Spoilage of rapeseed in elevator and farm storage in western Canada'

J. T. Mills

Elevator managers of the Alberta, Saskatchewan, and Manitoba Pools were surveyed by mail on the extent of rapeseed spoilage and heating in their elevators and on customers' farms. Signed questionnaire replies were received from 440 managers (54% return) who had handled 209,500 metric tonnes (9,300,000 bu) or 25% of the 1974 rapeseed crop delivered to Prairie elevators. Spoilage and heating, and mite infestations of the 1974 crop were reported by 23% and 24% of the managers respectively; corresponding figures for 1975 rapeseed were 19% and 25% The average amount of spoiled or heated rapeseed reported in elevators was 62.0 tonnes (2,752 bu) in 1974 and 55.3 tonnes (2,456 bu) to mid December in 1975. Generally crop districts with high incidence of farm spoilage and heating in 1974 coincided with districts of high elevator spoilage. Turning (moving grain from bin to bin during storage) in many instances did not prevent spoilage and heating. The higher the seed moisture content the higher the probability of spoilage and heating even with turning. In elevators spoilage and heating were mostly detected by odor and by grain examination during turning.

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On a effectue une enquête postale aupres des exploitants de silos-elevateurs de l'Alberta, de la Saskatchewan et du Manitoba pour tenter d'evaluer l'importance de l'alteration et du chauffage du colza dans leurs installations, de même que dans celles de leurs clients. Quelque 54% d'entre eux (440) ont retourne le questionnaire signe, de sorte que les donnees de l'enquête portent sur 209 500 tonnes metriques (9 300 000 boiss.) ou 25% des livraisons totales de 1974 aux silos-elevateurs des Prairies. Les repondants ont declare de l'alteration et du chauffage dans une proportion de 23%. et des infestations par les acariens dans une proportion de 24%. contre 19% et 25% respectivement pour la recolte de 1975. La quantite moyenne de colza altere dans les silos-elevateurs se montait respectivement a 62.0 et 55.3 tonnes (2 752 et 2 456 boiss.) en 1974 et en 1975 (mi-decembre). En general, les regions de culture affichant une forte frequence d'alteration dans les fermes correspondaient a celles ou les silos-elevateurs declaraient le plus d'alteration. Dans nombre de cas, le retournement du colza (par transvasage d'un coffre a l'autre pendant l'entre-posage) n'a pas éliminé ces phenomenes qui, par ailleurs, sont plus frequents quand la teneur en eau des grains est forte. En general l'alteration et le chauffage sont deceles a l'odorat ou par examen des grains au moment du retournement.

Canada produced an estimated 1.2 million metric tonnes (52.0 million bu) of rapeseed in 1974 of which 240,000 tonnes (10.5 million bu) were in store in primary and terminal elevators and 38,000 tonnes (1.7 million bu) on farms at the end of the 1973-74 crop year (2). Most of this seed was harvested and stored without becoming spoiled or heat-damaged. Some rapeseed, however, spoils and heats in storage, becomes downgraded by primary elevators, is often rejected by oil processors, and may be sold to feed mills or discarded. Accurate figures for the amount of spoiled or heat-damaged rapeseed are difficult to obtain as deliveries rejected by oil processors or elevators are not usually recorded nor are losses that occur in farm storage. Because of the large number of verbal reports of rapeseed spoilage and heating from growers and persons handling the crop, it was decided to determine the extent of spoilage and heating through a postal survey of primary elevator managers of the Manitoba, Saskatchewan, and Alberta Wheat Pools. Primary elevator managers were considered to be the best source of information as they often have an intimate knowledge of storage problems occurring on their customers' farms plus practical knowledge obtained through handling rapeseed in their elevators. This report summarizes the replies received from elevator managers handling the 1974 and 1975 crops.

