BULLETIN 371
JUNE 1943

DOCKAGE IN FLAXSEED

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More Weed Control Will Reduce Flax Dockage

Clean Seed

Use of clean seed avoids sowing additional weeds.

Clean Ground

Accumulated weed seeds in soil produce heavy infestations.

Crop Rotation

Frequent use of cleanly cultivated crops reduces weeds.

Early Seeding

Early-seeded flax gets ahead of late germinating weeds.

Seeding Down

Legumes and grasses offer more competition to weeds than flax alone.

Weed Sprays

Sprays control many weeds that compete with flax in its critical growth stages.

Accepted for publication June 14, 1943

8M—6-43

Dockage in Flaxseed

Rex W. Cox and W. W. Brookins[1]

WEED contamination in flax crops is one of the most persistent problems with which flax growers have to contend. Every year thousands of tons of dockage material consisting primarily of weed seeds are in the shipments arriving at the terminal markets. The loss to flax growers in Minnesota from weeds in the 1941 flax crop probably exceeded three million dollars. This estimate includes the loss in yield of grain from weed competition, reduction in the marketability of the straw, and the cost of shipping the dockage to the market. The purpose of this bulletin is to present some important facts relative to the prevalence and economic significance of the dockage problem in various areas of Minnesota and to show how the financial returns to producers of flax may be increased through the adoption of approved methods of weed control.

Amount of Dockage in Flax Crops

The divisions of Agricultural Economics and Agricultural Extension recently completed a study of the records of 9,797 carloads of flaxseed received at Minneapolis from Minnesota, North Dakota, South Dakota, and Montana during the crop season August, 1941, to July, 1942.[2] Shipments from Minnesota stations accounted for 7,413 cars and represented about 84 per cent of the total flaxseed marketed from the state during the period. The dockage in these cars averaged 11.3 per cent, or an equivalent of about one car of dockage for every 10 cars of clean flax. Minnesota marketed over 13 million bushels from the 1941 flax crop. On the basis of an average dockage content of 11.3 per cent, more than 41,000 tons of dockage were received at the terminal markets during the crop season, the shipment of which used the space of 950 cars and cost over $138,000.

The percentage of dockage ranged from 3 to 37 (figure 1). One third of the cars had less than 10 per cent of dockage, almost one half had between 10.0 and 14.9 per cent, and one fifth had 15 per cent or more of dockage material.

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[2] The data obtained for each car included the weight of the contents, percentage of dockage, the shipping point, and the cost of freight to Minneapolis. The data were obtained from the Federal Grain Supervision Office, Minneapolis, the State Weighmaster's Office, and the various railroads. Credit is due particularly to Mr. M. Johnson, Federal Grain Supervisor, for his assistance in the collection of the data.

Assistance in the tabulation of the data was furnished by the personnel of Work Projects Administration, Official Project No. 265-1-71-236, Subproject 459.

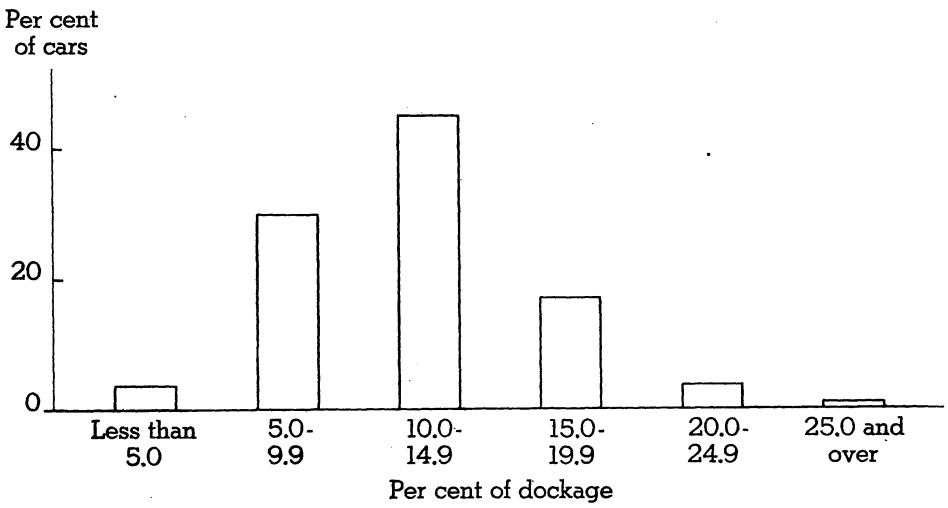

FIG. 1. Distribution of 7,413 carloads of flaxseed received at Minneapolis from Minnesota points according to the percentage of dockage, August, 1941 to July, 1942

