BUNT CONTROL IN WHEAT

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Summary

Several fungicides were tested over two seasons for the control of bunt or stinking smut of wheat (*Tilletia caries* (DC) Tul.). Lightly infected seed on contaminated soil gave rise to higher levels of infected heads than when the same seed was sown on clean land. The soil-borne phase of *T. caries* infected clean seed with 6% bunt, but this phase did not persist for more than one year. Mancozeb, chloroneb, hexachlorobenzene + fuberidazole, benquinox + methyl-arsenic sulphide, carboxin and benomyl gave very good control on seeds with measured spore loads of 0.1 and 0.4% w/w. The untreated seed produced 29.0 and 34.0% infected heads, respectively.

INTRODUCTION

Tilletia caries (DC) Tul. and *Tilletia foetida* (Wallr.) Liro are the two smut species responsible for bunt or stinking smut of wheat. The disease was common in New Zealand wheat crops in the early part of this century (Kirk, 1906). The work of Neill (1927) and of Blair (1950) showed that seed treated with a copper or mercury seed dust produced disease-free crops.

Sanderson (1964) showed that thiram, captan and the oxyquinones gave control equal to mercury and without the risk of pre-emergence damage as sometimes occurred under cold, wet conditions. The regular and systematic use of seed-dressing fungicides has achieved a high level of control and bunt-infected crops are now rarely encountered.

In the following trials, samples of grain infected with *T. caries* were obtained from a North Canterbury farm where the farmer had saved his own seed for at least seven seasons without fungicide seed treatment. Contamination of the grain reached such high levels that the last wheat harvest was rejected for milling purposes.

At this time fungicides of the carboxin and benomyl groups were being evaluated for loose smut control in wheat and barley. The effectiveness of these two materials against bunt was also evaluated and compared with standard seed dressings currently in use.

GLASSHOUSE TESTS

The viability of the bunted wheat samples was assessed when small lots of naturally contaminated seed were sown in boxes of sterile soil in autumn-winter of 1969. Some of the contaminated seed was also washed in running water and then air-dried before sowing. Untreated smutted grain, when grown in clean soil at a temperature of 19 to 20° C will produce an almost clean crop, but maximum infection occurs within the range of 9 to 12° C (Holten and Heald, 1941). Therefore, immediately after sowing,

the boxes were placed in refrigerated growing bins (at 10° C) for a period of five days before being moved to the glasshouse benches.

The mature plants grown from unwashed seed produced 64% smutted heads. Washed seed, where the only spores present were held in the beard end of the grain, produced 20% diseased heads.

FIELD TRIALS 1969-70

Trials were sown in the autumn of 1969 on two sites in North Canterbury. Site A was on land from which the diseased crop was harvested and Site B was on clean land with no previous history of bunt.

Seed wheat used was (1) certified Aotea (untreated), (2) seed from a neighbouring farm, slightly infected with bunt, and (3) heavily contaminated seed from the owner's crop.

Fungicides used were all slurry formulations and the seed was dressed and treated on a mobile plant. This unit was easily cleaned down between treatments and avoided the contamination of buildings and equipment with bunt spores. Drilling was carried out in mid-June in a dry seedbed, previously out of grass or stubble, using a Duncan force feed drill.

Germination counts of all fungicide-treated seed showed no significant differences from untreated seed. The level of bunt infection was determined by harvesting the heads at the firm dough stage (Feekes 11.2). Ten samples, each 1 metre by 1 row, were cut from random points within each treatment area.

Levels of infection, expressed as a percentage of the total number of heads harvested, are given for both sites in Table 1.

TABLE 1: CONTROL OF BUNT, 1969-70 TRIALS

Treatment (g/100 kg Seed)	Site A Infected Soil Spore Load on Seed			Site B Clean Soil Spore Load	
	Nil	Light†	Heavy	Light†	
benomyl 124.7	15*	18	35	3.0	
carboxin 187.0	23	20	55	3.0	
mancozeb 199.6	4	40	39	14.0	
captan 233.8	5	15	41	4.0	
organic-mercury 2.5	7	21	62	7.0	
benquinox 4.0/methylarsenic sulphide 8.2‡	7				
Control: No chemical 0				73	
Control: No spores or chemical 0	6			0	

*Percentage of infected heads.

