

EARLY CORN INBRED REACTIONS TO HEAD SMUT, COMMON SMUT, AND COMMON RUST

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Head smut (caused by the fungus *Sphacelotheca reiliana* [Kuhn] Clint) has recently been found in North Dakota. This disease often produces masses of black spores in infected corn plant tassels (Figure 1). Head smut can be distinguished from common smut by the absence of a light colored persistent membrane which surrounds the gall in common smut (Figure 2). Proliferation of floral parts in the tassel (Figure 3) and ear often occurs. Plants infected with head smut, unlike common smut, rarely produce grain and often are greatly stunted (1, 2). The disease has been reported to be more severe on corn planted late (soil temperatures around 70°F) in sandy soils. Subsequent water stress may further predispose plants to infection.



Figure 2. An ear of a plant infected with common smut. Note the membrane which surrounds the gall.



Figure 1. A typical tassel of a corn plant infected with head smut. Note the absence of a membrane surrounding the spores.

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Figure 3. A tassel of a corn plant infected with head smut. Note the abnormal proliferation of floral parts.

Common smut (caused by *Ustilago maydis* [DC.] Cda.) infected corn in North Dakota for many years. Plants infected by common smut produce galls surrounded by a white membrane usually have reduced grain production but only rarely are stunted with complete loss of grain as occurs normally with head smut.

Common maize rust (caused by *Puccinia sorghi* Schw.) also has been present in North Dakota for many years. It can be recognized by the cinnamon-brown powdery pustules scattered on both leaf surfaces (1, 2). Infections normally occur relatively late in the growing season and little if any yield reduction occurs. However, if conditions are favorable for early infections, yield reductions can result when the disease appears before or during silking.

Head smut was found in a field near Oakes, North Dakota in 1980. In 1981, adapted corn inbred lines were evaluated for resistance to head smut, common smut and common rust†. The study was seeded June 5 and June 17, 1981 (four replications per date) and evaluated in early September. Head smut and common smut infection levels were determined by counting diseased plants and computing the percentages of infected plants in each plot. Common rust was evaluated visually on a

plot basis by examining a sample of four leaves and rating the leaf showing the highest infection level. Evaluation was on a one to nine scale with one being assigned to leaves having no infections and nine to leaves completely covered by pustules.

Volunteer corn plants from the seed of the susceptible hybrid grown the previous year were removed at each planting date, but an appreciable number germinated later. These plants were infected badly with head smut and, to a lesser extent, with common smut. This indicated that the inoculum was present uniformly in the plot area and that lines without infections probably were resistant rather than escapes due to a lack of inoculum.

Head smut was completely absent in eight released lines (ND11RF, ND300, ND376, ND405, ND408, ND478, CM105, and CM174). These early maize inbreds, while not screened previously for resistance to head smut, appeared to be resistant and may warrant further screening. Some may have potential as parents of head smut resistant corn hybrids for this region. Other inbreds (ND246 and ND100) appeared to be susceptible and should not be used as parents in areas where this disease may be a hazard.

Table 1. Head smut, common smut, and common rust infection levels of selected corn inbred lines.

Inbred	Head smut infection			Common smut	Common rust
	Date 1	Date 2	Both		
	-----%-----				(1-9)‡
ND11RF	0.0	0.0	0.0	3.8	2.8
ND12RF	1.8	0.0	0.9	1.0	3.0
ND203	4.2	0.0	2.1	4.3	4.2
ND240	2.1	0.0	1.1	0.0	2.8
ND241	0.8	1.2	1.0	1.6	4.0
ND245	4.7	2.6	3.7	4.8	6.2
ND246	15.8	1.7	8.7	3.0	6.0
ND248	1.0	1.9	1.4	2.1	2.2
ND300	0.0	0.0	0.0	0.0	2.0
ND301	2.1	1.1	1.6	0.0	3.5
ND100	11.2	5.6	8.4	2.5	2.0
ND302	4.0	0.0	2.0	0.0	1.8
ND309	1.0	0.0	0.5	0.0	2.2
ND363	5.8	0.0	2.9	0.0	2.0
ND376	0.0	0.0	0.0	0.0	3.2
ND385	5.3	0.0	2.6	0.0	1.5
ND405	0.0	0.0	0.0	1.2	4.5
ND407	4.0	0.0	2.0	5.5	4.0
ND408	0.0	0.0	0.0	0.0	3.2
ND468	0.0	2.3	1.1	0.0	1.2
ND474	2.1	0.0	1.0	1.9	1.8
ND478	0.0	0.0	0.0	0.8	3.5
ND480	1.0	0.0	0.5	1.2	5.2
ND481	1.3	0.0	0.7	0.0	1.5
A654	3.4	0.8	2.1	0.0	2.0
CO109	8.3	0.0	4.2	0.0	2.8
A509	2.5	0.0	1.2	2.1	1.8
CG10	3.4	0.0	1.7	0.0	1.8
W64A	1.0	0.0	0.5	6.2	1.3
W59E	2.7	0.0	1.4	0.0	2.2
CM105	0.0	0.0	0.0	0.0	2.0
CM174	0.0	0.0	0.0	0.0	1.8
L.S.D. (0.05)†	6.4	3.3	3.8	6.0	1.4

†The Least Significant Difference (L.S.D.) is an aid to determine the significance of differences between two lines. If the difference is greater than the L.S.D. (0.05) value, the chances are greater than 19 to 1 that it is a real difference and not due to other factors such as chance or random field variation of inoculum levels.

‡The scale used in common rust is 1 to 9, with 1 assigned when no pustules were found and 9 when the leaves were covered completely.

There were no significant differences between planting dates for common smut and common rust infection levels, so these ratings were averaged over dates. Resistance to common smut is always a selection criterion in the North Dakota corn improvement project, while resistance to rust is a criterion only when natural infection levels are moderately severe. Yield losses from rust are much less than those from the other two diseases, so selection against susceptibility to this disease has been less rigorous. Probably due to the relative emphasis in previous selection, all lines showed some level of rust infection, but 17 lines were not infected with common smut and most others were infected at quite low levels. Only two lines, ND407 and W64A, had infection levels above 5 percent.

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their family responsibilities seriously. However, unlike their ancestors, these women do not expect their children to help with household work. Also unlike their ancestors, these women are dedicated to employment outside the home and work for career advancement.

They feel a commitment to both their career and family. They are employed because of financial reasons, but mainly because of dedication to their jobs. Generally, they do not expect their children or husband to help them with home related work, but they do try to get their husbands to see the problems faced in combining employment and caring for a family. Their worries are

Six lines (ND300, ND376, ND408, ND468, CM105, and CM174) were resistant to both smuts, but resistance to one of these diseases does not necessarily imply resistance to both. Genes for resistance to these diseases are different. The resistance is expected to be quite stable, once seed companies identify lines possessing this resistance and use them to produce resistant hybrids.

Head smut can cause severe yield reductions, but it is not expected to become a major problem for corn producers of this area. Seed companies producing hybrids for this region are capable of rapidly shifting to resistant hybrids since most inbreds appear to be resistant to this disease. Future inbreds undoubtedly will be screened for resistance to head smut if the disease appears to be a serious hazard.

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mostly related to their family's well being, but they also worry about themselves and financial matters.

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