Similar data also have been obtained from the records of 4,891 cars of flax received at Minneapolis from points of origin in Minnesota during the period August, 1942, to November, 1942 (table 1). A comparison of the data for the two years indicates a significant reduction in the amount of dockage shipped in the 1942 crop. The influence of season on dockage content is not apparent, despite the generally accepted observation that weed infestations were much more serious in flax in 1942 than in 1941. The lower dockage may be due in part to cleaning of high dockage flax before shipment or to more successful weed control on many farms. Also, many weeds such as wild oats shed their seed before harvest and more weed seeds were probably removed in threshing or combining than previously.

Additional information relative to the variations in dockage content among various years is provided in table 2. The data in this table show the distribution of carlot shipments of flaxseed from Minnesota, North Dakota, South

Table 1. Distribution of Cars of Flaxseed Received at Minneapolis from Minnesota According to the Percentage of Dockage, August, 1941 to July, 1942, and August, 1942 to November, 1942

Per cent of dockage	August, 1941-July, 1942		August, 1942-November, 1942	
	Cars		Cars	
	Number	Per cent	Number	Per cent
Less than 10.0	2,457	33.1	2,224	45.5
10.0-19.9	4,633	62.5	2,524	51.6
20.0 and above	323	4.4	143	2.9
Total	7,413	100.0	4,891	100.0

Table 2. Distribution of Cars of Flaxseed Received at Minneapolis from Four Northwest States According to the Percentage of Dockage, 1921-24, 1930-31, 1934, and 1941*

Per cent of dockage	Per cent of cars							
	1921	1922	1923	1924	1930	1931	1934	1941
Less than 10.0	43.0	31.1	39.3	28.3	35.3	26.3	19.7	31.5
10.0-19.9	46.6	49.7	51.7	42.8	50.3	55.6	57.1	62.1
20.0 and above	10.4	19.2	9.0	28.9	14.4	18.1	23.2	6.4
Total cars	6,092	4,255	5,452	7,124	7,803	6,376	3,212	9,797
Average per cent of dockage	11.5	13.9	12.0	15.8	13.5	13.2	19.0	11.7

* Data for 1921-24 were obtained from Phillips, C. L., Flaxseed: Abstracts and List of References, Mimeo., United States Grain Standards Act—Grain Investigations-41, Jan. 1927; for 1930, 1931, and 1934, from Phillips, C. L., and Boerner, E. G., *Ibid.*, Feb. 1935.

Dakota, and Montana to Minneapolis for the crop seasons of 1921-24, 1930-31, 1934, and 1941. There has been a decline in the proportion of the shipments with a high dockage content, but this decline was probably due to the cleaning of flaxseed before shipment.

There is no evidence to indicate any material improvement in the dockage situation for the seasons indicated. The percentage of dockage averaged 13.3 for the four years included in the earlier period and 11.7 for the 1941 crop, but the percentages in the earlier period ranged from 11.5 to 15.8 indicating the effect of the season on the relative amount of dockage in flaxseed.

Flax acreage has increased markedly since 1938. The average acreage in Minnesota for the 10-year period 1927-36 was about 550,000 acres. It increased to 1,431,254 acres in 1941 and to 1,639,753 acres in 1942. Many growers without previous experience with the crop began producing flaxseed and many fields unsuited to flax growing because of weed infestation were brought into production of the crop. On the other hand, farmers are giving increasing attention to more careful cleaning of flaxseed before sowing. These changes have undoubtedly influenced the general dockage picture in recent years.

