

Boil smut of corn

Clarrie Beckingham

District Horticulturist, Intensive Industries
Development, Mudgee

Andrew Watson

Plant Pathologist, Science and Research, Yanco

Introduction

In 2002 boil smut was found in sweet corn and popcorn crops in the Darlington Point area of NSW.

This information note summarises the current situation, highlighting recent developments and the impact that boil smut has had in infected areas of Australia.



A RECORD OF DISEASE OUTBREAKS

Boil smut is endemic throughout the world and occurs in all corn growing areas, except for New Zealand and parts of Australia.

Among the known disease outbreaks recorded are:

Europe 1750

USA 1822

Australia

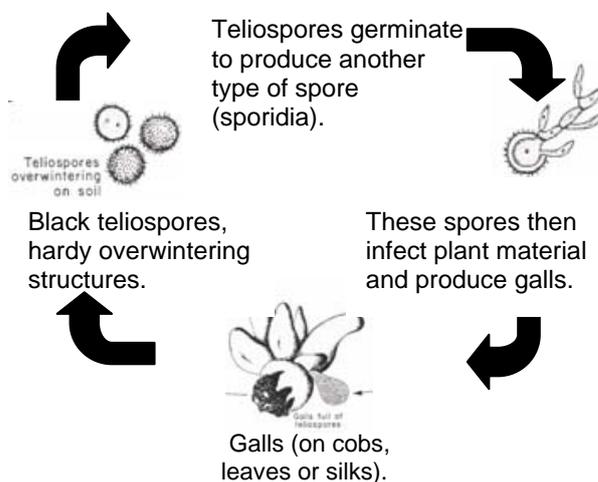
1911	Bathurst, NSW
1982	Northern rivers area of NSW & SE Qld
1987	Delungra and Quirindi, NSW
1989	Maitland, NSW
1990	Singleton and Tamworth, NSW
1991	Gunnedah, NSW
1992	Windsor, NSW
1992-93	Quirindi/Spring Ridge
1994	Narromine, Wellington, Dunedoo & Gilgandra
2002	MIA.

NB: All of Queensland has been considered an infected area since the repeal of Queensland boil smut legislation in April 1987.

The disease boil smut

Boil smut, also called common smut, is caused by the fungus *Ustilago maydis*. It attacks all types of *Zea mays*, including sweet corn, field maize and popcorn, as well as the related grass, teosinte (*Zea mexicana*).

Disease cycle of boil smut (partly courtesy G.N. Agrios, Plant Pathology).



Soil

Boil smut is primarily a soil-borne disease. Teliospores survive in the soil for many years, especially in galls and crop residues. They germinate under favourable conditions to produce sporidia, which are carried by air currents or splashed by water to young developing maize tissue.

Seed

Teliospores on seed can introduce boil smut into new areas. Treatment with an effective fungicide will prevent this seed-borne spread.

Infection

Infections develop directly from teliospores or from the fusion of sporidia of compatible mating types. All above-ground parts of the plant are susceptible, particularly young, actively growing, meristematic tissues. Systemic infection of seedlings can occur, but most infections are localised in older plants. Infection is increased by high soil nitrogen levels and by injuries caused by hail, blowing soil particles, cultivation or de-tasselling.

Galls

The interval between infection and gall formation varies from one week to several weeks under favourable conditions. Galls form on leaves, stems, tassels, or ears. Galls on the leaves are usually small, 0.6 – 1.2 cm in diameter, while large galls up to 15 cm in diameter can develop on ears. Leaf galls produce relatively few spores. Galls are covered by a white membrane, which ruptures to release the dark brown to black teliospores.

Spores

One average-sized gall may contain 200 billion teliospores, and if one percent of plants are infected in a field, it is possible to have over 200,000 billion teliospores produced per hectare. Each teliospore can produce four primary sporidia, which can then bud into secondary sporidia many times. This results in an extremely high reproductive capacity and an ability to spread widely.

Sporidia

Sporidia have a complex mating requirement, which allows the fungus to constantly produce new types that vary in their ability to infect maize varieties. This complex mating system may also explain the sporadic nature of the disease.

Resistance

No corn varieties or hybrids are completely resistant to boil smut. However, there is good field resistance to the disease in maize varieties. This resistance depends on the morphology and physiology of the variety. In general, sweet corn varieties are more susceptible to boil smut.

