

Head Smut

established in California

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Head smut—*Sphacelotheca reiliana*—a soil-borne fungus disease, which can not be controlled by chemical seed treatment, is one of the most destructive enemies of corn, sorghum, and sudan-

grass. It has become established in central California and appears to be increasing in severity and spreading in area.

The widespread planting of susceptible

corn, sorghum, and sudan varieties during 1956–60 has resulted in a marked increase in the prevalence of head smut. In 1960, an estimated 210,000 acres were planted to field corn, 281,000 acres to grain sorghum, and 7,500 acres in sudangrass. Head smut is found in at least eight counties in central California.

In field corn, head smut is often found in the delta areas of Sacramento, San Joaquin, and Solano counties. Twenty-one occurrences of head smut in delta corn fields have been recorded in 1959–60 with infections ranging from trace to 38.6% of the plants smutted. The disease was most frequently found in fields of King Philip hybrid maize grown for its



Head smut of clump of corn plants in the field.

Sporulation and Prevalence of Head Smut in Three Field Corn Varieties Grown in the Sacramento-San Joaquin Delta Region

Sporulation site on plant	Variety and per cent smut*		
	Kings-croft KY7A	Pfister 347	King Philip
Smutted ears only	10%	12%	10%
Smutted tassels only	54%	39%	56%
Both ears and tassels smutted	36%	49%	34%
Smut prevalence in fields	6.5%	10.7%	11.2%
County location of fields	Solano	Sacramento	San Joaquin

* Calculations are based on a total of 2,272 smutted plants examined in commercial fields of the three varieties.

Comparative Incidence of Head Smut Occurring in Varieties of Sudangrass, Grain Sorghums, and Hybrids in California*

Sudangrass		Grain Sorghum		Hybrid Sorghum	
Variety	% smut	Variety	% smut	Variety	% smut
Greenleaf	40	Dwarf White		T-601	26
Sweet	33	Durra	26	RS-610	25
Sudan-23	11	Norghum	21	DeKalb	
Sudax		Chiltex	17	E-56a	24
SX-11	5	Ryer-15	16	RS-590	22
Tift	2	D.D. Yellow		T-660	14
Wheeler	2	Sooner	12	RS-650	13
Piper	1	Reliance	8	Amak R-10	12
Lahoma	0	Double Dwarf-38	7	NK-210	11
		Dwarf Yellow Milo	7		

* Smut-infection data were obtained from inoculation experiments except for RS-610, Amak R-10, and NK-210 which were derived from surveys of commercial fields.

fine-textured papery husks used commercially as tamale wrappers. Other corn varieties found harboring the disease were PAG-323, PAG-347, Kingscrot-KY7A, Pioneer-352, and Pioneer-302.

The black spore masses of head smut appear only in the ears and tassels of corn. Often only the ear or the tassel is infected although commonly both are smutted. When an ear is infected the entire structure is reduced to a mass of smut with fine thread-like strands running through it. Plants with smutted tassels are usually dwarfed and fail to develop ears. The fungus lives over in the peaty soils of the delta and consequently infected corn is found in clumps of 3-6 smutted plants.

A pronounced increase in the prevalence of sorghum head smut has occurred since the advent of the high-yielding but smut-susceptible grain sorghum hybrids. During 1957-60 head smut was recorded in no fewer than 18 hybrid varieties in California. These perpetuate the smut by adding spore inoculum to the soil and thereby accentuating the disease problem in subsequent sorghum crops grown on the same land. Once established the fungus also attacks the old standard varieties of grain sorghum with almost equal virulence. Head smut in sorghum is now widespread in Butte, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties, with greatest losses—9%—41% of plants smutted—occurring in the delta region. Traces of head smut have also been found in Contra Costa, Madera, and Fresno counties.

Head smut of sorghum transforms the entire head into one large mass of black spores which first becomes apparent at heading time. Yield losses result from diseased plants with smutted heads occurring on dwarfed tillers. These may be obscured by leaves and thus escape detection. The smutted head is covered by a white membrane which soon breaks and allows the spores to be scattered by wind and rain to the soil where they overwinter. Once the soil is contaminated the planting of disease-free or chemically treated seed does not prevent infection.