Variations Among Crop-Reporting Districts

Flax production in 1941 was centered largely in the west central and southwest districts where 26 and 27 per cent of the state's harvested acres were located. The northwest district grew 18 per cent of the acreage; south central, 11 per cent; central, 10 per cent; southeast, 5 per cent; the remaining three districts accounting for 3 per cent.

The average percentages of dockage in the flaxseed shipments from the various districts are shown in table 3. While the variation in the percentage of dockage among the counties is rather marked (table I—Appendix), the variation among the important districts is relatively small, ranging from 10.4 in the west central district to 13.4 in the south central district.

A higher proportion of low dockage flax was shipped out of the northwest district, where 48.8 per cent of the cars contained less than 10 per cent of dockage (figure 2). In the west central district, 37.6 per cent of the cars fell in this classification and 32.9 per cent in the southwest district. A lower percentage of clean flax originated in the southeast and south central districts where 27.1 and 14.0 per cent, respec-

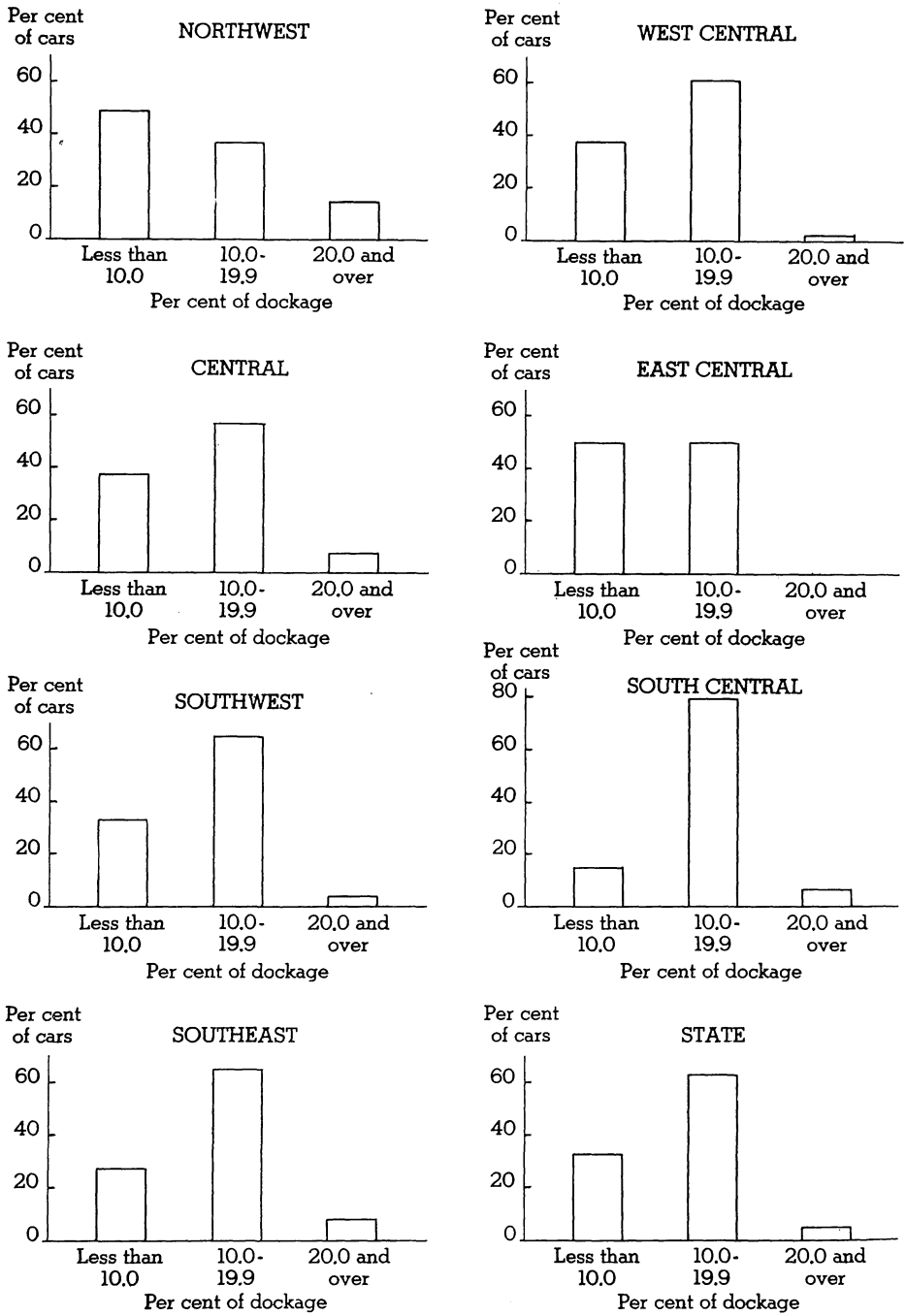

FIG. 2. Distribution of carloads of flaxseed received at Minneapolis from Minnesota crop-reporting districts according to the percentage of dockage, August, 1941 to July, 1942

Table 3. Amount, Average Percentage, and Cost of Shipping Dockage in Flaxseed Received at Minneapolis from Various Crop-Reporting Districts, August, 1941 to July, 1942*

Crop-reporting district	Number of cars	Dockage				
		Total	Per car	Average per-centage†	Cost of shipping	
					Total	Per car
		Tons	Tons	Per cent		
Northwest	519	2,269	4.4	11.0	$ 10,033	$19.36
West central	2,197	10,317	4.7	10.4	35,529	16.17
Central	847	4,104	4.8	11.2	11,337	13.38
East central	16	51	3.2	8.8	105	6.56
Southwest	2,549	13,204	5.2	11.4	45,334	17.78
South central	1,006	5,964	5.9	13.4	17,705	17.70
Southeast	273	1,418	5.2	12.3	3,927	14.50
Total	7,407	37,327	5.0	11.3	$123,970	$16.75

* The data do not include all the shipments from the districts listed in the table. Complete records of some cars were not available. Also, some shipments were consigned to Duluth. The north central and northeast districts, which have been omitted, shipped only six cars.

† The figure representing the average percentage of dockage may also be interpreted as the proportionate cost of transporting the dockage in flaxseed shipments from the districts to Minneapolis.

tively, of the carlot shipments contained less than 10 per cent.