†Identical seed lines.

‡Farmer's crop not included in trial.

FIELD TRIALS 1970-71

In general, control of bunt was poor in the 1969-70 season owing to the very heavy spore loading on the seed. For the 1970-1 season, therefore, clean seed was contaminated with bunt spores. Bunt balls were added to weighed lots of clean grain to give concentrations of 0.1, 0.4 and 1.6% weight for weight.

TABLE 2: CONTROL OF BUNT, 1970-1 TRIALS
% of infected heads for various spore loads and chemical treatments

Treatment (g/100 kg Seed)	Swannanoa: Infected Soil Spore Load % w/w				Woodend: Clean Soil Spore Load % w/w			
	0	0.1	0.4	1.6	0	0.1	0.4	1.6
mancozeb 199.6	0.0	0.4	0	0.6	0	0	0	1.1
chloroneb 202.7	0	0.9	0.2	1.9	0	0.1	0.1	1.8
benquinox 4.0/methyl- arsenic sulphide 8.2	0	0	0	1.7	0	0.13	0.2	2.6
hexachlorobenzene 5.7/ fuberidazole 0.7	0	0	0	0	0	0	0	0
benomyl 124.7	0	0	0	0	0.0	0.1	0.1	0.1
carboxin 187.0	0	0.2	0.5	1.4	0	0	0	1.36
Untreated	0.27	29.0	34.0	38.0	0.38	18.7	32.0	29.0

Grain was placed in conical flasks, the bunt balls were added and crushed, and the stoppered flasks were shaken for five minutes.

Fungicides were applied as slurries using a small rotary bench mixer which treated 4.5 kg of grain at a time.

As in the previous year, two sites were used, one on clean land and the other on the original area where the bunted crop was grown two years before.

These results are presented in Table 2.

DISCUSSION

Infection by *Tilletia* spp. can occur in two ways—first, by direct penetration of the seed from spores adhering to the seed coat and, secondly, by soil-borne spores infecting the coleoptile as it emerges and moves up to the soil surface.

Coating of the seed with an efficient fungicide is most effective for the control of seed-borne inoculum. The soil-borne infection is more difficult to control and few fungicides have given good protection.

With the introduction of the systemic fungicides of the carboxin and benzimidazole groups, it was considered that the movement of the active material to the growing points might protect the seedling coleoptile from soil-borne infection during the susceptible stages. The results in the first season did not support this and Table 1 shows that the level of infection was considerably greater in infected soil (A) than in clean soil (B) when systemic materials were used.

Captan, benomyl and carboxin gave good control when infected grain was sown on clean land.

An organo-mercury seed dressing, used as a standard for measuring the effectiveness of the newer fungicides, was less effective.

The use of methylarsenic sulphide on clean seed drilled by the farmer for his own crop into infected soil gave results similar to untreated seed. Thus it failed to protect the seed against the soil-borne phase.

The 1970-1 trials demonstrated the ability of current seed-dressing fungicides to control what would usually be regarded as high levels of crop infection. Hexachlorobenzene/fubendazole gave complete control of the disease and all the other materials gave satisfactory control.

At site A the soil-borne phase of *T. caries* seemed to have lost its viability after one year and increased infection due to the use of carboxin and benomyl did not recur.

It is important to note that the lowest level of loading of bunt spores on untreated seed (0.1%) gave an average of 29% infection at both trial sites. The amount of infection was only increased to 38% by a four-fold increase in spore load. When seed is contaminated with 0.1% of spores, the only sign is a discoloration of the beard end of the grain, easily overlooked by the casual observer. The large amount (29%) of bunt in the resulting crops emphasizes the need for continuing treatment with a suitable fungicide.

With intensive bulk grain handling methods in use today, no farmer should be tempted to make up his seed requirements from grain stored on his farm without treatment prior to drilling.

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