

# A SURVEY OF PESTS OF FARM-STORED BULK WHEAT IN CANTERBURY

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## *Summary*

A survey was carried out in Canterbury to determine the importance of insect and mite pests in farm-stored bulk wheat. After subjection to statistical analysis, enough evidence was obtained to stress the importance of low wheat moisture content (preferably between 12% and 13.5%), initial low wheat temperatures, and good container and general hygiene.

## INTRODUCTION

WHEREAS a decade ago bulk wheat storage on farms was practically unheard of in New Zealand, today it is estimated that well over half the wheatgrowers of Canterbury, Otago and Southland use bulk storage facilities. Associated with this increasing bulk storage is an increasing potential insect and mite problem. Although there is an abundance of overseas literature on insect and mite problems in relation to stored products (*e.g.*, Freeman, 1951), there is a paucity of published material in New Zealand. There is, in fact, no available information on the incidence of pests in farm-stored grain in New Zealand and it was largely to fill this need that the survey herein described was undertaken.

The following aspects are discussed in this paper.

- (1) Identity of the species involved.
- (2) Level and extent of infestations.
- (3) Influence of physical factors in wheat storage on pest populations.
- (4) Losses due to pest infestations.

## METHOD

### AREA OF SURVEY

The area surveyed extended from Christchurch to Willowbridge. It was bounded by the east coast and a line drawn approximately through Darfield and Geraldine.

### SAMPLING THE BULKED WHEAT

A sample of wheat 25.4 cm by 2.5 cm was taken with a sampling spear (French, 1968) from the centre of a silo or bin, 7.5 to 10 cm below the surface. This was placed in an Endecott's test sieve with a 1.59 mm mesh and shaken vigorously for 15 to 20 seconds. Mites or insects in the sample fell into a container beneath, and were counted. The following categories were used to score the sample:

- (1) Trace infestation (trc) = 1 to 2 mites or 1 insect
- (2) Light infestation (light) = 2 to 10 mites or 2 to 3 insects
- (3) Medium infestation (med) = 10 to 20 mites or 3 to 10 insects
- (4) Heavy infestation (heavy) = >20 mites or >10 insects

Owing to difficulties in counting mites, the medium and high mite levels were usually estimated.

A further sample was taken in the centre of the wheat, but at a depth of 75 to 95 cm. It was assumed that, if no pests were seen in either of the two samples, the remainder of the bulked wheat was not infested. There may be exceptions to this assumption but they are probably rare as when localized "hot spots" form. If mites or insects were found in either sample, further areas were probed to determine the extent and level of infestation. After the pests were counted, the shallower sample was placed in a sealed plastic bag for subsequent moisture content analysis. All moisture readings were carried out at the Wheat Research Institute in Christchurch on a standard "Marconi" instrument, recording results as percentages.

Both armoured and normal thermometers were used to measure temperatures at various depths in some of the silos and bins (see Table 1). Temperatures were always taken if serious infestations were observed.

#### RESULTS AND ANALYSES

Tables 1 and 2 summarize most of the important basic data obtained.

TABLE 1: BASIC DATA OBTAINED FROM A SURVEY OF PESTS OF FARM-STORED BULK WHEAT

	1967	1968	1969	1970	Average of 1971 Percentages	
No. farms visited	33	43	43	43	43	
No. silos examined	79	77	103	64	98	
No. bins examined	28	48	61	26	37	
% Farms infested:						
Overall (trc-heavy)	45	58	57	60	42	53
Infestation in silos (%):						
Nil	82	72	70	31	80	67
Trc-light	14	10	23	43	16	20
Med-heavy	4	17	7	25	3	12
Infestation in bins (%):						
Nil	64	52	53	31	43	49
Trc-light	18	20	30	30	35	27
Med-heavy	18	27	17	38	22	25
Overall infestation (bins + silos) (%):						
Nil	77	66	64	31	70	62
Trc-light	15	14	26	40	22	24
Med-heavy	7	20	10	29	8	14
Other details:						
Average wheat moisture content (%)	13.5	14.2	15.4	15.4	14.1	14.5
Average wheat temperature °C (uninfested)	—	16.4	15.1	14.3	16.3	
No. of cases of insect infestation (trc-heavy)	2	3	1	5	5	