Additional information relative to the dockage problem in the various districts is provided in table 4 which gives the distribution of shipping points within the district according to the average percentage of dockage. Very few shipping points in the south central district were in the low dockage group, but almost two fifths of the stations in the west central were in this group.

Shipping points within a county also vary significantly relative to the amount of dockage in the shipments. The stations in Marshall County in the northwest district ranged from 4 to 33 per cent, and those in Roseau County of the same district from 4 to 14 per cent. The range in Faribault County, south central district, extended from 7.1 to 15.7 per cent. In some counties the range was much narrower, but in general the evidence seems to indicate that corrective measures applied to the dockage problem must be approached more on a community basis rather than on a district or even on a county basis.

Dockage in Flaxseed at the Farm

Records obtained from 276 farmers in 15 counties distributed in the west central, central, southwest, south central, and southeast districts indicated that

Table 4. Distribution of Shipping Points in Various Crop-Reporting Districts According to the Average Percentage of Dockage in Their Shipments

Per cent of dockage	Distribution of shipping points in the districts											
	Northwest		West central		Central		Southwest		South central		Southeast	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Less than 10.0	21	23.1	38	39.1	25	30.8	24	26.1	4	4.7	11	23.4
10.0-19.9	51		59		50		68		82		36	
20.0 and over	19				3							
Total shipping points	91		97		78		92		86		47	

one fourth of the farms produced flax with a dockage of less than 10 per cent and almost three fifths between 10 and 19.9 per cent. Fifteen per cent of the farms were in the highest dockage group which ranged up to 70 per cent. Although this sample of farms is relatively small, the proportion of the farms in the low dockage class compares closely with the proportion of all shipping points in the state in this class. The proportion of the farms in the high dockage class, 20 per cent and above, was much greater than the proportion of shipping points. It thus appears that part of the high dockage flax lots as they came from the farm were cleaned at country shipping points to the degree that they fell into the 10.0-19.9 per cent dockage class. Observations made at various times indicate that most of the cleaning at shipping points prior to loading is confined to the very high dockage lots as received from the farm.