Methods

A one-page questionnaire containing 31 questions prepared by the Agriculture Canada Research Station, Winnipeg, was circulated by the country elevator divisions of 3 major grain companies, the Manitoba, Saskatchewan, and Alberta Wheat Pools. Elevators surveyed were located throughout the provinces of Manitoba and Alberta and in Wheat Pool areas C and D, approximately equivalent to crop districts 19 to 23 and 28 to 32, in Saskatchewan. Elevator managers were requested to answer questions relating to spoilage and heating of the 1974 and 1975 rapeseed crops in their elevator and on customers' farms. Signed questionnaires from the responding elevator managers handling rapeseed were analyzed and any comments abstracted. A reply is defined as one report from one elevator manager for the crop produced in a particular year.

[1] ***Contribution No. 726, Research Station, Agriculture Canada, Winnipeg, Manitoba, R3T 2M9***

Table 1. Frequency of occurrence of degraded, rejected, spoiled, heated, and mite–infested rapeseed from the 1974 and 1975 crops in elevators under survey

	Manitoba		Saskatchewan		Alberta		Prairie	
	1974	1975	1974	1975	1974	1975	1974	1975
No. of elevator replies*	126	131	200	200	106	109	432	440
No. of elevators reporting spoilage and heating in the elevator	31	21	50	40	18	21	99	82
% of total elevators reporting spoilage and heating in the elevator	25	16	25	20	17	19	23	19
No. of elevators degrading at purchase	22	11	43	27	28	13	93	51
% of total elevators degrading at purchase	17	8	22	14	26	12	22	12
No. of elevators rejecting rapeseed	28	17	44	39	18	12	90	68
% of total elevators rejecting rapeseed	22	13	22	20	17	11	21	15
% of total elevators with mite infestations	19	26	30	29	22	19	24	25

* Data was supplied in some instances for only one year

Replies to specific questions relating to elevator storage are grouped under four headings, 1) the frequency of occurrence and amounts of degraded, rejected, spoiled, heated, and mite-infested rapeseed in elevators; 2) frequency of occurrence and amounts of spoiled and heated rapeseed in elevators arranged by crop district; 3) most commonly used methods of detection of spoilage and heating of rapeseed in elevators; and 4) turning of stocks.

Replies to questions relating to storage on farms are grouped under three headings, 1) the frequency of occurrence and maximum amounts of spoiled, heated, and mite-infested rapeseed on farms as reported by customers to managers; 2) the frequency of occurrence and distribution of farm spoiled and heated rapeseed rejected by elevators; and 3) the most commonly used methods of disposal of spoiled and heated rapeseed by farm customers. Managers were requested to also send 900-g samples of sound and of some spoiled or heated rapeseed. These samples were subjected to biological, physical, and chemical tests to determine spoilage and heating levels of rapeseed. Results of these analyses are presented elsewhere. The term "spoiled rapeseed" denotes seeds that may or may not be heated but are deteriorated in quality usually manifested by a strong odor when compared to sound rapeseed of the same age. The term "heated rapeseed" denotes seed which has become charred, discolored, or otherwise affected as a direct result of abnormal rise in temperature; such seeds usually have a light brown or dark brown internal coloration.

Results

There were 432 replies to the questionnaire from managers handling the 1974 crop and 440 replies for the 1975 crop. Results are presented under elevator (Tables 1 to 6) and farm (Tables 3, 7, and 8) headings.

Spoilage and heating in primary elevators

1) Frequency of occurrence and amounts of degraded, rejected, spoiled, heated, and mite-infested rapeseed in elevators—On a prairie-wide basis, 23% of managers experienced spoilage and heating with the 1974 crop and 19% with the 1975 crop (Table 1). Spoiling and heating for the 1974 crop and incidence of rejection of rapeseed at purchase were less commonly experienced in Alberta than in Manitoba and Saskatchewan. Degrading of the 1974 and 1975 crops was less frequent in Manitoba than in the other provinces. Mite infestations were most commonly experienced in Saskatchewan.