TABLE 2: WHEAT INFESTATION IN BINS AND SILOS COMPARED WITH MOISTURE CONTENT — BULKED DATA

Moisture Content (%)			% of Containers Infested ( <i>trc-heavy</i> )	
			Bin	Silos
< 12	....	....	0	0
12 to 13.5	....	....	32	14
13.5 to 15	....	....	62	34
> 15	....	....	79	57

The insects and mites found during the survey were as follows:

<i>Ptinus tectus</i>	<i>Acarus siro</i> complex
<i>Oryzaephilus surinamensis</i>	<i>Cheyletus eruditus</i>
<i>Cryptolestes</i> sp.	<i>Haemogamasus plantiger</i>
<i>Ahasverus advena</i>	<i>Glyciphagus destructor</i>
<i>Liposcelis</i> sp.	<i>Tyrophagus</i> sp.
<i>Sitophilus granarius</i>	
<i>Tribolium</i> spp.	

#### GENERAL DISCUSSION

Chi-square tests were carried out on various combinations of relevant categories as mentioned below. Two basic forms of comparison were analysed:

- (1) Taking the farm as the unit and lumping all pest infestation levels into one group, and
- (2) Taking bins and silos as the units together with various infestation levels.

*Note:* "Old" facilities are those in use prior to 1967. Hygiene was rated on a 1 to 4 scale, 1 being poor, and 4 excellent.

Wheat moisture content categories are rated as: 1. < 12%; 2. 12 to 13.5%; 3. 13.5 to 15%; 4. > 15%.

In comparisons between farms on heavy and lighter soils, no significant differences were obtained except in 1970, when 80% of farms on heavy soils and only 25% on lighter soils had their grain stores infested. Data could have been biased by drought conditions reducing yields on lighter soils disproportionately.

Bulked data over the five-year survey period comparing old and new facilities showed significantly higher rates of infestation in old facilities, 55% of which were infested compared with 33% in new facilities.

Poor hygiene was noted repeatedly in individual storages and, although poor conditions were noticeably more infestation-prone, only in 1968 could a significant difference be demonstrated (at the 5% level).

Although no significant differences were demonstrated in any one year between storages with and without dryers, a constant pattern was discernible in the bulked data. There probably exists a temperature problem related to inexperience with dryers, resulting in temperature differentials sometimes resulting in production of "hot spots", moisture content inequality, and heavy pest infestations.

In comparison of bins with silos, the bins, which generally contained the greater amount of grain, were more generally infested (60% as com-

pared with 30% in silos on bulked data). This confirms Wilson's (1946) hypothesis relating to mass relationship redistributions providing more suitable conditions for infestation development.

Outdoor silos (usually of metal construction) were significantly more generally infested than those under cover, probably owing to effects of insulation, temperature inequality and moisture redistribution.

Comparisons between metal and wooden containers were somewhat confusing. Whereas, with silos, 38% of those of metal against 31% of wood were infested, with bins, 58% of metal construction and 68% of wood were infested.

Moisture content of stored wheat is of obvious importance. Generally, grain from heavy soils tended to have the higher moisture content but the difference was not sufficient to show significantly in infestation levels based on soil type comparisons. However, taken overall, high moisture level grain showed significantly higher infestations on data for 1968, 1970 and 1971 and, on analysis of bulked data, 80% of light-heavy infestations occurred in wheat of the > 15% category and approximately 95% of all infestations were in wheat above 13.5% moisture content.

There was no general trend in change of infestation over years.

Other relationships studied were presence or absence of removable sections of drying floors and presence or absence of concrete blocks under drying floors. In neither case was any difference in infestation level noted.

#### CONCLUSION

The data accumulated did not give a quantitative estimate of actual damage caused by pests but did indicate conditions such as moisture and temperature levels which exercise control over populations of pest species.

Infestations of mites far outnumbered those of insects.

It is considered that good container hygiene is essential (French, 1968) and correct use of dryers with controlled post-drying cooling is important where this equipment is used.

Once a container is contaminated, infestations are probable in succeeding years. Bins (probably because of larger capacity) are more liable to infestation than silos.

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