Another factor which tends to bring farm lots toward a uniform dockage content is the removal of a part of the dockage at the threshing machine. Combines with an attachment to clean the grain and sack the weed seeds frequently deliver flaxseed with dockages reduced to about 5 per cent. Thus, it is very difficult from the records of flax shipments or from threshed lots of flax on the farm to obtain a very accurate picture of the amount of dockage produced in the flax crop. It is likely that actual dockages exceed the volume indicated by the available data. The volume delivered to the local shipping point directly affects marketing costs. Actual dockage produced in the crop has an important bearing on yield and income return. Additional data are needed showing actual yield losses resulting from weed competition.

Dockage Removal at Country Shipping Points

With the use of proper screens many country elevators are equipped to clean flaxseed to 10 per cent dockage or slightly below without undue shrinkage of flax. Cleaning of flaxseed to a high degree of purity for crushing purposes is not considered practicable. Removal of all weed seeds and foreign material generally results in a shrinkage of at least 15 to 20 per cent from the original amount of flax. In addition to weed seeds, both sound and broken flax seeds are removed in the cleaning.

Flax screenings are finely ground to destroy all weed seeds and mixed with other grains for livestock feed. As a war measure to conserve shipping, it appears desirable that more of this dockage should be removed at country points and returned directly to farms as ground feed. In localities where portable feed grinders are not available, stationary grinders must be relied upon, but the use of the latter involves more local handling. If the dockage consists primarily of mustard seed, it is inadvisable to grind and mix with feed because of the characteristics of the oil in this seed. Dockage provides a low-cost feed. It is estimated that the cost of removing a reasonable amount of dockage is about $9.40 per ton of screenings. To this figure there must be added the cost of grinding and handling.

Removal of dockage at shipping points is only a temporary measure, and the most logical place to combat the dockage problem is on the farm. Elevator operators can reduce their own handling problems by encouraging farmers to plant clean seed and adopt control practices to combat weeds more effectively.

Weed Control Means Less Dockage

Flax plants do not shade the ground to the same extent as grain crops and, in consequence, weed plants have an excellent chance to develop. Clean ground is therefore an essential requirement for the production of clean flax. Experience of flax growers with the widespread and ever-present annual weed problem indicates that present accepted methods of culture have not been adequate to cope with the problem. On the other hand, a sufficient number of growers handle the crop so successfully as to indicate that lack of success lies partly with failure to take advantage of those practices which contribute to weed control. Season and other circumstances frequently dictate how far farmers can go in applying practices which they know to be useful.

Clean Seed: Thorough seed cleaning reduces weeds in the crop and improves stands. Seed clean enough for crushing is not of sufficient purity for sowing. Purities of 99 per cent or better can be obtained at small cost, where disk or gravity machines are used to supplement fanning mills. Cleaning of all farm seeds to be sown is as essential as cleaning of flaxseed if growers expect to reduce reinfestation of fields.

Clean Ground: A knowledge of weed infestation in the crops grown on a field in the previous two or three years appears necessary in selecting the cleanest ground for flax. The accumulation of weed seeds after small grain crops is an important factor. When these seeds are buried, sufficient numbers retain their germination to create a serious menace to flax during the season when they are brought to the surface by plowing or deep disking. More effective after-harvest control is probably one of the logical methods of combatting weeds.

Crop Rotation: Results of farm experience with flax following various crops in the rotation indicate that clean flax may be produced after most crops. Grass crops and alfalfa and certain clovers appear to provide cleaner ground than corn or small grains under usual conditions. Where flax follows cleanly cultivated corn in the rotation and is particularly weedy the situation is probably due to an accumulation of weed seeds below the depth of cultivation, buried at plow depth after some previous crop. Two years of corn in succession so that the ground is plowed and cultivated both seasons before seeding to flax appears a necessity on badly infested fields to bring annual weeds under better control.

Early Seeding: As a means of reducing dockage, the value of early seeding has been well established in Minnesota and North Dakota. More extensive spring working to control weeds is frequently advanced as a reason to justify delayed seeding. The troublesome weeds such as pigeon grass, lamb's quarters, pigweed, wild oats, etc., generally do not sprout until shortly before corn-planting time, and necessitate late May seeding if cultivation is to be effective. Iowa, Minnesota, and North Dakota data indicate that the loss in flax yield from late sowing outweighs any benefits from weed control by delayed seeding.