During 1974, a total of 211,000 tonnes (9,369,000 bu) of rapeseed was purchased at the 440 elevators (Table 2), representing 25% of the rapeseed delivered to primary elevators during 1974-75 (3). This amount purchased by the elevators represents 22% of the Alberta, 33% of the Manitoba, and 37% of the Saskatchewan totals for the 1974 crop. Spoilage and

Table 2. Amounts of rapeseed purchased, degraded, rejected, spoiled or heated in elevators under survey

	Manitoba		Saskatchewan		Alberta		Prairie	
	1974	1975	1974	1975	1974	1975	1974	1975
Total no. tonnes* purchased by elevators in the survey	35,650.7	40,264.9	107,741.3	91,295.2	67,622.8	71,600.0	211,014.7	203,159.8
No. tonnes purchased and degraded because of spoilage or heating	1,061.9	604.7	3,396.4	1,948.9	2,101.4	837.8	6,559.6	3,391.4
No. tonnes rejected because of spoilage or heating	1,598.2	550.9	3,464.5	2,572.1	805.2	639.6	5,867.9	3,762.6
No. tonnes spoiled or heated in the elevators	1,701.3	1,037.6	2,775.0	2,374.5	1,655.4	1,123.9	6.131.7	4,536.0
% of total tonnes purchased that spoiled or heated in elevators	4.8	2.6	2.6	2.6	2.4	1.6	2.9	2.2

* To convert tonnes of rapeseed to bu multiply tonnes by 44.4

heating of the 1974 crop occurring in Manitoba elevators was higher, at 4.8% of elevator purchases, than in Saskatchewan and Alberta elevators, which experienced about 2.5% spoilage.

2) Frequency of occurrence and amounts of spoiled and heated rapeseed in elevators arranged by crop district— Frequency of spoilage tended to be higher in some crop districts in 1974 (Tables 3, 4).

The average amount of rapeseed spoiled or heated in elevators reporting such incidence, on a prairie-wide basis, was 62.0 tonnes (2,752 bu) for the 1974 and 55.3 tonnes (2,456 bu) for the 1975 crops. The highest spoilage and heating of the 1974 crops occurred in Alberta with an average of 92.0 tonnes (4,030 bu) per elevator (Table 4).

3) Most commonly used methods of detection of spoilage and heating of rapeseed in elevators—The principal means used to detect spoilage and heating were odor and turning accompanied by crushing or temperature sensing either by hand or thermometer. Occasionally the presence of molds was used as the criterion of spoilage. Metal rods were used rarely to detect heating. Approximately the same trends of usage occurred in each province.

4) *Turning of elevator stocks in relation to occurrence of spoilage and heating*—Most managers, in their considered opinion, thought that spoilage and heating did not increase after stocks were turned (Table 6). However, when questioned specifically on the most recent report of spoilage or heating in their elevator, many managers stated that they had experienced such problems after turning stocks. This suggests that turning, in many instances, did not prevent spoilage and heating.

Managers were asked several other questions on the most recent report of spoilage or heating in their elevators. The questions and the replies are summarized in Table 6.

Moisture contents of the spoiled or heated rapeseed stocks before turning were mostly between 8.6% and 10.5%. Generally the higher the seed moisture content, the higher the likelihood of spoilage and heating even with turning.

Maximum temperatures attained by turned bulks were mainly in the range of 26° to 45°C. There were 16 reports of heating with maximum temperatures of 25°C and below, 122 reports between 26° and 45°C, 19 reports between 46° and 60°C, and 5 reports of 66°C.

The number of days after turning when spoilage and heating occurred varied from 0 to 200 days but was mainly between 6 and 30 days. In Manitoba most spoilage and heating occurred between 6 and 15 days and between 26 and 30 days after turning. In Saskatchewan the same trend probably occurs but the two peak periods are less distinct than in Manitoba. In Alberta, less spoilage and heating appears to occur 6 to 10 days after turning than in Manitoba and Saskatchewan (Table 6).