The disease is extremely difficult to contain and can spread great distances by:

- *wind* – spores can travel several hundred kilometres;
- *water* – especially by river and flood;
- *seed-borne* spores;
- *contaminated* machinery, clothes, shoes or motor vehicles;
- *movement* of livestock and manures;
- *wildlife*;
- *movement* of infected plant materials, for example products that may be used for stock fodder.

The fungus causing the disease is one of the most prolific spore producing smuts. As noted above, a single smut gall of average size may contain more than 200 billion teliospores. These teliospores are the primary source of infection and can live in the soil for up to 16 years.

There are no fungicidal control measures for preventing field infections or eradicating widespread outbreaks. Seed treatment can be used to reduce spread through contaminated seed.

In New South Wales and Queensland, boil smut has not caused serious economic loss in infected areas, although significant losses have occurred in individual fields. Rather, industry has learnt to live with the disease and to use appropriate hygiene to reduce the effects of the disease.

It is likely that boil smut will spread to all field maize, sweet corn and popcorn areas in New South Wales.

Recent developments and implications for industry

The industries at risk are:

- sweet corn for processing and fresh market;
- maize production for seed and grain;
- popcorn;

It is likely that every corn and maize area will record boil smut eventually.

Hygiene guidelines – machinery and equipment

Cleaning machinery after contact with an infected crop will reduce spore contamination and the risk of spread of boil smut. However, it will not eliminate all spores. Disinfection of harvesting, transport and drying equipment with chlorine or other products is not practical and would be unlikely to be completely effective.

Legislation to restrict the movement of machinery is not a practical option.

Machinery treatment

After coming in contact with an infected crop, machinery should be cleaned of all trash and crop

residues before it leaves the property. A wash inside and out with high pressure water equipment is also desirable. This treatment is also recommended for transport and drying equipment.

Farm hygiene consciousness

Property owners need to adopt more stringent quarantine measures on their farms. For example, a gate sign at the entrance to the farm with the message as follows should provoke self action for residents and visitors.

**This property is
FARM HYGIENE CONSCIOUS**

Please do not bring onto this farm:

- Dirty machinery.
- Plant debris.
- Weeds.
- Soil
- Unhealthy plants or animals.
- Second-hand containers.

Managing to live with boil smut in New South Wales

The options depend on whether or not the disease is present in your district.

On the Farm

Preventative action includes:

- Seed treatment – plant only treated seed to prevent the introduction of boil smut on the seed.
- Hygiene and quarantine – adopt a Farm Hygiene Conscious Program.
- Crop management – minimise plant injuries.

Control after infection is important. These measures will not eradicate the disease but growers could minimise losses from boil smut by paying attention to:

- *seed* treatment;
- *hygiene* and quarantine;
- *rotations* – may not have a large effect because the spores are long lived.
- *gall* or plant removal and destruction – an option for small areas with low infestations, e.g. fresh sweet corn growers or home gardeners. Growers should inspect crops closely and bag and remove affected cobs before galls burst. Infected material should be burnt;
- *stubble* burning – will reduce the number of spores surviving in crop residues, an advantage when using permanent bed technology;
- *maintain* balanced soil nutrient levels and avoid high nitrogen levels in the plant as this increases susceptibility to the disease;

- *minimise* plant injuries and avoid mechanical damage to plants during cultural operations in the crop.
- *Avoid* moisture stress of irrigated crops;
- *Trial resistant varieties* – breeding programs may produce resistant varieties of both maize and sweet corn. Tight husks and leaf whorls are thought to reduce plant infection.

Chemical control

Currently the only registered product for seed treatment is Vitavax® 200FF flowable fungicide. This product is a mixture of carboxin, a systemic fungicide active against a number of commonly occurring diseases of cereals and other crops, and thiram, a broad spectrum surface contact fungicide. This combination increases the spectrum of disease controlled than either fungicide used alone.

In your district

Management strategies need to be formulated according to processor/buyer and industry organisation requirements. Hygiene and movement of machinery and equipment need to be carefully assessed to minimise the risk of disease spread.

State

Industry needs to consider disease developments as they arise.

Seed treatment is important.

Note

Huitlacoche (pronounced wheat-la-COE-chay) is a corn fungus – sometimes referred to as corn smut – that's an ancient Mexican delicacy and becoming popular in trendy Mexican and South-western restaurants in the United States. The kernels affected by the fungus are swollen and black. The flavour is somewhat reminiscent of wild mushrooms or truffles. In fact, huitlacoche is sometimes marketed as corn mushroom or Mexican truffle.

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