Seeding Down: Sowing alfalfa, red clover, alsike clover, and grasses or legume grass mixtures with flax as a companion crop offers further opportunity for holding down weeds. These plants provide additional competition

to the weed plants. The use of sweet clover in this manner is less desirable, as the sweet clover plants frequently make considerable growth during the season and complicate harvesting. Clover stems as well as weed stems in the straw reduce salability of the straw and increase the difficulty of curing, both in the windrow and in the shock.

Weed Sprays for Annuals: A weed spray known by the trade name Sinox has been found effective for broad-leafed annual weeds. When Sinox is applied to flax fields, it causes only a slight and temporary injury to the flax plants, but it effectively eliminates such weeds as wild mustard, pigweed, lamb's quarters, wild buckwheat, and other weeds. Results of Sinox application to mustard-infested fields in Wisconsin indicate a reduction of mustard in grain fields the following year.

These represent a few weed control measures which apparently are not being used to the fullest extent by many flax growers.

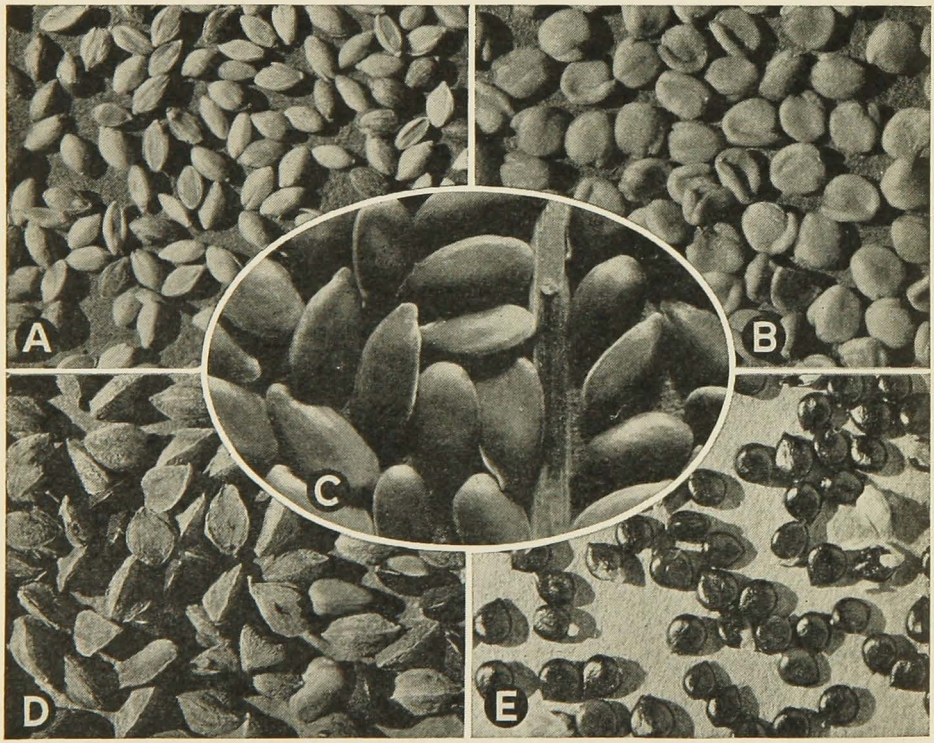

FIG. 3. Weed seeds common in flaxseed

A. Pigeon grass. B. False flax. C. Clean flax. D. Wild buckwheat. E. Smartweed.

Appendix—Table I. Carlot Shipments of Flaxseed from Minnesota Counties to Minneapolis: Gross Flaxseed, Amount and Average Percentage of Dockage, and Cost of Shipping Dockage, August, 1941-July, 1942*