Many instances of spoilage and heating were reported after turning stocks in the months July to October. This is also, however, the period during which most purchasing and turning of all rapeseed stocks normally take place. It is thus not possible, from the present data, to

Table 3. Frequency of occurrence of spoilage and heating, and rejection of rapeseed in primary elevators by crop district

Crop District *	1974 crop					1975 crop				
	No. elevators replying	No. elevators with spoilage and heating	% of replying elevators with spoilage and heating	No. elevators rejecting rapeseed	% of replying elevators rejecting rapeseed	No. elevators replying	No. elevators with spoilage and heating	% of replying elevators with spoilage and heating	No. elevators rejecting rapeseed	% of replying elevators rejecting rapeseed
Manitoba										
1	10	2	20	2	20	10	2	20	2	20
2	14	6	43	6	43	14	2	14	3	21
3	20	3	15	7	35	21	4	19	4	19
4	2	0	0	0	0	2	0	0	0	0
5	12	1	8	1	8	12	2	17	2	17
7	9	3	33	1	11	9	0	0	0	0
8	13	0	0	3	23	14	1	7	3	21
9	8	3	38	1	13	9	0	0	0	0
10	18	3	17	0	0	20	5	25	1	5
11	8	3	38	3	38	8	2	25	1	13
12	4	1	25	0	0	4	0	0	0	0
13	6	5	83	4	67	6	3	50	1	17
14	2	1	50	0	0	2	0	0	0	0
Total	126	31		28		131	21		17	
Saskatchewan										
19 (5a)	16	1	6	5	31	16	3	19	6	38
20 (6a)	15	3	20	3	20	14	0	0	2	14
21 (7a)	11	1	9	1	9	10	0	0	1	10
22 (8a)	27	12	44	10	37	27	11	41	9	33
23 (9a)	31	9	29	6	19	31	8	26	3	10
28 (5b)	35	12	34	7	20	36	5	14	6	17
29 (6b)	8	0	0	0	0	8	1	13	1	13
30 (7b)	19	2	11	0	0	19	2	11	1	5
31 (8b)	17	5	29	5	29	18	5	28	6	33
32 (9b)	21	5	24	7	33	21	5	24	4	19
Total	200	50		44		200	40		39	
Alberta										
35 (1)	2	1	50	0	0	2	1	50	0	0
36 (2)	12	2	17	0	0	13	3	23	1	8
37 (3)	8	0	0	2	25	8	0	0	0	0
38 (4)	36	6	17	5	14	36	6	17	4	11
39 (5)	21	2	10	0	0	23	5	22	2	9
40 (6)	15	3	20	6	40	15	2	13	3	20
41 (7)	12	4	33	5	42	12	4	33	2	17
Total	106	18		18		109	21		12	

* The crop district designations are those used by Sinha, R.N., et al. Oecologia (Berlin) 12:69 - 88, 1973. For Manitoba these designations are the same as those of the traditional crop districts; for Saskatchewan the corresponding traditional crop districts and for Alberta the agricultural reporting areas appear in parentheses.

state that turning of stocks in e.g. October is implicated as a factor in spoilage and heating.

Spoilage and heating on farms

1) Frequency of occurrence and maximum amounts of spoiled, heated, and mite infested rapeseed on farms as reported by customers to managers—Across the prairies ***6.5%*** of elevator farm customers had experienced heating and spoilage problems with their 1974 rapeseed (Table 7). Provincially, Manitoba had the highest percentage, 7.7% in 1974, but also the lowest percentage, 3.4% in 1975. Mite infestations on farms were

Table 4. Amounts of spoiled and heated rapeseed in primary elevators by crop district *