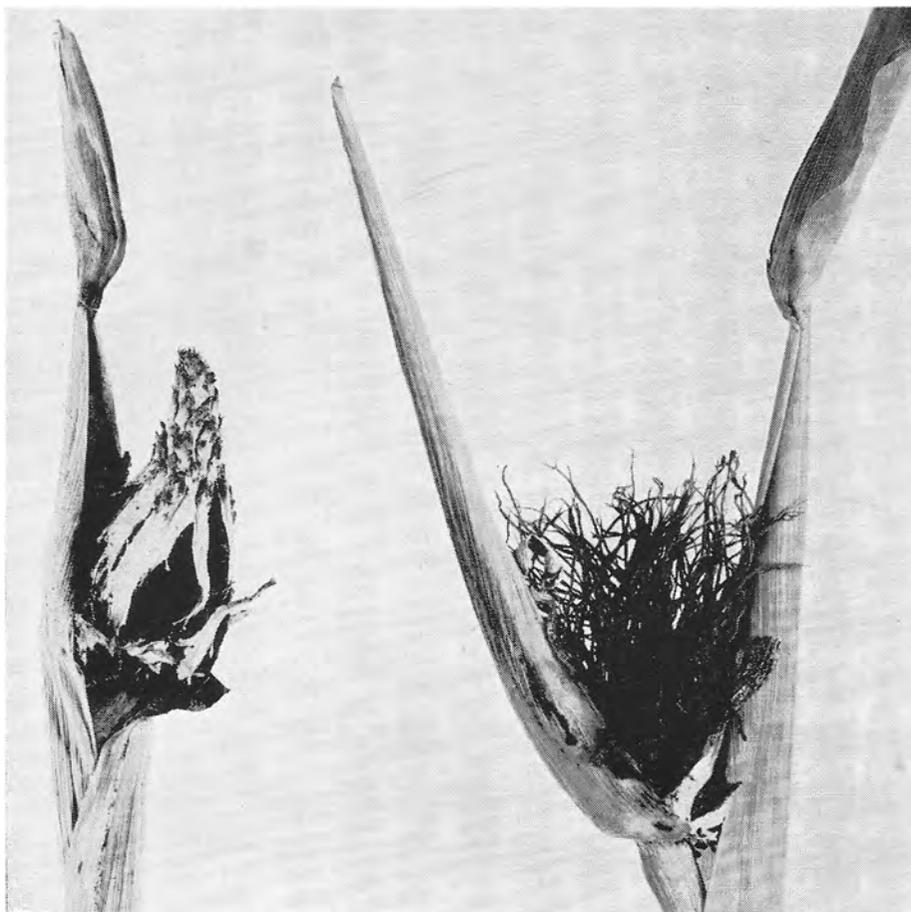
With the introduction of Greenleaf sudangrass to be grown as a certified seed crop in California in 1957, head smut first came into economic prominence. During 1957-59 head smut was commonly found coextensive with Greenleaf production primarily in Colusa, Glenn, Sacramento, Solano, Sutter, and Yolo counties. Stringent regulations dis-

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Left to right—a tassel partially infected and a corn ear completely displaced by smut.

Smutted sorghum. Left to right—a diseased panicle of NK-210 grain sorghum and a smutted panicle of Leoti forage sorgho.



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qualified sudan crops from eligibility for seed certification even when traces of head smut were found. Thus seed growers suffered losses where the disease was present. As a consequence the acreage of Greenleaf sudan grown for seed production was drastically curtailed from 2,579 acres in 1957 to 138 acres in 1960. The smut, however, is still perpetuated in Sweet Sudan, Sudan 23, and by susceptible volunteers which persist along roadsides, irrigation ditches, and fence rows. No head smut has been found in commercial fields of the variety Piper. The smuts on sudangrass and grain sorghum are known to be the same race. Cross-inoculation studies with soil-borne smut spores from sudangrass and grain

sorghum resulted in uniform cross-infection. Therefore, sudangrass and sorghum should not follow each other in rotation.

Two strains or races of the head smut fungus occur in California, one attacking corn and the other sorghum and sudan. These two races are distinct, however, and do not cross-infect. Thus sorghum and corn may follow each other in rotation. The fungus lives over as viable spores in the soil and the amount of infection in any field depends largely upon the inoculum level present in the soil. Susceptible crops when grown in succession in the same field result in a build-up of inoculum and an intensification of the disease with each successive crop.

Seed transmission of the fungus does occur to a small extent and is the common

method of introducing the disease into smut-free areas. Crop rotation using non-susceptible crops such as tomatoes, sugar beets, barley, safflower, and alfalfa offers a practicable means of reducing inoculum. Along with rotation attention should be focused on the destruction of volunteer plants which often become smutted and reinfest the soil. The selection and development of smut-resistant varieties are the best ultimate control for head smut. Therefore, breeding programs are underway at present to develop such resistant types.

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Head smut of sudangrass. Left to right—healthy panicle of Greenleaf sudan, a smut sorus covered by a white membrane, and an open sorus showing smut strands.