easily overlooked as harvest approaches.

CONTROL

The causal fungus lives within the embryo and hence is beyond the reach of mercury and other previously used fungicides. Several hot water treatments are effective to inactivate the fungus but these are seldom used except for special seed lots because of inconvenience.

Some disease spread is reduced by microscopic examination of seed lots, particularly for barley, and

rejection for sale of lots with excessive infection. Additional control is attempted by inspection of seed fields. This inspection is usually conducted after the spores have been released and the inconspicuous bare rachis is present. The Michigan standard of up to 2% permissible in foundation seed fields and up to 5% permissible in certified seed fields is virtually no protection to the seed purchaser unless effective seed treatment is used.

Recently a new systemic fungicide 5, 6-dihydro-2-methyl-1, 4-oxathiin-3-carboxanilide, known by the generic name of carboxin, was found to inactivate the loose smut fungus within the embryo. Numerous tests indicated an effectiveness of 95 to 100%. Carboxin did not gain widespread use because of cost, application difficulties and restriction to seed production crops. Carboxin is sold under the trade name of Vitavax. In addition to loose smut, carboxin controls stinking smut of wheat (common bunt) and covered smut of barley.

Effective seed treatment requires the addition of a broad spectrum fungicide to control seed rots and seedling diseases caused by other fungi. Maneb, thiram, mancozeb, and captan are some of the more commonly available broad spectrum fungicides. On September 3, 1974, the Michigan Department of Agriculture approved on an annual basis a combination of 17.0% thiram and 17.0% carboxin to be sold as Vitavax 200.

Effective control of seed-borne diseases requires thorough coverage of the seed. The slurry method with mechanical mixing assures thorough coverage. Planter box treatments generally do not assure such thorough coverage of the seed. Directions on the label by the manufacturer should be followed. Treated seed must be protected from accidental introduction into feed or food channels.