Manitoba					Saskatchewan				
	1974 crop		1975 crop			1974 crop		1975 crop	
Crop District	No. tonnes spoiled and heated	No. elevators	No. tonnes spoiled and heated	No. elevators	Crop District	No. tonnes spoiled and heated	No. elevators	No. tonnes spoiled and heated	No. elevators
1	64.2	2	103.6	2	19 (5a)	45.0	1	114.9	3
2	243.2	6	122.7	2	20 (6a)	128.4	3		
3	259.0	3	308.6	4	21 (7a)	22.2	1		
5	67.6	1	67.6	2	22 (8a)	641.9	12	653.2	11
7	193.7	3			23 (9a)	346.8	9	347.5	8
8			22.5	1	28 (5b)	938.4	12	427.9	5
9	107.8	3			29 (6b)			78.8	1
10	250.0	3	87.2	5	30 (7b)	94.6	2	78.8	2
11	225.2	3	225.0	2	31 (8b)	287.4	5	434.7	5
12	18.0	1			32 (9b)	270.3	5	238.7	5
13	268.0	5	100.2	3	Totals	2,775.0	50	2,374.5	40
14	4.5	1							
Totals	1,701.2	31	1,037.4	21					
Avg per elevator	54.9 t (2,437 bu)		49.4 t (2,193 bu)			55.5 t (2,464 bu)		59.4 t (2,637 bu)	

Alberta				
	1974 crop		1975 crop	
Crop District	No. tonnes spoiled and heated	No. elevators	No. tonnes spoiled and heated	No. elevators
35 (1)	67.6	1	90.1	1
36 (2)	90.1	2	195.9	3
37 (3)	596.8	6	326.6	6
38 (4)	202.7	2	153.1	5
39 (5)	85.6	3	135.1	2
40 (6)	612.6	4	223.0	4
41 (7)				
Totals	1,655.4	18	1123.8	21
Avg per elevator	92.0 t (4,084 bu)		53.5 t (2,375 bu)	

Avg amount of rapeseed spoiled in elevators on a prairie-wide basis: 1974 crop, 62.0 tonnes (2,752 bu)
1975 crop, 55.3 tonnes (2,456 bu)

* See footnote, Table 3.

reported less frequently than heating and spoilage problems.

Managers were asked for information on the maximum amount of spoiled or heated rapeseed that they had heard about on any one farm. The total of these estimates amounted to 8660 tonnes (385,000 bu) of the 1975 crop across the prairies (Table 7). This amount does not take into account all lesser amounts in the elevator customer areas.

2) Frequency of occurrence and distribution of farm-spoiled and heated rapeseed rejected by elevators— Generally crop districts with high incidence of farm heating and spoilage in 1974, indicated by high incidence of elevator rejection, coincide with districts of high elevator spoilage (Tables 3, 4).

3) Most commonly used methods of disposal of spoiled and heated rapeseed by farmers—The most frequently used method of disposal was the sale of affected seed to an elevator or to a feed mill (Table 8). Other frequently used alternative methods included selling to crushers or other seed houses, mixing with sound rape, and mixing for livestock feed on the farm. Discarding was generally the least popular method of disposal of spoiled and

Table 5. Most commonly chosen methods of detection of spoilage and heating of rapeseed in elevators by managers

Province	Choice	Chosen method expressed by % of total choice							
		Odor	Turning	Moldiness	Metal rod	Turning and crushing	Turning and temperature–sensing	Turning and sampling	Unspecified
Manitoba	1st	11	13	1	1	3	0	0	1
	2nd	14	4	3	2	1	0	0	0
	3rd	1	0	14	4	0	0	0	3
	4th	1	0	5	17	0	0	0	1
Saskatchewan	1st	18	14	1	1	1	2	0	0
	2nd	9	4	5	3	1	1	1	0
	3rd	1	2	10	6	0	0	0	1
	4th	0	1	5	12	0	0	0	1
Alberta	1st	15	16	0	1	1	1	0	0
	2nd	12	4	6	1	0	1	0	0
	3rd	1	2	13	5	0	0	0	0
	4th	0	1	5	15	0	0	0	0
Prairie	1st	15	14	0	1	2	2	0	1
	2nd	11	4	5	2	1	1	0	0
	3rd	1	1	12	5	0	0	0	1
	4th	0	1	5	14	0	0	0	1

heated seeds, but nevertheless it was used as a first choice by a few farmers in Saskatchewan (Table 8).