District and county	Number of cars	Gross flaxseed	Dockage		
			Total	Average percentage	Cost of shipping
		1,000 lbs.	1,000 lbs.	Per cent	
Northwest district					
Becker	49	3,935	413	9.5	$ 741
Clay	64	5,232	520	9.9	1,027
Clearwater	1	76	11	14.0	23
Kittson	28	2,080	259	12.5	642
Mahnomen	12	842	121	14.4	255
Marshall	52	3,958	537	13.5	1,271
Norman	34	2,570	405	15.7	832
Pennington	95	8,125	570	7.0	1,308
Polk	89	7,019	1,140	16.2	2,568
Red Lake	20	1,545	251	16.2	565
Roseau	75	5,581	311	5.5	800
North central district					
Beltrami	1	9	1	10.0	2
Cass	1	78	14	18.0	18
Koochiching	1	40	4	10.0	10
Lake of the Woods	1	78	5	7.0	14
Northeast district					
St. Louis	2	161	19	12.0	36
West central district					
Big Stone	181	16,957	1,802	10.6	3,307
Chippewa	231	20,607	1,961	9.5	3,186
Douglas	36	2,779	238	8.6	387
Grant	160	13,964	1,598	11.4	2,795
Lac qui Parle	333	30,371	2,999	9.8	3,362
Otter Tail	72	5,784	643	11.0	1,227
Pope	150	13,563	1,310	9.6	2,145
Stevens	172	16,444	1,815	11.0	3,081
Swift	300	28,684	2,383	8.3	3,719
Traverse	115	10,823	1,335	12.3	2,480
Wilkin	159	13,397	1,695	12.7	3,207
Yellow Medicine	288	25,813	2,856	11.0	4,733
Central district					
Carver	4	276	21	7.5	19
Kandiyohi	174	15,342	1,961	12.7	2,696
McLeod	79	7,233	809	11.0	1,075
Meeker	70	6,093	665	10.9	858
Morrison	2	137	12	8.5	17
Renville	344	30,151	3,222	10.6	4,589
Scott	4	246	40	17.7	39
Sherburne	2	111	6	5.2	7
Sibley	75	6,427	790	12.3	1,056
Stearns	79	6,329	600	9.5	868
Todd	3	238	29	12.4	44
Wadena	1	63	9	14.0	15
Wright	10	583	43	7.5	52

* The data do not include all the shipments from the counties. Complete records of some cars were not available. Also, some shipments were consigned to Duluth.

Appendix—Table I (Continued)

District and county	Number of cars	Gross flaxseed	Dockage		
			Total	Average percentage	Cost of shipping
		1,000 lbs.	1,000 lbs.	Per cent	
East central district					
Chisago	4	357	24	6.8	27
Hennepin	2	168	12	6.9	11
Mille Lacs	4	182	22	11.9	27
Washington	6	462	45	9.7	41
Southwest district					
Cottonwood	318	29,396	3,823	13.0	6,247
Jackson	317	28,590	3,321	11.6	5,751
Lincoln	133	12,005	1,148	9.5	2,073
Lyon	376	33,975	3,398	10.0	5,792
Murray	232	20,700	2,294	11.0	4,032
Nobles	430	39,150	4,433	11.3	8,159
Pipestone	156	14,414	1,851	12.8	3,430
Redwood	467	42,082	5,020	11.9	7,763
Rock	120	10,821	1,119	10.3	2,087
South central district					
Blue Earth	105	8,812	1,172	13.2	1,665
Brown	181	16,277	2,217	13.6	3,231
Faribault	184	16,787	2,028	12.0	3,184
Freeborn	37	2,965	499	16.8	724
Le Sueur	28	2,470	356	14.4	462
Martin	142	12,742	1,781	14.0	2,831
Nicollet	29	2,449	348	14.2	457
Rice	38	3,018	361	11.9	419
Steele	32	2,834	388	13.7	545
Waseca	46	3,865	486	12.5	699
Watonwan	184	16,741	2,292	13.6	3,489
Southeast district					
Dakota	40	3,397	375	11.0	378
Dodge	39	3,185	463	14.5	642
Fillmore	24	2,066	278	13.4	462
Goodhue	72	6,403	555	8.6	731
Houston	1	61	9	15.0	17
Mower	54	4,144	728	17.6	1,083
Olmsted	23	2,290	272	11.8	398
Wabasha	14	1,064	114	10.6	156
Winona	6	418	44	10.4	61