Managers were asked whether more information was needed to protect rapeseed from spoilage and heating during storage. Most managers, 77-80%, were in favor of more information, 14-19% were not in favor and 1-8% gave no answer. Twenty-three managers, including 13 in Saskatchewan, thought that farmers needed more information on all phases of harvesting and storage of rapeseed.

Additional comments were received on many questionnaires. Forty managers, constituting 9.9% of replies, stated that the upper moisture content limit for dry rapeseed should be lowered from the present 10.5%. Twenty-nine managers suggested new upper moisture content limits for dry rapeseed; three suggested 10.0%, one 10.0-9.5%, nine 9.5%, ten 9.0%, one 9.0-8.5%, three 8.5%, and two 8.0%.

Regarding detection of spoilage and heating in large elevator bins two managers stated that the presence of a spoilage smell meant that considerable spoilage and heating damage had already occurred. They thought that increased temperature was an earlier indicator of heating and spoilage.

Discussion

The data for purchases and degradings at elevators were considered to be accurate, as elevator companies encouraged truthful replies without recrimination. Further, managers are in a position to know accurately the condition and amounts of potential and actual purchases.

There is reason to believe that the 6.5% figure for farmers (Table 7) who had experienced spoilage and heating of rapeseed on their farms during 1974-75 does not reflect the true situation on farms. A similar elevator survey of wheat, oats, and barley during 1970-71 revealed at least five times as many moldy grain bulks and mite infestations on farms than in elevators (1,5). In the present survey, the percentage frequency of spoilage and heating in elevators is three times that occurring on farms of elevator customers. The 6.5% figure would have been much increased if all managers had supplied data on actual rather than potential customers. Also the figure would have been increased if more information on spoiled and heated rapeseed farm stocks mixed with good seed and sold off, fed to pigs, or discarded had been brought to the attention of managers.

Mite infestations of stored rapeseed in prairie elevators have been reported frequently. Work in the United Kingdom (4) and France (6) has also demonstrated mite infestations in storage that are probably related to the presence of seed-borne fungi.

It is important to be able to detect spoilage and heating in large bulks at an early stage. Checking the rapeseed temperature whilst turning stocks is a preferred method of detecting early damage; by the time odor is detectable

Table 6. Turning of elevator stocks in relation to occurrence of spoilage and heating

Question: Does spoilage and heating sometimes increase after turning?

% replies received

	Yes	No	No reply
Man.	33	43	24
Sask.	28	53	19
Alta.	14	59	27

Question: In the last case of heating or spoilage in your elevator, was the grain first turned?

% replies received

	Yes	No	No reply
Man	40	9	51
Sask.	40	12	48
Alta.	28	13	59

Question: If so, what was the moisture content of the stocks before turning?

	No. of reports of heating or spoilage at specified range of moisture content (%)											
	7.1–7.5	7.6–8.0	8.1–8.5	8.6–9.0	9.1–9.5	9.6–10.0	10.1–10.5	10.6–11.0	11.1–11.5	14.5	15.6	17.5
Man.	0	1	3	13	9	18	12	1	1	0	1	0
Sask.	0	4	2	15	21	25	17	7	2	1	0	1
Alta.	2	0	2	4	5	9	10	4	2	0	0	0

Question: What was the maximum temperature attained?

	No. of reports of heating or spoilage at specified temperatures (°C)									
	20°C & below	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	66–70
Man.	3	4	8	8	8	3	2	2	0	0	4(66°C)
Sask.	0	6	15	16	29	10	4	3	3	0	1(66°C)
Alta.	0	3	7	11	3	4	2	2	1	0	1

Question: What was the number of days after turning when heating and spoilage occurred?

	No. of reports of heating or spoilage at intervals (days) after turning															
	0–5	6–10	11–15	16–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	66–70	71–75	>76
Man.	1	1	5	6	1	2	8	2	2	3	0	0	0	0	0	0	1**
Sask.	5	1	3	1	7	1	4	7	1	1	1	3	0	0	0	2	1	1	1	3*
Alta.	1		4	3	6		6	4	1	1	2	0	1	2	1	0	0			1**

Question: What was the month of turning?

	No. of reports of heating or spoilage following turning of rapeseed stock in the month indicated											
	January	February	March	April	May	June	July	August	September	October	November	December
Man.	1	0	0	1	1	3	8	3	7	13	3	1
Sask.	2	0	2	0	1	4	6	8	16	20	4	3
Alta.	0	0	0	1	0	0	2	2	8	7	1	2

* One report each 78, 90 and 200 days after turning

** 90 days after turning

Table 7. Frequency of occurrence and maximum amounts of spoiled, heated, and mite–infested rapeseed from the 1974 and 1975 crops on customers' farms known to managers

	Manitoba		Saskatchewan		Alberta		Prairie	
	1974	1975	1974	1975	1974	1975	1974	1975
Total no. customers' farms serviced by elevators in the survey	4,147	4,770	10,982	11,612	5,212	5,825	20,341	22,207
No. customers' farms known by managers to have experienced spoilage and heating	318	164	705	595	309	205	1,332	964
% of total customers' farms with heating and spoilage problems	7.7	3.4	6.4	5.1	6.0	3.5	6.5	4.3
No. of farms with mite infestations in customer areas	175	172	316	242	114	78	605	492
% of total farms with mite infestations	4.2	3.6	2.9	2.1	2.2	1.3	3.0	2.2
Maximum amount (tonnes*) spoiled or heated rapeseed on any one farm known to manager	225.2	112.6	247.7	252.2	112.6	225.2	247.7	225.2
Total of above maximum amounts (tonnes)	2,051.4	1,198.4	4,805.2	5,010.9	1,804.1	1,484.3	8,660.6	7,693.6

* To convert tonnes to bu multiply tonnes by 44.4

Table 8. Most commonly chosen methods of disposal of spoiled and heated rapeseed by farm customers

		Chosen method expressed as % of total choice							
Province	Choice	Sell to elevator	Sell to feed mill	Discard	Unspecified	Sell to crusher	Other elevators seed houses	Mix for feed	Mix with good rape
Manitoba	1st	24	4	1	0	1	1	0	0
	2nd	6	17	2	0	0	0	0	0
	3rd	1	4	11	6	1	1	2	0
	4th	1	0	13	3	1	0	0	0
Saskatchewan	1st	24	1	3	1	1	1	0	0
	2nd	3	15	4	1	1	1	1	0
	3rd	1	7	7	3	1	1	1	1
	4th	2	1	12	3	1	1	2	0
Alberta	1st	26	0	2	0	2	0	0	0
	2nd	3	14	4	1	4	0	0	0
	3rd	1	8	12	2	1	0	1	0
	4th	0	2	10	5	0	1	1	0
Prairie	1st	24	2	2	1	1	1	0	0
	2nd	3	15	3	1	2	1	1	0
	3rd	1	7	9	3	1	1	1	1
	4th	1	1	12	3	1	1	1	0

in a large bulk considerable damage has already occurred.

Results from the present survey indicate that more information is required in certain areas to improve the storability of the crop on farms and in elevators. On the farms, producers should know that rapeseed differs in storability from wheat, oats, and barley and should be swathed, combined, and stored with extreme care. If spoilage is prevented on farms a better product will be delivered to elevators. In elevators, information is required on the effects of turning on the storability of

stocks as results obtained suggest that turning in many instances does not prevent spoilage and heating. Finally information is required on the individual and collective roles of molds, mites, and of seed respiration in spoilage and heating of rapeseed stocks of different varieties and ages and at different times of year.

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